The Design of 'Possible Worlds' as Contribution to the Unfished Project of Modernity

Development of a Reference Architecture to Support the Decision-Making Processes of Community-Driven Sustainable Human Development Initiatives

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To my parents.

Abstract

This dissertation's central ambitions are to point out and illustrate how design-oriented information systems research (ISR) can be utilized for critical and emancipatory (C&E) purposes as well as—although to a lesser extent—to offer a considerably different perspective on how ISR can contribute to the sustainable development (SD) research agenda.

Research programs intending to remove entrenched inequalities by changing the status quo exhibit a C&E orientation. A design-oriented methodology tends to be predestinated as underpinning for such endeavors because of its explicitly stated aim of change. The omnipresent SD discussion, at least in its original conceptualization, is one of the most prominent areas where design-oriented research programs with C&E features are urgently needed. In particular, design science research in information systems (DSRIS), the design-oriented research program in ISR, is considered to be a vital ingredient: the design of appropriate technical systems is gaining in importance, because the complexity and dynamics of SD issues exceed human problem-solving capabilities. However, SD concerns cannot be addressed by isolated technical artifacts; technical systems have to be aligned with the social systems in which they are embedded. This broader endeavor is called the design of socio-technical systems. In comparison to research under this heading, DSRIS rarely strives for C&E goals. This curious situation can be traced back to the methodological suggestions given in the hope that they bridge the 'relevance-rigor gap': relevant research has to be carried out in response to problems articulated in practice and results have to be rigorously evaluated in practical settings to demonstrate their efficacy to solve the explicated issues. Besides the inherent challenges of both these prescriptions, from the stance of C&E research, it seems implausible that powerful actors would grant access to a setting and support projects that challenge their positions. Hence, the postulated aim of change is merely an euphemism for endeavors that reinforce and solidify the status quo—they, due to the lack of empowering potential, can solely further what Habermas termed the 'colonization of the lifeworld'.

The method for the design of 'possible worlds' proposed in the present inquiry not only helps to overcome this limitation, but it simultaneously integrates DSRIS more clearly with the overarching undertaking of devising socio-technical systems. Against this background, a designed 'possible world', seen from an explicated value position, is a more desirable, theoretically possible alternative to factual existing contexts in a particular domain. It functions as 'crash barrier' for the design of social systems and it can at the same time be leveraged as domain model from which it is possible to elicit requirements for the construction of a reference architecture that describes technical

systems backing the processes of and within the ‘possible world’. However, in addition to the method’s development, the Ph.D. dissertation also illustrates the former’s application by designing a reference architecture for systems that support the decision-making processes of community-driven sustainable human development initiatives; one at least theoretically possible concretization of SD. As such, the inquiry makes three research contributions: its primary focus is a constructive extension of the disciplinary body of knowledge through the methodical guidance for C&E DSRIS; however, the reflection of SD as part of the exemplary application is also a critique of the way SD issues are currently tackled and of how they are integrated into the ISR canon.

To realize these aims the study proceeds as follows: based on a critical reflection of the philosophical underpinnings of DSRIS, it explicates different routes to bridge the relevance-rigor gap. One of these avenues then serves as starting point for the construction of a method that specifically addresses the peculiarities of C&E DSRIS. The core derivation from the traditional conceptualization of design-oriented ISR lies within the sketch of a desirable, hypothetical alternative of factually existing social systems, which, through the contrasting with the latter, allows to carve out intervention entry points, i.e., aspects in which the ‘factual world’ has to change to become more like the ‘possible world’. To justify the claim that this transition, manifesting itself in the determined intervention entry points, is at least theoretically possible and not utopian, the ‘realist synthesis’ as a technique for the gathering of justificatory evidence from the existing body of knowledge is presented. Rooting endeavors of DSRIS in the scientific knowledge base is an important move to free them from being confined to those problems that are articulated by powerful gatekeepers in practical settings. However, for the design of ‘possible worlds’ to bear fruit in ISR, this step needs to be complemented. Therefore, the synthesis is adapted to also permit the extraction of, from the perspective of the underpinning normative stance, suitable ‘draft meanings’, because these progressive (social) structures or organizational options resulting from interventions provide the basis for the design of reference architectures that are aligned with the ‘possible world’. To illustrate this, from an ISR perspective, fundamental usage scenario, the inquiry, based on a devised preliminary reference architecture development approach, carries out the afore-mentioned exemplary application of the method for the design of ‘possible worlds’.

Declaration

"I, Marcel Heusinger, hereby declare that this thesis, which is titled *The Design of 'Possible Worlds' as Contribution to the Unfished Project of Modernity*, is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the University of Duisburg-Essen or other institutes of higher learning, except where due acknowledgment has been made in the text."

Wachtberg, May 25, 2015

Marcel Heusinger

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Chapter 1

Introduction

"Wir fühlen, dass, selbst wenn alle m ö g l i c h e n wissenschaftlichen Fragen beantwortet sind, unsere Lebensprobleme noch gar nicht berührt sind. [We feel that even if all *possible* scientific questions have been answered, the problems of life remain completely untouched.] [emphasis in the original]"

Wittgenstein (1963, §6.52)

Even in the 21st century the old, constantly recurring problems of poverty and economic crisis still exist; furthermore, new challenges such as climate change and global terrorism have to be dealt with. Although we are living in times where knowledge is increasing at rates unimaginable in former times, scientific progress has not sufficiently answered these problems of life. Au contraire, scientific progress informing technological development has created problems which are endangering the global life supporting system, the very foundation of all human living. Rockström et al. (2009) in their article published in *Nature* attest that three out of nine interlinked planetary boundaries are already overstepped and, more recently, Running (2012) in his *Science* article suggests that humanity will have exhausted the planetary boundaries within the next few decades. The authors of these warning articles, published in the most prestigious academic journals, are not alone: in their analysis of the abstracts of 11.944 scientific papers published between 1991 and 2011 J. Cook et al. (2013) find that 97,1% of these articles endorse that global warming is caused by humanity, especially due to the greenhouse gas emissions that exceed the planetary boundary. This is relatively puzzling because "the natural laws that constitute the larger frame of reality are already known. There is general scientific consensus about these laws. Although we may ignore them, we cannot change them or make them go away" (Nattrass and Altomare 2001, p. 14). Empirical evidence suggests that 'developed' countries have to bear the blame for huge parts of these problems, as high levels of human development (HD) are correlated with strong unsustainability (Neumayer 2012, p. 576; Sachs and Tilman 2007, p. 151). However, 'developing' countries still strive for the same way of living according to the motto: economic growth first, environmental protection afterwards. Unfortunately, the underlying idea of dealing with problems separately tends to be highly defective as the negative consequences of efforts to reduce strong unsustainability in 'developed' countries exemplify [e.g., the intra-generational effects of the biofuel production (cf. RFA 2008) or 'radiating' examples with inter-generational actualizations such as Chernobyl or Fukushima]. Reducing (strong) unsustainability at the expense of HD achievements is unrealistic, undesirable, and faulty (Huber 1995, pp. 39–40). Furthermore, even in 'developed' countries the number of people left behind is increasing. For example, there is the crisis of higher education (Avital et al.

2007, p. 572), rising unemployment rates, declining governmental support, and increasing inequalities (OECD 2013, pp. 11–12). From this point of view, it is at least questionable if the life style of 'developed' countries is a suitable role model for 'developing' countries.

The increasing pressure of these problems as well as the recognition that these problems cannot be addressed in isolation or sequentially gave rise to the integrated and overarching concept of sustainable development (SD) (WCED 1987). However, in the course of time the aspirations have been narrowed and reduced, in the highest political arenas, to merely environmental considerations. This manifests itself in the most recent conceptualization as 'green economy' (OECD 2011; UNDP 2011; UNEP 2011; World Bank 2012). Although the 'greening' of the economy is undeniably important, it renounces the insights that pushed SD on top of the internal agenda in the first place. Furthermore, a green economy is in itself insufficient to tackle other problems, e.g., social fragmentation, that pressurize the cohesion of value pluralistic, modern societies. On the contrary, these problems tend to be a side-effect of the 'colonization of the lifeworld' (Habermas [1981] 1987b, p. 522). This does by no means imply that green economic growth is unnecessary or undesirable, it merely indicates that it needs to be paralleled by complementary efforts:

> "However, a differentiated reconnection of modern culture with an everyday sphere of praxis that is dependent on a living heritage and yet is impoverished by mere traditionalism will admittedly only prove successful if the process of social modernization can *also* be turned into *other* non-capitalist directions, if the lifeworld can develop institutions of its own in a way currently inhibited by the autonomous systemic dynamics of the economic and administrative system [emphasis in the original]" (Habermas [1981] 1997, pp. 52–53).

At least since the Enlightenment and the seminal work of Comte ([1851] 1875, [1852] 1875, [1853] 1876, [1854] 1877), sciences are expected to advise and support societal development, that is, they fulfil a task for society as a whole. In contrast to other social sciences, information systems research (ISR) solely focuses on the economic subsystem, thereby not only neglecting its duty to 'enlighten society at large' (cf. Albert 1972, pp. 89–93), but it also struggles to uncouple itself from the economic mother discipline and establish, especially the design-oriented tradition in ISR, itself as a scientific discipline (Frank 2006, pp. 5–6). Although there are some developments that have sharpened the scientific profile, notably the guidelines proposed by Hevner et al. (2004), the present inquiry argues that the current conceptualization of design science research in information systems (DSRIS) prevents it from unfolding and realizing its full potential. The study's central thesis is that the methodological foundation of DSRIS is internally connected to a concept of 'instrumental rationality' (Habermas [1981] 1987a, pp. 244–246) that inevitably bounds DSRIS to the economic and the administrative subsystems. If this thesis is right, DSRIS cannot contribute to the 'unfinished project of modernity' (Habermas [1981] 1997); rather, it can only foster the colonization of the lifeworld. One the one side, this limits its contribution to, for example, the recently emerging phenomenon of sustainable human development (SHD), which is based on the efforts of HD scholars who try to overcome the afore-mentioned watering down of SD (cf. Crabtree 2013; Heusinger 2013b; Hirvilammi et al. 2013; Lessmann and Rauschmayer 2013; Peeters, Dirix, and Sterckx 2013; Pelenc et al. 2013; Sen 2013; Schultz et al. 2013; Watene 2013). On the other side, such a narrow focus provides a fertile ground for critical and emancipatory (C&E) ISR projects that criticize such efforts retrospectively and try to evoke transformations by pointing out ideological contradictions. Although both approaches provide valuable and important insights, a science that tackles the problems of life and contributes to the unfinished project of modernity is critically constructive and constructively critical. It advises and supports the lifeworld in developing institutions inhibited by systemic imperatives. However, the current methodical repertoire of ISR is limited in this respect.

To overcome this challenge, the present inquiry puts forward a critical reflection of both DSRIS and C&E ISR and, by exploiting the identified options for a broader conception of DSRIS, develops a methodical proposal that allows to carry out C&E design science research (DSR) projects—this approach is, in reference to D. K. Lewis (1986) and Frank (2009), called the design of 'possible worlds'. To demonstrate the feasibility, the present inquiry illustrates the method's application by designing a 'possible world' that takes up the proposal of community-driven SHD initiatives (Heusinger 2013b). Insofar, the inquiry can also be framed as an ISR-related contribution of the SHD discourse. Yet, as the following refinement of this research topic shows, the focus rests on the extension of ISR's knowledge base.

Chapter 2

Research Problems and the Study's Purpose

"Good research deals with significant issues and attempts to answer significant questions about the issues. It participates in a lager conversation about the issue, resulting in a review of previous research and theory that informs the research question. It demonstrates a sound methodological approach with appropriate forms of validity. It provides some kind of evidence for inferences, draws implications, and makes recommendations for future study and practice."

Herr and Anderson (2005, p. 69)

Within the next section the general description of the research topic outlined in the foregoing introduction is broken down into concrete research problems the present inquiry addresses. This specification is followed by a review of the research purpose, i.e., it is explicated in which way the study contributes to resolving these problems. This must not be mistaken with providing a *solution*; this would be an exaggerated aspiration! This chapter closes by justifying that the proposed approach meets the requirements demanded for a 'valid' dissertation. In short, the aim of this chapter is to justify that the dissertation satisfies the first part of the demands for 'good research'. This endeavor is continued in the following chapters.

2.1 The Research Problems

A research problem can be defined as "an issue, controversy, or concern that guides the need for a study" (Plano Clark and Creswell 2010, p. 83). This allows to link the general research topic to the more specific research question (see chapter 6) and it provides the background for justifying the study's purpose as well as its originality and validity; both discussed in the two succeeding sections. Such an intermediary step is particularly relevant for the present study as the outlined research topic is relatively broad and by far exceeds the scope of a single research project. As such, the following singles out and briefly sketches, refined by the detailed analysis in chapter 5, the most significant aspects of the topic to crystalize the study's scope.

As indicated by the purpose statement at the end of the introduction, the present inquiry pursues a dual strategy: on the one hand, there is the development of a method to design 'possible worlds', and on the other hand, there is the exemplary application of the method itself. Whereas the former is the focal aspect, the latter, due to the need to provide credible evidence for the feasibility of the method, is actually a self-contained, with some qualifications, research project. In short, there are two focal research problems.

Firstly, it is claimed that, in comparison to relevant reference disciplines such as economics (Avital et al. 2007, p. 568), C&E research projects within ISR in general and DSRIS in particular are clearly underrepresented (cf. Avgerou 2005, p. 103; Carlsson 2010, p. 218; Myers and Klein 2011, pp. 17–18). Furthermore, the few studies that are actually carried out are not published in flag-ship or major journals[1] but are banned to 'alternative outlets' (cf. Richardson and Robinson 2007, p. 253; Walsham 2005a, p. 225). Although there are exceptions to this rule (e.g., Myers and Klein 2011), researchers attribute this exclusion from central publication channels to the lack of dedicated or 'appropriate' research methods (cf. Cecez-Kecmanovic 2005, pp. 37, 39–40; 2011, p. 440; McGrath 2005, p. 93). The few endeavors that succeeded, such as the one of Myers and Klein (2011), to be accepted in top journals such as *MISQuarterly*[2], often fall back on qualitative and hermeneutic methods that are closely associated with interpretive research (cf. Cecez-Kecmanovic 2011, pp. 444–445; McGrath 2005, p. 86; Ngwenyama 1991, p. 272; Stahl 2008b, p. 143) or even adapt/appropriate originary interpretive research methods (e.g., Alvarez 2005; Myers 1997). However, the underpinning ontological and epistemological assumptions confine such projects to ideological criticism (see sections 5.3 and 7.2). An intermediary corollary, therefore, is that there is considerable scope for development of dedicated methods (Adam 2005, p. 124). Such efforts are specifically important in respect to the ever increasing social problems as touched in the introduction:

> "Critical research, potentially at least, offers a promising approach for addressing some of the complex and thus far intractable issues we face today. Yet, doctoral students, as one source of potential critical researchers, usually decide not to pursue a critical project, even when their supervisors conduct critical research. Supervisors may argue that this is because they give their students room to find their own approach, but might it not also be because their students can usually find more guidance in the literature on how to conduct an interpretive or normative project? Over time, are we reinforcing other approaches and keeping critical research on the sidelines simply because the latter is too difficult for us?" (McGrath 2005, p. 98).

Particularly puzzling is that there are virtually no C&E DSR projects, although DSRIS explicitly strives for changes in existing structures and processes (cf. Iivari 2007, p. 53; 2010, pp. 45, 57; Purao, Rossi, and Sein 2010, p. 179; Sein, Rossi, and Purao 2007, p. 106) and therefore tends to be a prime candidate for such research endeavors. Additionally, there is a wealth of literature that could guide novice C&E researchers in their efforts. However, as pointed out more fully in section 5.2, the methodological underpinning outlined in the seminal work of Hevner et al. (2004), is too restrictive to develop methods supporting C&E researchers (cf. Heusinger 2013a, forthcoming). In other words, the first research problem is a bias in the methodical repertoire of ISR, which can be explained using the distinction of *communicative* and *instrumental/strategic action* introduced by Habermas[3]: whereas the former

1. Note that C&E research is, for example, even excluded in the analysis of different research traditions in the information systems (IS) literature carried out by Chen and Hirschheim (2004). For a 'filling' of this gap see Richardson and Robinson (2007).

2. As indicated by a recent call for papers there is a demand for such research efforts: `http://www.misq.org/skin/frontend/default/misq/pdf/CurrentCalls/ICTChallenges.pdf`, accessed May 25, 2015.

3. This distinction is key to distinguish the first and the second generation of the Frankfurt school: whereas the first generation's program outlined in *Dialectic of Enlightenment: Philosophical Fragments* (Horkheimer and Adorno [1947] 2002) is 'bleak and pessimistic' (Finlayson 2005, pp. 15, 54–55) the introduction of communica-

is defined as the type of interaction between two individuals, who enter in an inter-personal relationship by coordinating their actions through a mutual, rationally motivated agreement of the interpretations of a particular action situation (Habermas [1983] 1990, p. 58; [1981] 1987a, p. 128; [1992] 1996, pp. 4, 17–19), the latter is defined as an action in which "one actor seeks to *influence* the behavior of another by means of threat of sanctions or the prospect of gratification in order to *cause* the interaction to continue as the first actor desires [emphasis in the original]" (Habermas [1983] 1990, p. 58). On a societal level this distinction is paralleled by the differentiation of the lifeworld (*Lebenswelt*) and the system, both important facets of social life or society (*Gesellschaft*), but guided by different rationalities (Habermas [1992] 1996, p. 27): moral-practical or communicative and cognitive-instrumental rationality respectively. The *lifeworld* is the culturally transmitted and linguistically organized repository of implicit knowledge that provides members of a society with an intersubjectively shared background of 'obviousnesses' and unproblematic beliefs and that functions as a referential context to achieve consensus in the communicative actions of individuals in their everyday encounters (Habermas [1985] 1987, p. 314; [1981] 1987b, pp. 182–193; [1992] 1996, pp. 21–23). The *system*, on the other hand, which comprises the economy and administration as the two central subsystems as analyzed by Weber ([1956] 1978), emerges within and out of the lifeworld (Habermas [1981] 1987b, pp. 229–293)[4] as a response to the increasing size and complexity of societies. This development overtaxes communicative action's ability for social integration, eventually leading to an institutionalization of instrumental rationality in the system (Habermas [1981] 1987a, pp. 300–304; [1992] 1996, p. 25; [1992] 1996, p. 39). Based on these distinctions, the afore-mentioned 'thesis of the colonization of the lifeworld' (Habermas [1981] 1987b, p. 522) can be described as the absorption of lifeworld functions by the 'system', that is, the system absorbs or professionalizes more and more functions of the lifeworld and thereby replaces communicative mechanisms by market transactions and administrative bureaucracies (e.g., juridification) by non-communicative mechanisms. Areas of communicative action are transformed into contexts of strategic action. Habermas ([1981] 1987b, pp. 212–216, 222) argues that these systemic processes can, and indeed do, disturb cultural reproduction, social integration, and socialization in the lifeworld, creating crises or social pathologies (e.g., loss of meaning and legitimacy, crisis of orientation and education, disintegration, anomy, alienation, departure from tradition, demoralization, and psychopathologies)[5]. In respect to the present research problem this discussion allows to conclude that the scope of ISR is either confined to the system, thereby neglecting its duty in respect to society, the largest stakeholder of research, or, even worse, it fosters the colonization of the lifeworld that creates serious social side-effects, manifesting themselves, for example, in the riots in the United Kingdom (UK) (2001 and 2011) as well as the riots in French Banlieus (2005). Furthermore, it also indicates why the 'green economy', undermining the political nature of SD, is an unsuitable conceptualization of SD. A green economy—as necessary as it might be—is in itself insufficient to resolve the community cohesion problem and the increasing social fragmentation in modern societies.

tive action and the analysis of the relation between communicative and instrumental/strategic action opens up new perspectives, in particular by the public sphere, that the first generation has not adequately considered (see also Habermas [1981] 1987a, pp. 489–534).

4. A relationship that is re-discovered in the new institutionalism in economics as, for example, illustrated by the 'informal constraints' discussed by North (1990, pp. 36–45) (see also Ostrom 1990; O. E. Williamson 2000, and the discussion in section 10.3).

5. For critical reflection of the functionalist explanation and a complementary extension in form of a normative account see Jütten (2011).

Correspondingly, the research problem addressed by the exemplary application of the method unfolds in a lifeworld context. In line with Habermas, who beliefs that the process of modernity cannot or, even if it could, should not be reversed because it provides important societal functions, the present inquiry argues for a more balanced development by fostering the development of lifeworld institutions (cf. Habermas [1981] 1997, pp. 52–53). Although Habermas ([1981] 1987a, [1981] 1987b) is not explicit about how a colonization of the lifeworld can be prevented, his *The Structural Transformation of the Public Sphere* (Habermas [1962] 1991) as well as his discourse ethic contributions (cf. Habermas [1983] 1990, [1991] 1994, 1992) and his thoughts on political theory (cf. Habermas 1986, [1992] 1996, 1998, 1992), both underpinned by his theory of modernity[6], indicate that such a remedy can be found in lifeworld discourses and the influence they exercise on the 'public sphere'[7] (schematically depicted in figure 2.1), i.e., the 'place' in which private people form a public (Habermas [1962] 1991, p. 27; [1964] 1974, p. 49). Discourses within the lifeworld, supported by an 'independent journalism of the quality press' (cf. Habermas [2008] 2009, p. 132), are vital to form a public opinion that subjects systemic processes to public scrutiny. In this view, democratic opinion- and will-formation directs the acting political system (cf. Habermas 1998, p. 250).

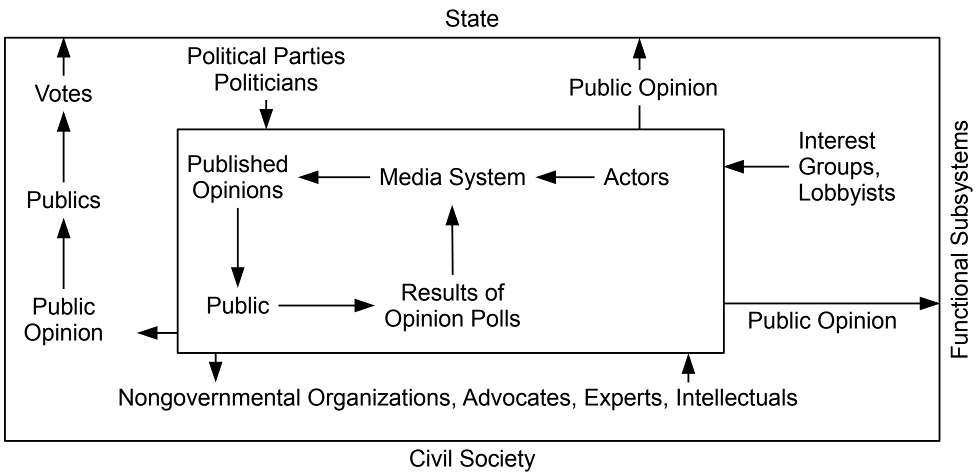

Figure 2.1: The Public Sphere, source: Habermas ([2008] 2009, p. 166)

However, such an endeavor needs to be aware that the public sphere, relatively soon after its genesis in the 18-century, began to decline. The economic and structural transformations, inter alia, through the evolving of the press into large corporations and their appropriation

6. For more extensive discussion of modernity and its place in the research program of Habermas see Habermas ([1981] 1997, [1985] 1987, 1992, 2002). For an introduction to Habermas research program from an ISR perspective see Ross and Chiasson (2011, 125–132) as well as Heng and Moor (2003, pp. 334–341).

7. Historically the public sphere emerged out of and within the civil society that itself appeared as response to the functional specialization of the state and the adaption of the capitalist mode of production (cf. Habermas [1962] 1991, pp. 14–26; 1998, p. 153); the latter providing the financial basis for the former (i.e., taxes) (Habermas 1998, pp. 108–109). At this time, the 18th-century Europe, the public sphere was gradually institutionalized by the discourses carried out in coffee houses, salons, and table societies (*Tischgesellschaften*) (Habermas [1962] 1991, pp. 32–36). Although these three types of discourses differ in some respect, they all allowed a social interaction in which status and privileges were completely disregarded, the laws of bureaucracy and the market were suspended, in which a common concern was critically reflected and discussed (i.e., a public opinion emerged), and which were, at least in principle, inclusive or generally accessible (Habermas [1962] 1991, pp. 36–37; [1964] 1974, p. 50). In short, the public sphere constituted the field in which civil society formed a public opinion to direct and influence the operation of state authorities (Habermas [1964] 1974, p. 49). However, since the economic system has separated from civil society, the modern public sphere unfolds between the state, the economic system, and the modern civil society (cf. Habermas 1998, p. 249, 251; [2008] 2009, p. 166, and figure 2.1).

for private interests, which aim to pervade the public sphere with a vested interest-colored 'public opinion', gradually dissolved the public sphere (see also Habermas [1964] 1974, p. 53–55; [2008] 2009, pp. 133–135):

> "The communicative network of a public made up of rationally debating private citizens has collapsed; the public opinion once emergent from it has partly decomposed into the informal opinions of private citizens without a public and partly become concentrated into formal opinions of publicistically effective institutions. Caught in the vortex of *publicity that is staged for show or manipulation* the public of nonorganized private people is laid claim to not by public communication but by the communication of publicly manifested opinions [emphasis in the original]" (Habermas [1962] 1991, pp. 247–248).

Although the development took—from the moral point of view—an unfavourable direction, the beauty of the research program, which underpins the second generation of the Frankfurt school, lies in its non-radical and non-aporetic but reasonable and constructive outlook. The suggestion is not to reverse history or to radically transform society, but to foster the re-construction of the public sphere by strengthening the modern civil society and counter refeudalization by establishing more democratic structures (see also Habermas 1998, p. 153):

> "The idea of the public sphere [...] calls for a rationalization of power through the medium of public discussion among private individuals [...]. It could only be realized today, on an altered basis, as a rational reorganization of social and political power under the mutual control of rival organizations committed to the public sphere in their internal structures as well as in their relations with the state and each other" (Habermas [1964] 1974, p. 55).

In other words, a contribution to the 'unfinished project of modernity' (Habermas [1981] 1997) unfolds in endeavors that strengthen the organizations in civil society. A real and constructive contribution of ISR to this larger project presupposes methodical support that is freed from factual constraints and systemic imperatives, which encourage and expedite the colonization of the lifeworld.

2.2 The Research Purpose

This section elaborates on the research purpose, i.e. the major intent and focus of a study (Plano Clark and Creswell 2010, p. 135). In the introduction to this chapter, the study's purpose was described as (i) developing a *method* that supports C&E DSR projects and (ii) demonstrating the feasibility of the method by applying it to an *exemplary case*. The following expands on the details of this purpose and relates it to the two research problems outlined in the preceding section.

As mentioned above, the primary focus of the Ph.D. thesis rests on (i), that is, the development of a method for the design of 'possible worlds' to support C&E DSR projects in ISR. The foundation of this endeavor is a critical reflection of both DSRIS and C&E ISR to carve out the respective presuppositions and exhibit opportunities to free the methodological underpinning of DSR from its internal connection with instrumental rationality as well as to uncouple C&E ISR from an interpretive stance. This preparatory work provides the background from which the development of a method for the design of 'possible worlds', a synthesis of the broadened conceptions of DSRIS and C&E ISR, unfolds. This effort culminates in a method that frees DSRIS from factual constraints and systemic imperatives, which paves the way for critical and constructive ISR. Complemented by the traditional approaches for the construction of technical systems [e.g., the reference architecture development approach (Angelov, Grefen, and Greefhorst 2012)], this provides the basis for (ii), which illustrates how a 'possible world' can be utilized for the design of technical systems. In short, the design of 'possible worlds' results in domain models that, due to their abstract and open nature, can be adduced for the design of reference architectures. In this respect (ii) is seen as an additional argument that supports (i) by demonstrating the method's feasibility. (i) and (ii) together form an input to an ongoing discourse in ISR in which the scope and the nature of the discipline are reflected and continuously updated.

However, the very nature of (i) suggests that (ii) is also a self-contained research project, addressing its own problem and, by implication, having its own purpose. As indicated in the foregoing discussion, this exemplary application crosses the disciplinary boarders, which is, on the one hand, desirable to avoid desolating effects in 'boarder areas', but on the other hand, also entails the danger of 'dilettantism' (cf. Chmielewicz 1994, pp. 26–27). Although parts of the conceptual underpinning of the exemplary application received a preliminary evaluation (Heusinger 2013b), this danger is presently less serious due to the hierarchical ordering of (i) and (ii). Nevertheless, the primary purpose of the exemplary application is to strengthen civil society organizations in order to bring in harmony the influence the economic system is exercising, often at the expense of the lifeworld, on the political system. To address this problem, the method constructed in this dissertation thesis is used to design a community-driven SHD initiative. This 'possible world' is, drawing on the existing ISR repertoire, used as domain model for the design of a reference architecture that supports the decision processes of such initiatives. In recourse to the research problem discussed in the preceding section, such initiatives, as civil society organizations, are an attempt to re-construct the modern public sphere with respect to the issues summarized under the umbrella of SHD, including the community cohesion problem. From this point of view, the results of (ii) function, by their nature as possible options for the restructuring of the lifeworld, as input to practical lifeworld discourses in which such suggestions are reflected and translated in real world transformation.

Although, the research project also exhibits traces of a criticism of two tendencies in ISR, that is, the inclination (a) to 'objectify' social concerns, i.e., the treatment of human beings solely as means—a violation of the Kantian Practical Imperative (see p. 22 of the Ph.D. thesis)—for economic production (section 5.2) and (b) to narrow down SD concerns to environmental and/or economic considerations (section 5.5), the inquiry can also be framed as (c) a general criticism of the discourses on SD and HD (section 5.5), (d) an illustrative application, a supportive argument currently missing, of the reference architecture development approach proposed by Angelov, Grefen, and Greefhorst (2012) (chapter 11), or as (e) an avenue of ISR that investigates inhibited potentials of information and communication technology (ICT) to break the linkage between high levels of HD and strong unsustainability (part IV)—the central challenge of the 21st century (Neumayer 2012, p. 576). Nevertheless, the focal point is, originating from the philosophy of science, a critical reflection of ISR's knowledge base and a constructive contribution to it (i–ii). Even though the exemplary illustration (ii) is considered to be a contribution to discourses beyond the disciplinary boundaries, this facet of the dissertation is developed to a lesser extent than (i). The considerations (a–e) are addressed only en passant and without the necessary depth.

2.3 The Program's Validity and its Originality

Whereas the preceding section discussed the study's purposes and their internal relation to the research problems, the subject of this section is to explicate the validity and originality of the research project in respect to the *formal requirements* a dissertation has to satisfy. This intermediary step in the outline of the research program differs from the *content-wise* originality and validity, manifesting themselves in those knowledge contributions that unfold against the anticipated audiences of the research project, that are discussed in the next chapter.

A general requirement of the validity of a dissertation, which applies to virtually all types of research projects, is that it (i) matches the overall subject of the respective discipline and that it (ii) extends the existing disciplinary body of knowledge (cf. UDE 2006, §9.1–2; Wissenschaftsrat 2002, p. 48). In respect to the present inquiry, which is located in a discipline called Business & Information Systems Engineering (BISE) (*Wirtschaftsinformatik*), the subject can be delineated as being concerned with information systems (IS), defined in a first approximation, refined in section 5.1, as socio-technical systems comprising social and technical system (WKWI 2011, p. 1). Whereas BISE used to differentiate itself from ISR, which is also concerned with the interplay of social and technical systems (cf. Bostrom and Heinen 1977a, p. 17; Galliers and Land 1987, p. 900; Lee 1999, pp. v–vi), by exclusively focusing on technical systems in business organizations, within the recently published BISE profile (WKWI 2011, p. 3) these differences tend to dissolve (see also Österle et al. 2011, p. 8): the broadened scope of BISE includes societal aspects as well. A consequence to this convergence is that the terms BISE and ISR can, in most cases, be used interchangeably. The following uses the term ISR because of its brevity.

As the research purposes in the preceding section indicate, the focus of the present inquiry leans more toward the social facets of IS: the aim is to open up the possibility to develop technical systems in an environment freed from factual constraints and systemic imperatives. As such the endeavor is clearly situated within the disciplinary boundaries (i), and the methodical proposal itself is a contribution to the ISR knowledge base (ii). Similarly, the exemplary application of the method serves a purpose that can be clearly located in the broadened scope of ISR, i.e., it investigates the potential of ICT applications in civil society organizations (i). The designed social system, in its function as a domain model, as well as the corresponding technical system are ISR artifacts that enrich the disciplinary body of knowledge (ii). Admittedly, the latter is often more acceptable than the former, although research in design theory development (cf. Fountain 2001, p. 98; Goldkuhl 2004, pp. 62–63; Gregor 2006, pp. 620, 629; 2009, p. 8; Gregor and Jones 2007, p. 322; Markus, Majchrzak, and Gasser 2002, pp. 181–182; Walls, Widmeyer, and El Sawy 1992, p. 43), recognizing the embeddedness and path dependency of technical systems, is beginning to see that technical systems are inseparable of social systems and creates more comprehensive artifacts. However, this avenue of research is out of scope in the present inquiry; therefore, the following will concentrate on (a) the method and (b) the technical system as knowledge contributions to the disciplinary body of knowledge.

Although the contribution to the disciplinary body of knowledge or originality are frequently mentioned (e.g., Österle et al. 2010, p. 3; Österle, Winter, and Brenner 2010, p. 5; Österle et al. 2011, p. 9)[8] there is no precise guideline of how to explicate that an inquiry

8. Although the "Memorandum on Design-oriented Information Systems Research" (see Österle, Winter, and Brenner 2010; Österle et al. 2010, 2011) is specifically concerned with those criteria that DSR "must comply with" (Österle et al. 2011, p. 9), these principles apply to almost all types of inquiries: the result should (i) not be

contributes to the disciplinary body of knowledge. Frank (2006, pp. 34–35) suggests that a form of 'progressive problem shift' (cf. Lakatos 1970, p. 118) is a suitable operationalization of originality. However, he also points out that such a demonstration is difficult to achieve and might not be justifiable with absolute certainty. Therefore, he suggests, as a pragmatic but acceptable compromise, to establish the originality in reference to published literature (Frank 2006, p. 25). The literature review summarized in chapter 5 does exactly this. It indicates—to the best of the author's belief—that (a) is an original contribution to the disciplinary body of knowledge. Analog to (b). However, in the case of (b) the progressive problem shift can also be operationalized in a different direction: the resolution of a technological uncertainty. Such an uncertainty exists if there is no best practice solution that can be applied to the focal problem (cf. Hevner et al. 2004, p. 81; Kuipers 2007, p. 61; OECD 2002, p. 46). As indicated above, although there is an approach for the design of reference architectures (Angelov, Grefen, and Greefhorst 2012), this method has been used only for the analysis and classification of existing reference architectures. Correspondingly, the employment for the design of a reference architecture, as done for the designed 'possible world', is accompanied by a certain methodical uncertainty. Although the analysis of this application is not a central concern of the present inquiry and required modifications are not fed back into the approach, this ambiguity contributes to the present inquiries originality.

Before the discussion turns to the next chapter, i.e., the research program's relevance, a brief intermediary reflection of the foregoing argument is inserted as a summary of the first chapter. After a brief introduction, the first section laid out the research problems the present inquiry addresses: (i) a methodical deficit in ISR's knowledge base and (ii) ISR's (unwilling) contribution to the colonization of the lifeworld. The next section related these problems to the study's purpose, that is, to the construction of a method for the design of 'possible worlds'. It was suggested that this method contributes to the resolution of both issues. Whereas the method itself narrows (i), the method's application addresses (ii). It was further pointed out that the method's application carried out in this inquiry has a Janus face: on the one hand, it provides an argument for the method's feasibility, the emphasized aspect in this study, and, on the other hand, it constitutes a self-contained research project. This dual strategy influences, as the foregoing discussion already illustrates, the dissertation's representation; however, deviations from the traditional structure of research reports are minimized as far as possible. The chapter closed, by anticipating the discussion in chapter 5, with an examination of the research program's originality, a vital prerequisite of Ph.D. theses and research in general, which has to be seen as a first approximation that unfolds only throughout the study.

idiosyncratic but applicable to a class of problems (i.e., abstraction), (ii) enhance the existing body of knowledge (i.e., originality), (iii) open up its reasoning to scrutiny (i.e., justification), and (iv) be beneficial to certain stakeholders (i.e., relevance). In respect to the present inquiry the following can be determined: (a) and (b) satisfy (i) by virtue of their nature; (ii) is addressed in this chapter; the discussions in part III and chapter 11 explicate the reasoning of (a) and (b) respectively, therefore allow to scrutinize the justification (iii); and (iv) is discussed in chapter 3.

Chapter 3

The Program's Relevance

"Scientific discovery and scientific knowledge have been achieved only by those who have gone in pursuit of it without any practical purpose whatsoever in view"

Max Planck

Although Max Planck might be right and science should not solely be guided by having a practical purpose in mind, times have changed. Today, a practical purpose or relevance is considered to be a defining characteristic of 'good research'. Taking this demand into account, the aim of this chapter is to explicate, thereby complementing the discussion on originality, the research program's relevance. However, relevance is not an intrinsic attribute of research, it unfolds in relation to audiences (cf. Bratteteig 2007, p. 67; Frank 2006, pp. 3–4). As indicated in section 2.2, the present inquiry understands itself first and foremost as an input to a larger discourse, which implies that the study's relevance has to be determined within this overarching discussion. Nevertheless, the inquiry can, at least to a certain degree, foresee such a debate by (i) anticipating potential participants and (ii) pointing out which facets are expected to be of interest to these audiences. Correspondingly, the chapter is divided into two sections: whereas the first explicates the audiences the study has 'in view', the second suggests which of the following facets are expected to arouse their interest.

3.1 Anticipated Audiences

Within the literature there are various recommendations of audiences that research can or should address (e.g., Alon 2009, p. 727; Carlsson 2007, pp. 77–78; Herr and Anderson 2005, p. 69; Hevner 2007; Hevner and Chatterjee 2010, pp. 19–20; Hevner et al. 2004, p. 90; Mertens 2010, p. 20; Österle et al. 2011, p. 8; Plano Clark and Creswell 2010, p. 82; Reason and Marshall 2006, p. 315; Zelewski 2007, pp. 101–102). Table 3.1 summarized the four most frequently mentioned audiences and their respective knowledge interests. Despite the varying suggestions in respect to the type of audiences, the literature does also not agree on the number of audiences an inquiry should serve. Although Zelewski (2007, pp. 101–102) makes a good point that there are reasonable arguments to focus on just one audience and address its needs 'optimally', the dual strategy pursued here urges to take a different route.

As indicated in section 2.2, the present inquiry has two purposes and, by implication, two audiences: on the one side, there are IS scholars, and on the other side, there are civil society practitioners. In respect to the Ph.D. thesis' context, which can be described as a formal

Table 3.1: Research Audiences and their Knowledge Interests

Audience	Interested in information that	Indicator
Researcher	is exiting	'That is exciting!'
Scholars	provides deeper insight into a particular issue, including generalizable ideas	'That is interesting!'[a]
Practitioners	relates to and solves real world problems	'That works!'
Policy Makers/ Management	helps them to make decisions, that is, information about effects (i.e., cost and benefits) and side-effects	'That is beneficial!'

[a] Davis (1971) has written an highly insightful and 'interesting' article about what is considered to be 'interesting' in science.

academic qualification process, and the hierarchical ordering of the purposes, the IS academics are the primary audience. However, this broad category can be further divided into researchers who are interested in DSR, those who are involved in C&E research projects, those who investigate SD and/or HD from an ISR perspective, and a general ISR audience. The latter is used as a proxy to indicate some facets that might interest certain groups, but which are only addressed en passant. Similarly, but mainly to avoid unnecessary complications, the second audience is also not further sub-categorized and continued under the undifferentiated umbrella term 'civil society practitioners'. In other words, it is expected that the present inquiry can make contributions, of varying substance, to discourses in (i) DSRIS, (ii) C&E ISR, (iii) ISR on SD and/or HD, (iv) to ISR in general, and (v) to civil society practitioners. Whereas inputs to (i) and (ii) are substantial and specific, arguments to the remaining debates are scattered throughout study. The next section elaborates which knowledge contributions participants in those five discourses can expected from the investigation carried out in the following chapters.

3.2 Knowledge Contributions

Based on the explication of the audiences or discourses in the preceding section, this section points out which facets of the following inquiry are expected to be most relevant to these debates. This discussion is ordered along the significance the respective debate has for the Ph.D. dissertation, that is, which aspects are emphasized in the study.

Firstly, the critical reflection of the traditional notion of DSRIS (a), that is, of the build-evaluate-loop (cf. Walls, Widmeyer, and El Sawy 1992; Hevner et al. 2004) and its narrow conceptualization of 'relevance' and 'rigor', as well as the constructive proposal of the design of 'possible worlds' (b) are inputs to the DSR discourse in ISR [audience (i)]. More specifically: within section 5.2, addressing (a), the framing of DSR is challenged by carving out the internal connection to instrumental rationality and by pointing out the weaknesses of research following the build-evaluate-loop. It is disputed that this approach is the only way to go; rather, the build-evaluate-loop is, despite its explicitly stated aim for change, a tool to maintain the status quo, thereby a special case of DSRIS, and it hampers the consolidation of insights in the disciplinary body of knowledge. This reflection is not only an asset by enhancing the self-awareness of scholars interested in DSR, it also provides the foundation from which the re-construction in part III originates—the construction of (b). The design of 'possible worlds', in turn, is an argument brought into the DSRIS discourse, which, based on broader notions of relevance and rigor, opens up the opportunity to synthesize or consolidate wisdom in the existing knowledge base and, resting on the incorporation of insights from C&E ISR, gives moral and ethical facets of research their rightful place in DSR. Neglecting these concerns, despite the (im-)perfect moral responsibility of applied researchers (cf. Niiniluoto 1993, p. 15), leads to what in reference to Rousseau and his First Discourse can be call the 'law of declining morals':

> "The daily ebb and flow of the tides are not more regularly influenced by the moon, than the morals of a people by the progress of the arts and sciences. As their light has risen above our horizon, virtue has taken flight, and the same phenomenon has been constantly observed in all times and places" (Rousseau [1750] 1913, p. 134).

What Rousseau ([1750] 1913, p. 134) criticizes is that (most) sciences, at least since the Enlightenment, detach from value considerations and hide behind the, in social sciences non-existing, cloak of 'objectivity'; an argument discussed more thoroughly in section 7.3. In respect to the broadening scope of ISR (see section 2.3), this entails the danger of a further colonization of the lifeworld, manifesting itself in a 'selective pattern of rationalization' (cf. Habermas [1981] 1997, p. 44; [1981] 1987a, p. 329), a term describing the invasion of the lifeworld by an alien form of rationality:

> "Many different occasions for discontent and protest arise wherever a one-sided process of modernization, guided by criteria of economic and administrative rationality, invades domains of life which are centered on the task of cultural transmission, social integration, socialization and education, domains oriented towards quite *different* criteria, namely towards those of communicative rationality [emphasis in the original]" (Habermas [1981] 1997, p. 44).

In short, a method for the design of 'possible worlds' (b) is an attempt to initiate a debate about the self-understanding of DSR in particular and ISR in general (see section 5.2): on the one hand, confining the scope of DSR to the economic and administrative subsystems neglects one of the largest stakeholders of research and leaves the nagging doubt of how ISR can distinguish itself from consulting companies, and on the other hand, fostering the 'one-sided process of modernization' by an invalid application of methods, suitable to the 'system', has serious social side-effects in the lifeworld (see section 2.1) for which researchers in applied disciplines such as ISR are morally responsible. The design of 'possible worlds' provides the methodical armamentarium for DSR to overcome this dilemma [audiences (i), (ii), and (iv)].

Secondly, as the critical reflection of C&E ISR (c) in section 5.3 reveals, the transformative aspirations of C&E research are limited. The central thesis in this respect is that C&E ISR cannot unfold its full potential, because of its ingratiation with interpretive research. As the latter is underpinned by ontological and epistemological assumptions that are discussed under the umbrella of (social) constructivism (see section 7.2), C&E ISR is bound to ideological criticism. Analog to (a), (c) is a worthwhile contribution to the C&E ISR discourse because its explicates in which way it is depriving itself from the possibility to fully unfold its critical and emancipatory potential. Complemented by (b), an additional input to this debate, the present inquiry offers the methodical underpinning that allows C&E ISR to go beyond the self-castigating view that pointing to contradictions in ideologies exhausts the scope of C&E research [audience (ii)]. In other words, the design of 'possible worlds', with its constructive emphasis inherited from DSR, provides the methodical equipment with which C&E researchers can pursue an active strategy, rather than only react to already established facts.

> "If the aim of critical work is to emancipate and if this is done by intervening in public discourses, then the strength of the work and its success depend on the plausibility of narratives, not on any empirical data [. . .] (Stahl 2008a, p. 78).

In this view, the narratives of 'possible worlds' are feasible and justified prospects of desirable, alternative states that C&E scholars can 'toss' into public debates. This, as suggested by the title of the present inquiry, is a contribution to the unfinished project of modernity, because it counters one of the unfavorable processes of modernity: the increase of specialized knowledge in the hands of experts drifting away from everyday life (cf. Habermas [1981] 1997, pp. 45–46). This reconnection of the disintegrated spheres is illustrated by the exemplary application of (b).

In sum, the three discussed aspects [(a)-(c)], are those features of the present inquiry that make the Ph.D. thesis a relevant contribution. As these insights emerge in the dialectic examination of DSR and C&E ISR with (b) as a synthesis, the primary audiences can be located in these two ISR traditions [audiences (i) and (ii)]. Correspondingly, the study's golden thread, outlined in the next chapter, is spanned along their interests. This implies, on the other hand, that the relevant facets for the remaining audiences are spread across the subsequent pages. The following will, therefore, explicate where these audiences can find the most relevant aspects.

Thirdly, academics interested in SD and/or HD [audience (iii)] can benefit not merely from the critical reflection of SD and HD but just as much from the introduction to SHD, which attempts to revive the initial idea of SD. This relatively new conceptual development, tackling the concrete problems of the 'unfinished project of modernity', attracts considerable interest from scholars and practitioners, especially politicians. However, this preliminary introduction is not only important as an undertaking that prevents the degeneration of this 'boarder area' (cf. Chmielewicz 1994, p. 22), it also is a criticism of ISR, which confines SD to 'greening' initiatives and which conceives and treats human beings as resources. Although these reductionist and technocratic tendencies might be suitable and justifiable in some cases, they cannot, from the moral point of view, claim validity as general rules. The exemplary application of (b), from this point of view, provides thus an illustration of an avenue for ISR that addresses the urgent 'problems of life' in a different way.

Fourthly, the exemplary application of (b) is also a valuable resource for civil society practitioners [audience (v)]: the synthesis of a considerable amount of scientific research on civil society organizations in a form that explicates development options 'that work', a time-consuming effort practitioners often cannot afford because pressuring real world problems demand immediate solutions (cf. p. 193), provides insights that can support their daily work and the operation of civil society organizations. Furthermore, the corresponding technical system is also a 'profitable' tool, because the development of IS is still a risky and difficult effort (IEEE 2000, p. 1), which often results in the loss of financial resources (cf. Charette 2005). A reference architecture can therefore not only lower costs for the development of technical systems, but is also reduces the risk of failure, which saves resources—time and money—that are chronically lacking in civil society organizations.

Finally, in addition to the afore-mentioned contribution to ISR in general [audience (iv)], the design of 'possible worlds' and the construction of a corresponding technical system provides a 'fertilized ground' for research on design theories. Although the need to advance ISR as a discipline by fostering theoretical development has been articulated more than two decades ago (cf. Walls, Widmeyer, and El Sawy 1992, pp. 37, 57), achievements in this domain are still considered to be unsatisfactory (e.g., Baskerville et al. 2011, p. 14; Heinrich 2011, p. 237). Existing guidelines such as, for example, those of Hevner and Chatterjee, do not help to overcome this state. On the contrary, they foster idiosyncratic development by demanding that DSR

> "values research outcomes that focus on *improvement of an artifact in a specific domain as the primary research concern* and, then, seeks a broader, more general understanding of theories and phenomena surrounding the artifact as an extended outcome [emphasis added]" (Hevner and Chatterjee 2010, p. 15)

Degrading theoretical development to a 'second-class citizen', combined with the "task and situation specific" evaluations (March and Vogus 2010, p. 197), perpetuates a state in which 'researchers' have to "rely on intuition, experience, and trial-and-error methods" (Hevner et al. 2004, p. 99) to carry out their inquiries. However, even more recent contributions such as the "Design Science Research Theory Development Framework" proposed by W. L. Kuechler and Vaishnavi (2012a), despite making considerable progress in integrating kernel theories, do not recognize that technical systems are 'path dependent' (David 1985), i.e., that IS are embedded in a socio-historical context. The design of 'possible worlds' is a suitable candidate to enhance design theory development by adding social system aspects to the otherwise technical focus. Unfortunately, a detail elaboration of this avenue exceeds the present inquiry's scope and can only be briefly sketched as future research option (see chapter 14).

Chapter 4

Structure of the Remainder

"As academics, we can help by willing to develop more complex theories for explaining the behaviour of humans in widely divergent settings. We do not need to be complex, just to be complex. But we need to get over our simplicity hang-ups."

Ostrom (2012, p. 129)

After the research program has been introduced and situated in the overarching discourse, the final task of the first part is to explicate the arrangement of what follows, that is, to outline the structure in which the carried out research project is represented. The classic format of reports is, as indicated before, retained as far as possible. Nevertheless, the dual strategy pursued in the inquiry makes a minor change inevitable: the description of the methodical underpinning in part III is, due to the development of the method for the design of 'possible worlds', substantively more rich than the conventional representation of existing methods. This, however, is the only derivation from the traditional structure as the following reveals.

As depicted in figure 4.1, the second part comprises two chapters: firstly, a review of the existing body of literature in chapter 5, and secondly, a specification of the concrete research questions (section 6.1) as well as their breaking down in distinct research objects (section 6.2) in chapter 6. The literature review, laying down the background of the inquiry, comprises five sections, which can be divided into three conceptually different categories. The first category details the unit of analysis, i.e., the information systems (IS). The purpose of this section is to demarcate two different research avenues in ISR, to anchor the present inquiry in the socio-technical tradition, and to introduce the term 'possible world' (section 5.1). Based on this groundwork, the two remaining categories prepare the foundation for the two specified purposes (see figure 4.1): whereas the second category examines the two ISR traditions that are appropriated for the construction of the method for the design of 'possible worlds' (sections 5.2 and 5.3), the third category prepares its exemplary application by discussing the socio-historical context, refined in the following chapter, in which a 'possible world' is designed (section 5.5) and by specifying the technical system that complements the former design (section 5.4). However, as indicated in figure 4.1, the latter is a hybrid, because it is also the natural complement of 'possible worlds'.

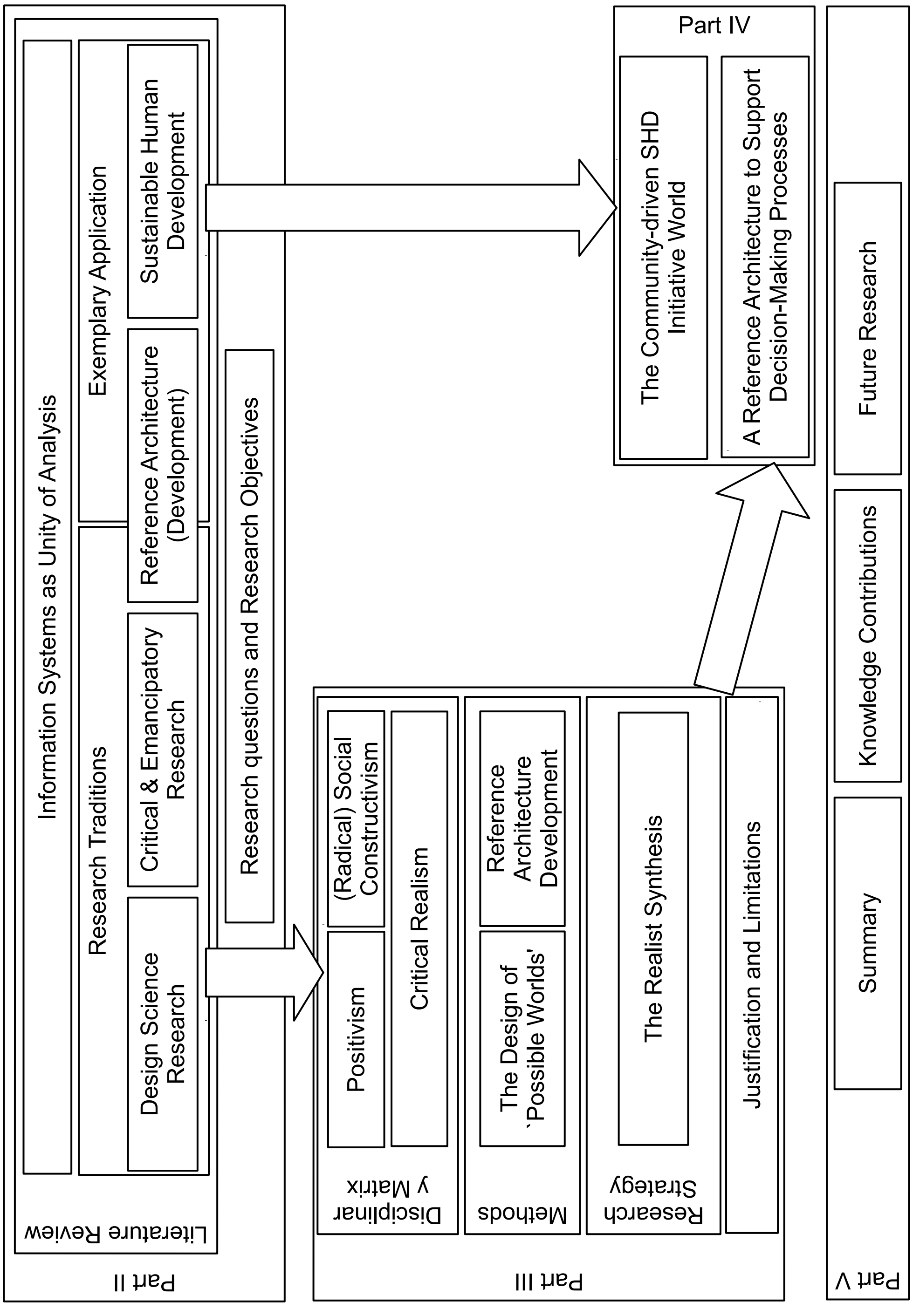

Figure 4.1: Structure of the Dissertation

Within the third part the method for the design of 'possible worlds' is developed. This construction proceeds in three steps, each described in one chapter: in chapter 7, which might also be called the '-isms of philosophy', the ontological and epistemological assumptions of the dissertation are outlined. Although the central aim is to defend critical realism as viable underpinning, it also serves to enlarge the arguments made in sections 5.2 and 5.3. This chapter uses the 'dialectic movement', an approach often attributed to Hegel ([1807] 1910), to contrast the three different disciplinary matrices found in ISR: opposing positivism, as the long-established scientific 'paradigm', with (radical) social constructivism (thesis vs. antithesis) allows to present critical realism as the synthesis that overcomes the presently relevant deficits of both former positions. This discussion, by disclosing the assumptions underpinning the next chapters, is essential to satisfy the justification principle of 'good research' (cf. Frank 2006, p. 35; Österle et al. 2011, p. 9), but it also paves the way for both the design of 'possible worlds' (section 8.1) and Pawson's (2006) 'realist synthesis' (section 8.2). The former uses the latter as research strategy, i.e., to extract and synthesize design process' 'material' from the existing body of knowledge. Together these two approaches allow to design 'possible worlds'. Complemented by a preliminary but conventional, therefore only briefly sketched, method for the design of reference architectures (section 8.3), this rounds out the research design, which is subjected to a critical reflection in chapter 9 before it is applied to the second research problem in the Ph.D. thesis' next part.

Part IV, mainly illustrating the feasibility of the developed method, comprises two chapters: whereas the first designs a 'community-driven SHD initiative'-'possible world' (chapter 10), the second uses the former as domain model for the development of a reference architecture that supports the decision processes of these initiatives (chapter 11). Although the method's exemplary application is primarily an argument that supports the validity claim of the design of 'possible worlds', it is still a self-contained research project. From this point of view, the application contributes to the 'unfinished project of modernity' by preparing justified development options for the public sphere that informs lifeworld discourses. The application, thereby, highlights why, as suggested by the title, the design of 'possible worlds' is itself considered to be a contribution to the 'unfinished project of modernity'.

The final part of the present inquiry briefly summarizes the main results in relation to the research questions (chapter 12), explicates the knowledge contributions (chapter 13), and points out limitations as avenues for future research (section 14).

Part II

The Study's Background

Chapter 5

Existing Body of Knowledge

"Der praktische Imperativ wird also folgender sein: *Handle so, daß du die Menschheit, sowohl in deiner Person, als in der Person eines jeden anderen, jederzeit zugleich als Zweck, niemals bloß als Mittel brauchest.* [The practical imperative will thus be the following: *Act in such a way that you treat humanity, whether in your own person or in the person of any other, never merely as means to an end, but always as ends themselves.*] [emphasis in the original]"

Kant ([1786] 1974, pp. 66–67)

Within this first chapter of the second part the foundation of the present inquiry is laid out, before the next chapter explicates the concrete research questions that guide the third and fourth part of the study. Following from the dual strategy pursued in the research program, already indicated in chapter 4, the groundwork is divided into three categories: within the first category the unit of analysis is specified to anchor the inquiry in the socio-technical information systems research (ISR) stream and, at the same time, demarcate it from the tradition exhibiting a technical focus (section 5.1). As the latter excludes social aspects, it is, in contrast to the former, not bound by the practical imperative. However, the implications of this unfold only in the discussion of the two research traditions, the second category in this chapter, that are appropriated for the construction of a method for the design of 'possible worlds': design science research in information systems (DSRIS) (section 5.2) and critical and emancipatory (C&E) ISR (section 5.3). Whereas this analysis provides the background for part III, the two sections in the third category focus on the fourth part. Whereas the second section in this category explicates the context in which and for which a 'possible world' is designed (section 5.5), the first section complements, anticipating the insights gained in section 8.1, this discussion by a preliminary analysis of the type of technical system that can be constructed based on 'possible worlds' (section 5.4).

5.1 Information Systems as Unit of Analysis

From a historical point of view, the emergence of information systems (IS) as discipline is attributable to the rising importance and usage of information and communication technology (ICT) in the 1950's (Szyperski 2011, p. 202). Because no prescientific skill was available, the computer and corresponding challenges emerged simultaneously (Bunge 1966, pp. 329–330). Mainly researchers with a business administration or an engineering background were attracted to these practical problems (Frank 2006, p. 5; Heinrich 2011, p. 326), tackled in large cooperative projects funded by business organizations. Those projects are not only important milestones in the discipline's history (Szyperski 2011, pp. 204–205), they also instantiated the lasting, mutually beneficial cooperation with practice. This tradition is fostered, because it provides the continuous funding required to demerge from reference disciplines and establish IS as scientific field (Frank 2006, p. 7)[9].

Without going into the details of this development or re-constructing the genesis of design science research (DSR) (see section 5.2), emerging from the 'research through development' tradition (Szyperski 2011, 204), this brief historical sketch makes the internal divide of ISR in two different research streams more comprehensible (see also Carlsson et al. 2011, p. 110): on the one side, there is a research avenue—the dominating stream (cf. Kautz et al. 2013, p. 111; Richardson and Robinson 2007, p. 262)—solely concerned with ICT applications, i.e., IS are equalized with ICT applications (e.g., Gregor 2009; Hevner 2007; Hevner et al. 2004; Hevner and Chatterjee 2010; W. L. Kuechler and Vaishnavi 2012b, 2012a; Nunamaker, Chen, and Purdin 1991; March and Smith 1995; Peffers et al. 2008); on the other side, IS are defined much broader, namely as socio-technical systems[10] (e.g., Bostrom and Heinen 1977a, 1977b; Carlsson 2007, pp. 76–77; 2010, pp. 213, 219; Carlsson et al. 2011, p. 110; Hevner 2007, 89; Hevner et al. 2004, 79-80; Österle et al. 2010, p. 3; 2011, p. 8; Orlikowski and Baroudi 1991; Venable 2006, p. 8; Walls, Widmeyer, and El Sawy 2004, pp. 49–50; WKWI 2011, p. 1). Whereas the former notion of IS tends to be influenced by the engineering background, academics with a business administration background tend to favor the broader conception of IS. Leaving aside the two sources of origin, the difference between both perspectives can be illustrated in reference to the entities of the broader perspective depicted in figure 5.1.

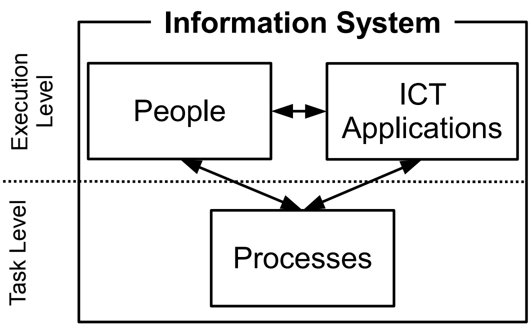

Figure 5.1: IS as Socio-Technical Systems, adapted from: Sinz (2010, p. 29)

Figure 5.1 reveals that socio-technical systems comprise three elements, viz. people, processes, and ICT applications. This allows to distinguish the broader from the narrower view as follows: whereas the narrow view focuses on ICT applications, the broader view widens this perspective by including 'action systems' (Aken 2005, p. 397) as well. Although these systems are also implictly recognized in the former, otherwise techniques such as requirements engineering are superfluous, both streams attribute a different status to ICT applications (cf. Mumford 1983, p. 38, 65): the narrow view includes the action system merely as a source

9. The down side of this close cooperation is that the scope of research is often confined to practical problems and opportunities, because only those research projects that promise beneficial contributions to business success are 'worthy' of being funded; on the other side, the amount of funding is often used as indicator to measure researchers' reputation. This mechanism or internal connection explains why corporate entities, which represent only a subset of settings with which ISR in its broader conceptualization (see section 2.3) is concerned, receive almost all attention (cf. Córdoba and Midgley 2008, p. 125; Kanungo 2001, p. 395; 2004, p. 407).

10. Trist (1981) and Mumford (2006) provide an interesting historical overview of the socio-technical systems approach and its contributions.

of requirements and, at the same time, perceives the ICT application as an end[11]. This, for example, neglects that within an organizational settings different functionalities of distinct technical systems are configured and complemented by customized ICT to realize desirable process outcomes (Steward and Williams 2005, p. 204). The socio-technical system perspective, in contrast, recognizes this configurational aspect in addition to the interdependent relationship of action/social and technical systems (cf. Mumford 1995, p. 81):

> "The human being cannot operate at a high level of efficiency without the machine and the machine cannot operate at all without the human being. Such a system is unlikely to function effectively if this mutual dependency goes unrecognised and only the machine part of the system is consciously designed" (Mumford 1983, p. 13).

Including the social system to broaden the perspective allows to draw another, for the present inquiry, important distinction. Given that an ICT application is always embedded in a socio-historical context, something both streams share (cf. Hevner et al. 2004, p. 84), the development of a novel technical system transforms a pure social system to an IS or changes an already existing IS. The narrow view, concentrating on the ICT application, recognizes changes only in relation to the novel technical system, thereby neglecting or ignoring unintended (social) side-effects caused by the introduction of ICT applications (e.g., Fountain 2001, pp. 36–38; North 1990, p. 65; Stahl 2008a, pp. 64–66; 2009, pp. 127–128). The broader perspective not only recognizes these changes in composition and structure of existing action systems or IS, it also allows to deliberately plan them. The scenario planning is, for example, a technique that is, although in this case focusing on events in the business environment, used to anticipate changes:

> "[S]cenarios are [...] created as internally consistent and challenging descriptions of possible futures. They are intended to be representative of the ranges of possible future developments and outcomes in the external world" (Heijden 1996, p. 5).

Such scenarios are "alternative, dynamic stories that [...] illuminate options for action" (Peterson, Cumming, and Carpenter 2003, p. 359). Peterson, Cumming, and Carpenter (2003, p. 361) further suggest that each plausible scenario "should be clearly anchored in the past, with the future emerging from the past and present in a seamless way". In the present case, however, the aim is not to anticipate changes in the environment, but to plan changes in a social system. This involves a double shift: on the one side, the focus lies on the action system not on the environment, and on the other side, the reactive understanding is replaced by a (pro-)active, forward-looking stance. In reference to D. K. Lewis (1986), such an inward- and forward-looking scenario planning will be called the design of 'possible worlds'; first conceptually introduced to ISR by Frank (2009, pp. 165–166). The definition of 'possible worlds', which is thoroughly explored in section 8.1, reads as follows: a 'possible world' is an internally consistent set of feasible social system-options that represent desirable alternatives to factually existing social systems comprised in IS, which, in virtue of their nature, can be used, accompanied by a corresponding technical system, as input to discourses in which changes to factually existing social systems or IS are debated.

11. This implies a particular assumption in regard to human beings. In anticipation of the discussion in chapter 7 and in reference to the afore-mentioned distinction of rationality proposed by Habermas ([1981] 1987a, pp. 244–246), it can be argued that this approach is underpinned by instrumental rationality. This entails the danger to objectify people, that is, to treat human beings in the same manner in which other objects, e.g., ICT hardware, in the organizational setting are treated (see also Bhattacharyya 1995, p. 62; Chua 1986, p. 604; Mumford 1983, p. 12).

As many facets of this definition require a more thorough analysis, postponed till section 8.1, that would exceed the scope of this section, an intuitive, approximating, and preliminary definition of 'possible world' is the following: a desirable and possible alternative to factually existing IS. Although the 'possible world' is itself, if accompanied by a corresponding technical system, an IS, there are some peculiarities. Therefore, before the analysis turns to the discussion of design science research in information systems (DSRIS), the remainder of this chapter will, in anticipation of and preparation for the following four chapters, explicate those differences, which are most significant in relation to the succeeding discussions.

The greatest divergence between factually existing IS and 'possible worlds' is an epistemological, because the latter cannot be grasped using traditional discovery or justification techniques (cf. Chmielewicz 1994, p. 37; Ladyman 2007, pp. 355–356):

> "While any knowledge contribution that is intended to qualify as scientific requires justification, truth alone is not sufficient in this case. A possible world is intended to differ from the factual world. Therefore, statements describing *possible worlds cannot be tested against reality. Designing possible worlds should result in offerings to inspire those who might realize them*, thereby emphasizing an essential goal of Economics, namely, creating interesting (and feasible) options for action [emphasis added]" (Frank, forthcoming).

This characteristic of 'possible worlds' is by far the most challenging and significant, because an adequate treatment of 'possible worlds' requires alternatives for both the context of discovery and the context of justification—the key task of part III[12].

Another difference, already indicated in the introduction to the present inquiry, is the dominance of instrumental rationality, which was brought into ISR by scholars with a background in (business) administration and economics. However, 'possible worlds' are, like "offerings to inspire those who might realize them" (Frank, forthcoming), mainly driven by communicative rationality. Besides this difference on the axiological dimension, ISR inherited another systemic aspect from its reference disciplines:

> "Definitions of information systems [. . .] implicitly assume an organizational setting. In doing so, the definitions imply the existence of a formal IS management structure, a certain pattern of information system use, and a specific notion of utility associated with information and associated technology" (Kanungo 2004, p. 408).

From the perspective of the unfinished project of modernity and the contribution of 'possible worlds' as well as the purpose of the exemplary application of the method for the design of 'possible worlds' to strengthen the public sphere, clearly defined organizational boundaries and formal processes for the management of IS[13] are not necesssarly given in lifeworld contexts. In fact, it is argued that

> "[i]f we are genuinely interested in improving the lives of people in the information society, beyond those parts of their lives spent working in, or receiving services from, formal organisations, *we need to transcend the boundaries of those organisations* [emphasis added]" (Córdoba and Midgley 2008, p. 127).

This, however, implies that those insights in the ISR knowledge base, which were gained

12. In anticipation of the discussion in part III these issues are solved in section 8.1, which develops a method for the context of discovery, and section 8.2, within which a research strategy for the context of justification is presented.

13. An extensive discussion of these processes can, for example, be found in ISO and IEEE (2008, chap. 6) as well as Esposito and Saltarello (2009, pp. 24–26).

in organizational settings in the 'system', are not readily applicable in lifeworld contexts (cf. Kanungo 2001, p. 395). Based on a field study carried out in Southern India, Kanungo (2001, pp. 399-401) suggests there are at least two differences: on the one side, most contributions in the disciplinary body of knowledge are "premised on the assumption that the user of the information is the user of the computer system" (p. 399), whereas in 'less developed' contexts intermediaries use technical systems and transmit information verbally (i.e., 'human-mediated computer use')[14], and on the other side, within these contexts ICT applications often do not have an "owner *per se*", but are collectively owned by the groups of people (Kanungo 2001, p. 400; 2004, pp. 416–417), which makes ICT management more complex in the lifeworld. Whereas the former tends to be a problem of 'less developed' countries[15], the latter issue applies to all lifeworld contexts. In other words, the design of 'possible worlds', if not carried out for a formal organizational setting, needs to be aware of the presuppositions in the body of knowledge synthesized during the design of 'possible worlds'.

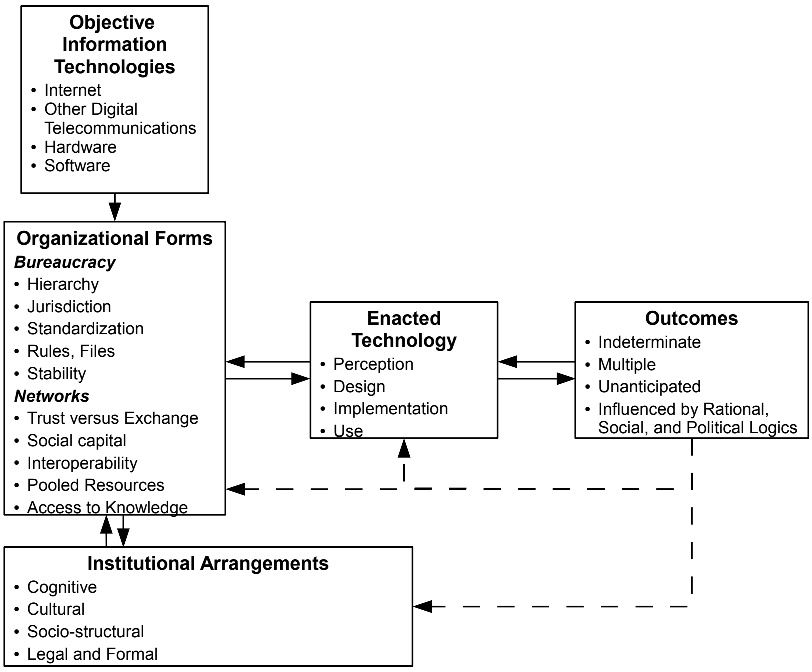

Figure 5.2: Technology Enactment Framework, source: Fountain (2001, p. 91)

Although the present inquiry generally agrees with the analysis of Kanungo (2001, 2004), it does not share his idea of 'IS for emancipation', that is, of IS that are "emancipatory in nature" (Kanungo 2004, p. 407). This perspective entails a trace of 'technological determinism', i.e., the assumption that the "use of a certain technology will lead to predetermined consequences" (Stahl 2008a, p. 64). At least since the seminal work of Fountain (2001) and her 'Technology Enactment Framework', depicted in figure 5.2, it has been recognized that the 'objective' side of ICT, [i.e., "the capacity and functionality of hardware, software, telecom-

14. Kanungo (2001, p. 399) uses this term to describe contexts in which the information desired by the information user, who, in his field study, often can neither read or write nor is trained in dealing with ICT applications, is provided by another human being, who uses ICT applications to gather the required information and transmits it verbally to the information user.

15. Although it is believed that this is a 'less developed' country-specific issue, the ability to read and write in more 'developed' countries is not self-evident. For example, Wölfel et al. (2011, pp. 2–4) point out that the reading and calculation capabilities of approximately 25% of German adults are insufficient to cope with day to day life problems (see also Castells 2010, p. 168, for similar statistics about the United States of America (USA)).

munications, or digital devices" (Fountain 2001, p. 88)] needs to be distinguished from its 'enactment' [i.e., from perception, design, implementation, and use of this ICT application in a particular, socio-historical constituted organizational setting (pp. 10, 89)]. In reference to figure 5.2, this means that embedding ICT applications, characterized by 'objectively' existing capabilities and functionalities, in a social system, which is in turn characterized by an institutional arrangement, leads to multiple, indetermined outcomes, because it cannot fully be anticipated how the ICT application is enacted (see also Mumford 1983, p. 37).

The risk of (social) side-effects, depicted as dashed arrows in figure 5.2, underlines the importance of the socio-technical systems tradition in ISR: it can reduce the risk of IS failure. Furthermore, the framework also suggests that changing IS by introducing or replacing existing technical systems always entails changes to the social system, which in turn allows to draw the following conclusion: a novel technical system, aiming to solve a particular real world problem, is designed in relation to an *anticipated social system*, which is created, by changing the factually existing social system (e.g., through employee training), only during the introduction of the technical system. Although participatory or agile techniques have changed the locus and temporal aspects of this approach (see sections 5.2 and 9), the general argument, i.e., technical systems are designed for a future version of a social system, still holds. As indicated above, the design of 'possible worlds' merely reverses the direction: design a desirable future state of social systems and elicit requirements for the construction of technical systems from this 'possible world'; together, both system descriptions, by providing 'interesting and feasible options of action' (Frank, forthcoming), inform the practice in which IS are changed (see section 9). While not excluding other applications, the central aim is to allow for ISR that is critically constructive and constructively critical. The analysis in the next two sections explicates why DSRIS and critical and emancipatory (C&E) ISR, despite being predestinated for such endeavors, are, in their current form, unable to carry out such projects. This provides the basis for the construction of the method for the design of 'possible worlds' in part III.

5.2 Design Science in Information Systems Research

"Die Philosophen haben die Welt nur verschieden *interpretiert*, es kömmt drauf an, sie zu *verändern* [Philosophers only *interpreted* the world differently, however, it is important to *change* it] [emphasis in the original]"

Marx ([1845] 1969, p. 7)

At least since Lakatos (1970) and Kuhn (1996) published their seminal works, the philosophy of science no longer considers scientific progress to be a linear process of knowledge accumulation; instead, it is conceived as a process, guided by the 'progressive problem shift' (cf. Lakatos 1970, p. 118), of 'research programs'[16] replacing each other. These research programs are multi-dimensional research endeavors, which vary in research topic, purpose, scope, etc., but they also differ in their orientation. In respect to this latter feature, four idealized types of research programs can be distinguished (Kuipers 2007, pp. 58–61): descriptive, explanatory, design, and explicative research programs. As indicated before, the present inquiry can be located in the third category. According to Kuipers (2007, p. 61) these research programs can be characterized as research in which certain, not necessarily technological,

16. For a discussion of the term 'research program' as successor of Kuhn's (1996) 'paradigm' and 'disciplinary matrix' in the first and second edition of *The Structure of Scientific Revolutions.* respectively see Blaug (1976).

artifacts are constructed to satisfy particular demands, often derived from the intended use of the finished product. Within ISR the methodology underpinning this type of research program is captured in the 'build-evaluate loop' (March and Smith 1995). The following will give a brief sketch of this methodology as well as its relevant methodical[17] extensions before turning to a critical reflection, providing one part, complemented by the next section, of the background on which the discussion in part III unfolds.

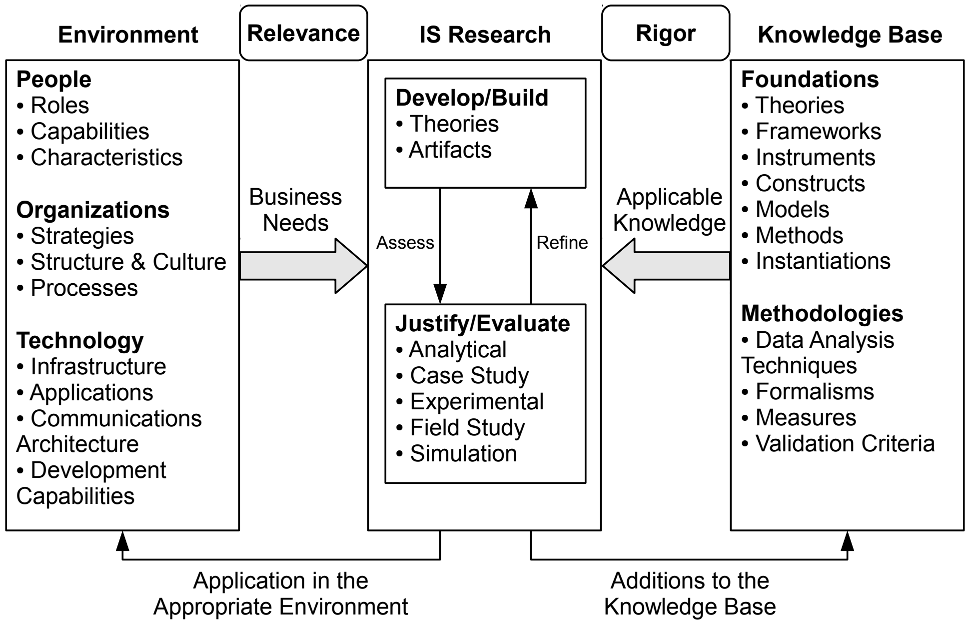

Figure 5.3: ISR Framework, source: Hevner et al. (2004, p. 80)

The build-evaluate loop describes a two-stage process in which an artifact is constructed (build phase) and then assessed against the demand that initiated the process (evaluate phase) (cf. Hevner 2007, pp. 87–88; Hevner and Chatterjee 2010, pp. 2, 7; Hevner et al. 2004, pp. 79–81; Iivari 2007, pp. 42, 45; March and Smith 1995, pp. 258–260; March and Vogus 2010, p. 200). As discussed in section 2.3, to be considered scientific such a construction process needs to be, inter alia, systematic and result in a novel artifact. These two demands are captured in the 'ISR Framework' (see figure 5.3) proposed by Hevner et al. (2004, pp. 79–81), which provides the underpinning for the DSR guidelines summarized in table 5.1.

Table 5.1: DSR Guidelines, source: Hevner et al. (2004, p. 83)

Guideline	Description
1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.

Continued on Next Page

17. Note the difference between 'methodology' and 'methodological' on the one side and 'method' and 'methodical' on the other side (Zelewski 2007, p. 97): the former is the theory of the latter. Following Cecez-Kecmanovic (2005, p. 37), the term methodology can be defined as "an overall strategy of conceptualizing and conducting an inquiry, and constructing scientific knowledge" (see also Cecez-Kecmanovic 2011, p. 441).

Table 5.1 – Continued from Previous Page

4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

The DSR-relevant facets of this conceptualization can be framed in terms of three interrelated cycles (Hevner 2007, pp. 87-91): (i) the *relevance cycle* captures the interaction between the design cycle and the environment, which provides the business needs that define the demands satisfied through building a novel and relevant artifact, and it is the setting in which the artifact is introduced to evaluate its performance in regard to the specified needs (within figure 5.3 this cycle is represented by the gray business need arrow and the left arrow at the bottom of the figure); (ii) the *rigor cycle* captures the interaction between the design cycle and the disciplinary knowledge base. On the one hand, the knowledge base provides applicable knowledge, ensuring that both, the construction and the evaluation processes are conducted systematically and rigorously, and on the other hand, the successfully created and evaluated artifact becomes part of the disciplinary knowledge base after the research process (within figure 5.3 this cycle is represented by the gray applicable knowledge arrow and the right arrow at the bottom of the figure). In respect to the DSR guidelines summarized in table 5.1, the entities of these two cycles are represented by the second, fourth, and fifth guideline. Whereas the two gray arrows represent guidelines two and five respectively, the two arrows at the bottom of figure 5.3 are the essence of the fourth guideline (Hevner et al. 2004, pp. 84, 87): DSR can make a contribution (i) through the designed artifact itself, if it provides a solution to an unresolved problem or if it extends the reach of existing knowledge, and/or (ii) by extending the foundations or methodical repertoire[18] that constitute the ISR knowledge base. In sum, the two afore-mentioned cycles are supportive in nature, they provide inputs to the design cycle and transfer its outputs to the environment and the knowledge base respectively (Hevner 2007, pp. 87–91). The *design cycle* itself, the central element of the framework, comprises two the mutually interdependent activities discussed in the following.

The *build phase* is described as creative, goal-driven systematic search process in which concrete solutions for identified problems are devised and eventually constructed (see also March and Vogus 2010, p. 200; Hevner and Chatterjee 2010, pp. 3, 31; Iivari 2010, p. 55, and the sixth guideline in table 5.1):

> “the build process in design science is a creative process of generating and representing the space of alternative solutions and devising mechanisms for moving from worse to better ones” (March and Vogus 2010, p. 197).

In addition, it is demanded that the build processes is ‘grounded’ by referencing the source

18. Within figure 5.3 this is referred to as methodologies, but as Zelewski (2007, p. 91) points out, methodology is the science of methods and it is questionable if there can be more than one. Correspondingly, it tends to be reasonable to assume that Hevner et al. (2004) actually refer to research methods and research strategies, which are also comprised in the foundation section of the knowledge base. Nevertheless, the present inquiry considers the build-evaluate loop as a methodology from which methods can be derived. These methods are what the knowledge base can contribute to the actual design process.

from which the idea to initiate the build phase is derived (Iivari 2007, pp. 52-53). Sometimes grounding refers to justification and knowledge generation (cf. Goldkuhl 2004, pp. 60–61); in this case, however, it is confined to the context of discovery[19]: "I [Hevner] much prefer the direction of identifying several different *sources of ideas for the grounding* of design science research [emphasis added]" (Hevner 2007, p. 90). The main source for the problem space are practical problems and opportunities as captured in the relevance cycle and the second guideline, i.e., the artifact should be relevant to the constituent community, especially practitioners in business organizations, who are responsible for deciding if organizational resources are committed to the construction, procurement, and usage of artifacts (cf. Carlsson 2007, pp. 77–78; 2012, p. 295; Hevner 2007, pp. 87-89; Hevner and Chatterjee 2010, p. 20; Hevner et al. 2004, p. 83; Mertens 2010, p. 20; Österle, Winter, and Brenner 2010, pp. 5–6; Rossi and Sein 2003, p. 4); sources for the solution space as a second aspect of grounding include analogies and metaphors, existing artifacts, theories, or creative insights (cf. Iivari 2007, pp. 52–53; 2010, pp. 56–57; Hevner 2007, pp. 87–90; Hevner et al. 2004, p. 83; Österle, Winter, and Brenner 2010, pp. 5-6; Rossi and Sein 2003, p. 4).

This rather vague definition of the build phase has often led to pragmatically conducted projects (cf. Carlsson 2010, pp. 23–24; Hevner 2007, p. 91–92; Purao, Rossi, and Sein 2010, pp. 181, 190; Sein, Rossi, and Purao 2007, p. 108), which hinders ISR to become a science (cf. Frank 2006, p. 31; Heinrich 2011, p. 327): The more researchers focus on the pragmatic dimension and ignore the cognitive dimension, the less chances ISR has to establish itself as a scientific discipline. This provides the background of the fifth guideline, i.e., the demand to employ appropriate methods or techniques rigorously (cf. Hevner 2007, p. 90; Hevner et al. 2004, p. 88). The deliberately maintained vagueness rests on two insights: (i) the build phase is inevitably creative in nature (cf. March and Vogus 2010, pp. 197, 200; Hevner and Chatterjee 2010, p. 31; Iivari 2010, p. 55), which makes it difficult to define a DSR approach systematically in every respect (Iivari 2010, p. 55), and (ii) the various types of artifacts that can be constructed differ in their respective designs and, by implication, require methods adapted to their peculiarities (Iivari 2007, p. 44; 2010, p. 49). Correspondingly, the build phase leaves open the selection of an adequate method for the development of artifacts, which according to the first guideline, encompasses constructs, models, methods, and instantiations (see also Hevner and Chatterjee 2010, p. 6; March and Smith 1995, pp. 255-258). However, the list of legitimate artifacts has been extended over the years[20] and includes, inter alia, the afore-mentioned 'possible worlds' (Frank 2006, p. 12; 2009, p. 162; Heusinger 2013a, p. 339). Within section 5.1 it was already indicated that methods focusing solely on ICT applications (e.g., Nunamaker, Chen, and Purdin 1991; Peffers et al. 2008) are inadequate, because 'possible worlds' are IS in the broader sense. Although methodical support for such artifacts is relatively rare (Carlsson et al. 2011, p. 110), there are some highly interesting proposals, which will be discussed after the design cycle's second phase.

A central argument in the conventional conceptualization of DSR is that building an artifact is not sufficient, it is the evaluation that makes the project a valid research project (Riege,

19. Within the philosophy of science techniques for the context of discovery and the context of justification are distinguished (Chmielewicz 1994, p. 37; Ladyman 2007, pp. 355–356): whereas the former deals with the question of how to achieve novel knowledge (i.e., the genesis of research results), the latter deals with the question of how to justify novel research results.

20. The range of DSR artifacts is wide and includes, for example, improvements of existing artifacts (Carlsson 2007, p. 79; Hevner 2007, p. 89; Iivari 2007, p. 56), alogrithms and techniques (Venable 2006, p. 8), conceptual models (Schermann, Böhmann, and Krcmar 2009, p. 176), theories (Gregor 2006, p. 613; Rossi and Sein 2003, p. 5), or even organizations (March and Vogus 2010, p. 199).

Saat, and Bucher 2009, p. 73). More moderately, Hevner (2007), echoed in Hevner and Chatterjee (2010, p. 19), insists that

> "it is important to maintain a balance between the efforts spent in constructing and evaluating the evolving design artifact [...]. Having a strong grounded argument for the construction of the artifact [...] is insufficient if the subsequent evaluation is weak" (Hevner 2007, p. 91).

In contrast to the only vaguely defined build phase, the evaluation phase is articulated more clearly. The goal of an evaluation is to assess the efficacy or consequences of the artifact's instantiation in use (cf. Gregor 2009, p. 4; Nunamaker, Chen, and Purdin 1991, p. 95), similar to justification in the other research programs, by either employing empirical-quantitative (Iivari 2010, p. 48; March and Vogus 2010, p. 197) or interpretive (Hevner and Chatterjee 2010, p. 113) methods. Instantiation and evaluation are considered to be mandatory activities for a valid research project (Riege, Saat, and Bucher 2009, p. 73). This is common tenor of DSRIS: from more general instructions such as Hevner et al.'s (2004, p. 83) third guideline (i.e., "[t]he utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods") to the more specific demands of W. L. Kuechler and Vaishnavi (2012a, p. 407) in theory development (i.e., the "[v]alidation of the artifact generates information that is used to assess the correctness of the entire reasoning/circumscription chain") (see also Becker 2010; Carlsson 2010; Hevner 2007, p. 91; Hevner and Chatterjee 2010, pp. 2, 19; Hevner et al. 2004; B. Kuechler and Vaishnavi 2008; W. L. Kuechler and Vaishnavi 2012a; March and Vogus 2010, p. 197; Niehaves 2007, p. 97; Nunamaker, Chen, and Purdin 1991, pp. 100–101; Österle et al. 2010, pp. 4-5; 2011; Peffers et al. 2008; Venable 2006, p. 186). The ultimate concern is the 'effectiveness' or 'validity' of the claim(s) manifested in the artifact, that is, the evaluation is performed to justify all non-evident or unshared assumptions embodied in the artifact (cf. Frank 2010, p. 41). In short, the answer to how novel research results are justified, the central question of the context of justification (Chmielewicz 1994, p. 37; Ladyman 2007, pp. 355-356), in DSRIS is verificatory, like the answer of the empirical-quantitative tradition (Zelewski 2007, p. 104). In the critical reflection at the end of this section, this will be referred to as justification through 'post-construction evaluation'. However, before turning to the critical reflection of DSRIS, the following presents two methods that are concerned with the design of IS in the broader sense[21], namely the 'socio-technical IS design science research (STISD)' (Carlsson 2010) and the 'Effective Technical and Human Implementation of Computer-based Systems (ETHICS)' (Mumford and Weir 1979). These examinations deepen the foregoing discussion and, in addition, prepare the background for chapter 9, in which the design of 'possible worlds' is related to these approaches in order to situate the former more clearly in ISR and explicate its novelty.

The 'socio-technical IS design science research (STISD) approach' outlined by Carlsson (2010), refined in Carlsson et al. (2011) is "an alternative IS design science research approach" based on critical realism (Carlsson 2010, p. 211). The STISD differs from the dominating tradition in two respects (pp. 218–220): on the one side, it has a broader focus on IS, i.e., it goes beyond the ICT application-focus, and on the other side, it understands DSR outputs not as ends, but as means to change a social system in order to achieve a certain goal.

21. For a brief introduction and critical analysis of the Soft Systems Methodology (SSM) and the Technological, Organizational, and Personal Perspectives (TOP) approach, two further, not as closely related approaches see Córdoba and Midgley (2008, pp. 129–131).

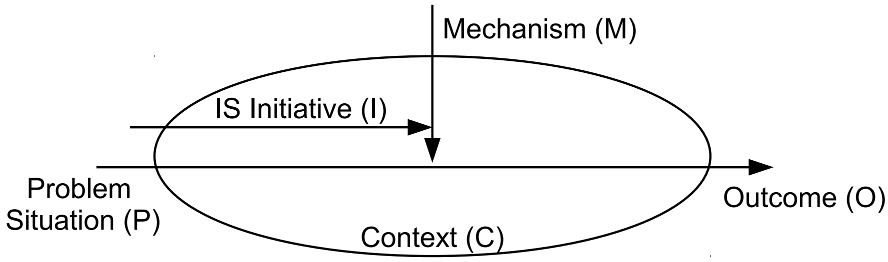

Figure 5.4: The Realist IS Intervention, source: Carlsson (2010, p. 220)

These shifts, Carlsson (2010, pp. 220–221) argues, culminate in the insight to situate DSR within the 'PIMCO-configuration' that is schematically depicted in figure 5.4. The PIMCO-configuration is essentially a variant, extended by an IS initiative, of the 'realist explanation' proposed by Pawson and Tilley (1997, 63–78) (see also Danermark et al. 2002, pp. 41–70; Pawson 2006, pp. 20–25; Robson 2002, pp. 30–33; Tilley 2000, p. 5). The realist explanation can be, in anticipation of the more thorough elaboration in section 7.3, summarized as follows: within a particular context a certain action triggers a set of mechanisms operating in this setting. The working of these mechanisms will eventually produce an observable outcome of the action. This implies, in order to change the outcome, the configuration of the operating mechanisms needs to be changed. This is done by an IS intervention[22], which is defined as

> "the design and implementation of a solution in a socio-technical system where IS (including IT artifacts) are critical means for achieving the desired outcomes of the intervention" (Carlsson 2010, p. 213).

Such an IS intervention is developed in a process that comprises the four steps depicted in figure 5.5: the first step involves the identification of problem situations (P) and desired future states (O), which should be realized by employing the design knowledge developed in the succeeding steps (Carlsson 2010, p. 222; 2012, p. 292–292). The researcher reviews the existing body of knowledge for theoretical grounding (Carlsson 2010, p. 222) and develops design theories out of suitable extant theories. This transformation is, according to Carlsson et al. (2011, p. 114), creative in nature, because "there is not necessarily one way of logically getting from an extant theory to a design theory" (see also Carlsson 2012, p. 293). Nevertheless, the finally created design theories take, ideally, the form of technological propositions, i.e., statements of the following structure (see also Carlsson 2009, p. 813; 2012, p. 293):

> "In problem situation (P) and context (C), to achieve outcome (O), then design and implement IS initiative (I) [. . . , which] includes three different types of designs: (1) *object design*, (2) *realization design*, and (3) a *process design* [emphasis in the original]" (Carlsson 2010, p. 223).

Within the final step an initial version of the design theory or each comprised technological proposition is tested in a practical setting in order to gather empirical evidence for the technological proposition's understandability, applicability, and practicability (Carlsson 2010, pp. 223, 226; 2012, p. 293).

Even this brief sketch of the STISD approach[23] reveals that it closely resembles the build-

22. In latter writings the terminology was changed to 'design proposition' (Carlsson et al. 2011).
23. For further details see Carlsson (2007, 2009, 2010, 2012) and Carlsson et al. (2011).

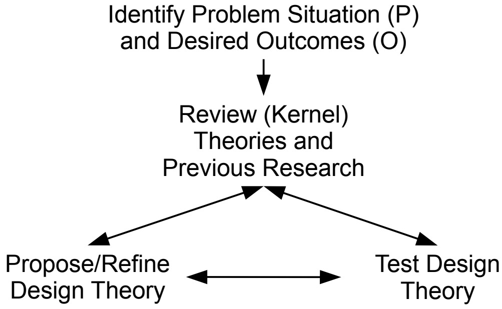

Figure 5.5: Development of Design Theory and Design Knowledge in DSRIS, source: Carlsson (2010, p. 221)

evaluate loop[24]. The only notable difference, not included in the schematically representation depicted in figure 5.5, is the 'realist IS intervention' and, following from it, the insight that IS applications are merely means to evoke changes in contexts as this leads to a situation in which actions produce more desirable outcomes. This view of IS will in reference to Bots (2007, p. 384) be called 'IS as transient structures'.

This leads the discussion to the 'Effective Technical and Human Implementation of Computer-based Systems (ETHICS)' approach (Mumford 1983, 1995; 2000, p. 132; Mumford and Weir 1979)[25], the second socio-technical systems approach. ETHICS is described as a participatory approach in which technology, similar to the STISD, is perceived as a means and not as an end (Mumford 1983, p. 65). Mumford (1983, p. 64, 70) states that the principle aim is the design of completely new systems characterized by the "successful integration of company objectives with the needs of employees and customers". In order to achieve this goal a process comprising the following seven steps is suggested (cf. Mumford 1983, p. 39; 1995, p. 29; 2000, p. 132; Mumford and Weir 1979, p. 26): (i) analyze business and social needs, (ii) set efficiency and social objectives, (iii) sketch socio-technical solutions achieving these objectives, (iv) select the best fitting alternative, (v) design this alternative in detail, (vi) implement the system, and (vii) evaluate the implementation. Following Mumford (1983, pp. 68–105), the currently relevant key aspects of these seven steps, all carried out in a participatory fashion, can be summarized as follows (see also Mumford and Weir 1979, pp. 38–43): based on preparatory work[26] carried out in advance of the actual design process, the first activity involves the identification of (a) technical/efficiency needs and (b) human/social needs using interviews and questionnaires respectively. Whereas the former aims to identify unexpected or undesired system behavior (i.e., variances[27]), the latter, based on the ETHICS job satisfaction framework (cf. Mumford 1983, p. 42–50; 1995, pp. 33–39; Mumford and Weir 1979, pp. 11–25), tries to carve out satisfactory and unsatisfactory aspects of the work-

24. In reference to the preceding discussion of the build-evaluate loop the STISD can be re-characterized as follows: step 1 involves the grounding of the design process in the 'problems and opportunities' source; step 2 captures what was labeled 'rigor' cycle', i.e., using applicable knowledge from the knowledge base; step 3 is the construction process, which cannot be further specified, because it is a creative process; and step 4 is the evaluation phase.

25. Hirschheim and Klein (1994) propose an interesting emancipatory extension of ETHICS. Furthermore, Ross and Chiasson (2011, pp. 137–138) discuss ETHICS in respect to the critical social theory of Habermas.

26. This preparatory work includes (a) a definition of the focal system, of its boundaries, and of its interfaces or relationships to other systems in the organization and (b) a description as well as critical reflection of the focal system's activities and functions (Mumford 1983, pp. 68–74).

27. Within ETHICS two types of variances are distinguished: on the one side, there are key variances, which are inherent to the system's objectives and/or tasks, i.e., controllable but ineliminable variances (cf. Mumford 1983, p. 39, 74; 1995, p. 88-89), and on the other side, there are operational or 'secondary variances' (cf. Mumford 1995, pp. 92), which in virtue of being designed into the system can be eliminated through a re-design (cf. Mumford 1983, p. 40, 75; 1995, p. 92).

place. The next step transforms the identified needs or problems in lists of prioritized goals and compares the two resulting lists with each other to identify and resolve conflicts. Within the next step the refined lists of technical and social objectives are used to sketch different socio-technical solutions, which are expected to achieve the specified objectives. As shown in figure 5.6, which depicts the relationship between the first four steps of the process, partially comprising activities of the fifth step as well, this step comprises two sub-activities: whereas the first creates technical systems and social systems, or 'organizational options' (Mumford 1983, p. 92), in isolation, the second integrates those sketches to form socio-technical solutions. The best fitting of these abstract, socio-technical options is then selected to be fleshed out in all its details. Mumford (1983, p. 98) points out that the selection procedure should involve all affected employees and the management level. Within the second to the last step, this detailed solution is then implemented. To determine the step's success, the final step, employing the instruments of the first step, evaluates the option's realization.

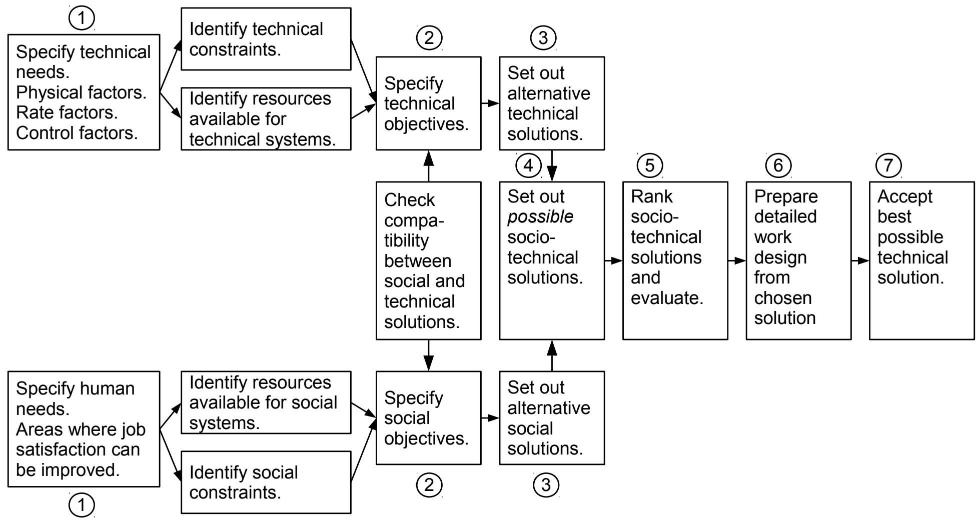

Figure 5.6: Socio-Technical System Design in the ETHICS Method, source: Mumford and Weir (1979, p. 37)

This brief sketch of the ETHICS method emphasizes three presently relevant aspects. The first of these, already mentioned in section 5.1, is that technical systems are developed in relation to anticipated social systems (or vice versa). Within figure 5.6 this is reflected in (3) and (4): (4) tests if the isolated sketches of (3) can be integrated into a coherent socio-technical system sketch. The second relevant aspect is that the development of the isolated sketches in (3) is supported by an external 'facilitator' who informs participants about organizational and technical options (cf. Mumford 1983, p. 33, 91; 1995, pp. 98–99). This external facilitator is important to overcome an employee-related issue that, in reference to Nobel Memorial Prize laureate Sen (2013, p. 11), can be called the 'downward adaptation of what is possible' caused by continual exploitation (see also Johnstone 2007, p. 75)[28]. Finally, ETHICS presupposes an existing organizational setting (see section 5.1) to which the researcher or facilitator has access. This latter addition is an important facet that allows to carve out a serious challenge inherent to all participatory or action research approaches: access to an organizational setting has to be granted by the management level, which also has the power to reject design

28. However, Jankowski (2009, p. 1971) points out that the influence exercised by facilitators might also reduce participants' confidence and trust in outcomes.

proposals, as well as to withdraw support in the name of company constraints (cf. Mumford 1983, p. 98). This suggests that only those designs that do not endanger the power position of these 'important stakeholders' will pass step (7) (see figure 5.6). Correspondingly, ETHICS, despite its laudable aim of democratizing the workplace, is, unfortunately, a status quo preserving technique (cf. McGrath 2005, pp. 87–88). Whereas the first two aspects, that is, the external support of organizational options as well as the integration of technical systems and social systems in a practical setting, are important to relate the design of 'possible worlds' and ETHICS to each other (see section 9), the third aspect will be dealt with below under the heading of 'important stakeholders'.

After this brief excursion into the realm of methodical approaches based on the build-evaluate loop, the discussion now turns to the critical reflection of the methodological foundation of DSRIS, especially in respect to the design of 'possible worlds'. This analysis focuses on the two core concepts DSRIS tries to bridge: rigor and relevance. As indicated above, the central aspect of rigor is the systematic application of either empirical-quantitative or interpretive methods in the evaluation of an instantiated artifact. The rationale, which underpins the claim that only those studies are valid DSR projects that rigorously evaluate a construction, is that the evaluation of an instantiated artifact is supposed to justify all non-evident or unshared assumptions embodied in the artifact. Although this justification through 'post-construction evaluation' is well-established, the central argument of the following is that it is not perfect and, following from this, that there is room for complementary approaches such as a 'within-construction justification'. In other words, the rationale for a more pluralistic perspective of justification is, following Heusinger (2013a), derived from the difficulties associated with the conventional justification approach. The central of these challenges originates from the 'amplified contingency' (Frank 2006, pp. 11-12) of DSRIS's unit of analysis leading to the insight that "the evaluation process in design science is task and situation specific" (March and Vogus 2010, p. 197). In other words, the evaluation of the effectiveness is spatially and temporally bound to a specific social context. This corresponds to the second moment of the scientific enterprise, the moment of 'open-systemic application of theory' (Bhaskar 2008, p. 108) (see section 7.3). In the 'moment of theory', the first moment, knowledge is gained in controlled environments (i.e., closed systems such as laboratories), which is then leveraged to measure or predict events in uncontrollable environments (i.e., open systems such as organizations). As it is impossible to control all influencing variables to isolate the effects of specific causes within open systems, observed events and their magnitude are always the result of multiple amplifying and/or curtailing influences. Because of the contingency of the context, the 'practical/technological utility' (Niiniluoto 1993, pp. 3-5) ascertained in the evaluation in one context, does not guarantee practical utility in another (see also Bailey 2012, p. 7; T. Binns 2009a, pp. 104–105, for a general social science perspective). Furthermore, the suggestion to exclude trial-and-error descriptions from research reports to preserve the reader's motivation (Chmielewicz 1994, p. 38) makes it impossible to reconstruct and explain processes in open systems—a prerequisite to derive trans-contextual knowledge and to learn from failure (Habermas [1981] 1987a, footnote 18, p. 29). This in turn has the consequence that neither the possibility of transferring an artifact to another context nor the effectiveness of this transfer can be explained scientifically; they are based on experience or 'assumed rationality' (Bhaskar 2008, p. 110). This, finally, focusing on 'practical utility' at the expense of the first moment's 'epistemic utility' (Niiniluoto 1993, pp. 3-5) inhibits the elimination of hypotheses from the existing body of knowledge (cf.

Albert 1972, pp. 273–274; Bunge 1966, p. 336; Chmielewicz 1994, p. 194; Popper 1962, pp. 111–114), because the practical application of the instantiated artifact and its successful evaluation does not give an indication of the 'truth' of the embedded theoretical propositions (Bunge 1966, pp. 334–336). For example, it is still possible that only some part of the theoretical knowledge embedded in the artifact holds in practice or the evaluation is successful despite false theoretical statements (i.e., spurious correlation). This in turn maintains the (insufficient) state of the knowledge base which forces DSRIS to "rely on intuition, experience, and trial-and-error methods" (Hevner et al. 2004, p. 99) or 'assumed rationality'.

Another issue emerges from the relationship of 'artifacts' and 'instantiations'. The foregoing discussion used both terms more or less intuitively. To unfold, what might be called the 'embodiment issue', the meaning of these terms need to be specified. H. A. Simon, one of the key figures in DSR (cf. Walls, Widmeyer, and El Sawy 1992, p. 32), describes artifacts as interface between an outer and inner environment:

> "We might hope to be able to characterize the main properties of the system and its behavior without elaborating the detail of *either* the outer or inner environments. We might look toward a science of the artificial that would depend on the relative simplicity of the interface as its primary source of abstraction and generality [emphasis in the original]" (H. A. Simon 1996, p. 9).

In this perspective an 'artifact', i.e., an abstract interface, and the 'instantiation', i.e., a concrete product with specified inner, and possibly, outer environment, are different things. The difference between both becomes more comprehensible if explained, for analytical purposes, in terms of the "Three Worlds" proposed by Popper (1978) often suggested as philosophical underpinning for DSR (cf. Gregor and Jones 2007, p. 321; Iivari 2007, p. 42; 2010, pp. 48–49). Without discussing its implications as underpinning of DSR, Popper distinguishes three worlds: the physical world (world 1), the mental world (world 2), and the world of products of human mind (world 3). He defines world 1 as "the world that consists of physical bodies" (Popper 1978, p. 143), world 2 as "the world of mental or psychological states or processes" (p. 143), and world 3 as

> "the world of the products of human mind, such as [...] scientific conjectures or theories, and mathematical constructions; songs and symphonies; paintings and sculptures. But also aeroplanes and airports and other feats of engineering" (p. 144).

In this distinction, artifacts are abstract world 3 objects, which are distinct from their embodiment or physical realization, i.e., instantiation, which is a concrete object in world 1. There is no one-to-one correspondence between artifacts and instantiations, as different inner environments might serve equal purposes (H. A. Simon 1996, pp. 10–12). Furthermore, world 3 objects are—transferring the argument for the realization process designs made by Aken (2005, p. 397)—realized as world 1 objects via internalization, i.e., the creation of world 2 object. Gathering empirical evidence about the efficacy of the instantiation happens in world 1. However, the efficacy refers to the instantiation, not the artifact. Correspondingly, the evaluation is mainly an evaluation of the skills with which the internalized version (world 2) of the artifact (world 3) is translated into a world 1 object; see also Chmielewicz (1994, pp. 159–161) for similar arguments in the case of falsification or Pawson (2006, pp. 26–37) for the problems associated with the translation of programs or agendas into interventions or actions. In respect to the afore-mentioned epistemic utility, the gained insights are generally fallible, which does not make them less important, but it indicates that they are far from absolute or perfect. This more internal problem occurs in addition to the first issue, which evolves from the external, unique environmental conditions in the specific context in which the artifacts is embedded.

An intermediate reflection of this argument, before turning to a critical investigation of the relevance cycle, results in the following insights: (i) within the build-evaluate loop 'post-construction evaluation' is used to justify the activities performed in the build phase; (ii) the evaluation is performed by instantiating the artifact in the 'environment', therefore, the results are spatially and temporally bound to this specific context; (iii) evaluation does provide knowledge of efficacy in a particular context, but does not give any information about the efficacy in other contexts, which are inevitably different; and (iv) admitting the designed and evaluated artifact to become part of the disciplinary body of knowledge, is based on the fallible assumption that it might inform other design cycles; also reflected in listing existing artifacts as a source for the solution space (see p. 30). In other words, the 'post construction evaluation' is not perfect: it neither delivers trans-contextual insights nor does it help in adopting artifacts to different contexts. Hence, Heusinger (2013a, pp. 340) suggests a complementary 'within-construction justification'. The relationship between these two justifications can be illustrated using the three different tests known in software engineering (IEEE 2004, sect. 5.2.1): unit testing (i.e., the testing of isolated software components), integration testing (i.e., testing of the interaction between software components), and system testing (i.e., testing of the whole system, comprising the software components). Whereas the 'post-construction evaluation' resembles the system testing, partially including the integration testing as well, the 'within-construction justification' focuses on the former two. A fully exploration of the latter type of justification is conducted in section 8.2, but the line of argument goes as follows: building an artifact by combining evaluated artifacts taken from the disciplinary body of knowledge (i.e., justified components and their interactions), does not provide a complete system test, which has to be performed for each context anyway, but it provides a possible structure of components applicable in the context. In other words, it is argued that designing artifacts by synthesizing insights from the existing body of knowledge results, if taking the limitations of the 'post-construction evaluation' into account, in equally, that is, sufficiently justified, valid artifacts. Furthermore, as a synthesis allows to identify context-specific variations of artifacts, the design, in contrast to the 'post-construction evaluation' approach, can account for trans-contextual adaptions, which results in more abstract or general artifacts. This, however, does not imply that a 'post-construction evaluation' is superfluous; on the contrary, such an evaluation is necessary for the adaption in the concrete context and it provides important insights on which the 'within-construction justification' approach is based. On the other side, the results of a 'within-construction justification' approach as a starting point for the traditional approach lessen the need to rely on assumed rationality. This interplay underlines the benefits of a complementary approach, which is the pivotal element for introducing the 'realist synthesis' (Pawson 2006). This expansion of the disciplinary knowledge base in respect to the context of justification is one of the two extensions necessary for the design of 'possible worlds' (see section 5.1), which are per definition not instantiable and therefore neither evaluable nor justifiable by a 'post-construction evaluation' (cf. Chmielewicz 1994, p. 146; Frank 2006, p. 30; 2009, p. 172). In short, the foregoing argument culminates in a call that is similar to what Iivari states in his rhetorical question:

> "if building of a theory is accepted as a scientific contribution without complete testing, why cannot the building of a novel IT meta-artifact also be accepted without complete evaluation, provided that the IT meta-artifact is novel and well argued?" (Iivari 2010, p. 56).

Relevance in DSRIS, as the second concept subjected to critical reflection, is mainly concerned with the grounding of a DSR project's purpose in practical problems and opportunities, i.e., demands articulated by 'important stakeholders'—predominantly managers who decide if organizational resources are committed to the study. Those articulated demands enter DSR projects in form of goals or context-specific requirements. According to the postulate of the 'absence of value judgments', which should ensure objectivity, justification has to be free from value judgments (Chmielewicz 1994, p. 293). However, a common (mis-)interpretation of this demand is to personally detach from all values, which is possible because values do not have a binding force (Niiniluoto 1993, p. 15), and solely focus on selecting the 'objectively' most effective means to achieve given goals. This is how the thesis of the colonization of the lifeworld (Habermas [1981] 1987b, p. 522, and section 1) unfolds in science: communicative rationality of research projects is replaced by instrumental rationality.

However, there are, from a moral point of view, strong arguments for extending this perspective: sciences in general and applied sciences in particular have considerable societal consequences or social side-effects. This point of view is, at least implicitly, acknowledged in early disciplinary contributions such as the one of Galliers and Land (1987, p. 900), who define the goal of ISR as to "improve the effectiveness of IS implementations *in* organizations and to assess the impact *on* individuals or organizations [emphasis in the original]". Although the 'impact on individuals' is a relative neutral description, there are also more critical accounts within ISR (Cecez-Kecmanovic, Klein, and Brocke 2008, pp. 125–127; Fountain 2001, pp. 36–38; Mumford 1983, pp. 10–20; Mumford and Weir 1979, p. 9; Stahl 2009, pp. 127–128) and even beyond the disciplinary boundaries. For example, the Nobel Prize laureate North (1990, p. 65) argues that introducing new technology (often) leads to the "deliberate deskilling of the labor force", that is, the substitution of highly skilled employees who have a strong bargain power, with less skilled and therefore less powerful staff. In other words, technical systems affect social systems, e.g., workplaces, in fundamental ways:

> "Clerks who were previously able to progress a job through from start to finish were now left with the boring task of inputting data to the computer and the slightly more interesting task of handling computer rejections" (Mumford 1983, p. 17).

Correspondingly, the design of technical systems is not a neutral endeavor; rather, the values articulated by 'important stakeholders' are embedded, without questioning them, in technical solutions (cf. Nissenbaum 2001, p. 120), which means that technical systems are designed and enacted to strengthen these values. This leads to a view that portrays IS development as a "form of symbolic violence with developers and analysts assuming the role of cultural producers capable of imposing their worldview on the unsuspecting users of their technology products and service" (Kvasny and Truex III 2000, p. 289). In the same vein, Chmielewicz (1994, pp. 278–279) states that it is hard to accept that researchers, despite these societal consequences, work on means without taking a normative stance in relation to goals (see also Avital et al. 2007, p. 584; Cecez-Kecmanovic, Klein, and Brocke 2008, p. 126; Lyytinen and Klein 1985, pp. 208, 215; Myers and Venable, forthcoming, for IS related arguments). He further argues that, because researchers' obligations are different from those of politicians and managers (i.e., system representatives), they should consider the normative implications of their research (see also Walsham 2005a, p. 227), that is, they should accept the 'moral responsibility' coming along with their contributions (Niiniluoto 1993, p. 15).

One general consequence of the focus on instrumental rationality is that human beings, immanent in IS, are expected "to conform to the demands of the machine" (Mumford 1983, p. 12), i.e., they are treated as adaptable objects. Although this violation of Kant's ([1786] 1974, pp. 66–67) 'practical imperative', which introduced the present chapter, might to some degree and in special circumstances be acceptable and justifiable, the foregoing discussion shows that it is a serious deficit if normative considerations are completely excluded, especially from applied disciplines: it makes the discipline morally questionable. Additionally, the internal connection between DSR and instrumental rationality confines intellectual curiosity—the source of important scientific problems (cf. Bunge 1966, p. 330)—to the search for technical efficiency gains (Mumford 1983, p. 12); it blurs the criteria that demarcate DSRIS—as a scientific discipline—from design practice carried out in the 'system'[29]; and, finally, it neglects the duty of scientists to enlighten society (Albert 1972, pp. 89-93), which might be one reason for the fact that "IS does not enjoy an outstanding reputation among the general public" (Frank, forthcoming)[30].

Turning this situation into a more desirable state of affairs does not require a fundamental revision of the disciplinary foundations, but it, as suggested in the introduction, demands to either confine DSR to the administrative and economic subsystems, a value decision hard to justify for an academic discipline that, at least partially, is financed by society at large, or to broaden the scope of the context of discovery. The latter, the more reasonable option, suggests that DSR does not restrict itself to the search of solution for given goals, rather, it can question goals or set its own goals.

In respect to the goal of designing 'possible worlds', defined as desirable and possible alternative to factually existing IS, the present inquiry suggests including criticism as an additional source for the grounding and initiation of a design cycle (cf. Albert 1972, pp. 89–90, 118–123; Chmielewicz 1994, p. 307; Frank 2006, p. 55; forthcoming; Popper 1978, p. 163; Zelewski 2007, pp. 104–105). This is just a generalization of the 'business needs' in the ISR framework (see figure 5.3), as the business needs of 'important stakeholders' can be interpreted as an articulated managerial criticism, mainly in economic terms, of the current organizational setting. However, the more general concept of criticism can be operationalized in different directions, for example towards moral criticism. Correspondingly, DSR projects

29. Within the literature there are various suggestions to distinguish scientific design from design practice. For example, Venable (2006, pp. 9–10) argues that science invents technology for a general class of problems and stakeholders, whereas the design practice applies existing technology to address the problems of a particular stakeholder (see also Bratteteig 2007, p. 69; Hevner and Chatterjee 2010, pp. 7, 15; Niehaves 2007, p. 96) or Iivari (2007, pp. 56–57) suggests that it is the rigor of the method employed in the artifact construction that differentiates design science and practice (see also Hevner 2007, p. 90; Iivari 2010, p. 55). However, the foregoing discussion shows that the conventional conceptualization of DSR (i) considers the build phase as creative process, (ii) focuses on the needs of specific 'important stakeholders' in particular settings, and (iii) is, due to the socio-historical uniqueness of settings, seldom in the position to generalize the knowledge gained in a particular setting. In short, the demarcation of design science and design practice is not clear cut.

30. Adam (2005, p. 125) argues that other applied disciplines, e.g., the media profession, have a code of conduct to which professionals subscribe. He describes these codes of conduct as contracts "between a profession and society: accountability of the profession and its members is given in return for the trust, confidence and respect of the public [...]". Although the Association for Information Systems (AIS) has a code of conduct, available at `http://ais.site-ym.com/?CodeofResearch`, accessed May 25, 2015, it addresses only questions of how to carry out research; goals and purposes of research are not regulated. A first attempt is made by Myers and Venable (forthcoming), who develop a set of ethical principles for DSR, which, as DSR is the tradition in ISR that produces changes, is an important move in this direction. For a more extensive discussion of normative theories used in the economic practice and informatics see Bose (2012, pp. 19–22) and Brey (2012) respectively.

can be carried out to solve problems which 'important stakeholders' might consider irrelevant and unworthy of funding, but which are relevant, even unknowlingly, to 'unimportant stakeholders'. The next section examines the ISR tradition that is generally concerned with this broadend scope of the context of discovery, thereby, completing the background on which the method for the design of 'possible worlds' can be developed.

5.3 Critical & Emancipatory Information Systems Research

Kant in his famous essay *On the Old Saw: That May be Right in Theory but it Won't Work in Practice:* "Thus, when the theory did not work too well in practice, the fault lay, not in the theory, but rather in there being *not enough* theory which a man should have learned from experience [...] [emphasis in the original]"

Kant ([1793] 1974, p. 275)

As indicated in section 2.1, one of the research problems of the present inquiry originates from the tension between DSR and C&E ISR. The general understanding of C&E research and its conceptualization in ISR as discussed in the following serve to locate the research problem more precisely within this nexus and it explicates the normative foundation of the present inquiry as well as that of the exemplary application of the method in part IV.

Generally, C&E ISR is often presented as a third alternative to the two more traditional approaches (cf. Cecez-Kecmanovic 2005, p. 19; Cecez-Kecmanovic, Klein, and Brocke 2008, p. 124; Iivari, Hirschheim, and Klein 1998, pp. 175–176; Iivari 2007, p. 55; Myers and Klein 2011, p. 19; Ngwenyama and Lee 1997, pp. 150–151; Orlikowski and Baroudi 1991, p. 24; Richardson and Robinson 2007, pp. 251–253; Stahl and Brooke 2008, pp. 51–52)[31]: positivist and interpretive research. This division is largely based on the seminal work of Orlikowski and Baroudi (1991), who derived it from the work of Chua (1986). However, Stahl (2008a, p. 9) points out that this division is more an attempt to break the otherwise dichotomic framing of research approaches. This argument is in line with the enumeration of research programs in the introduction of the previous section, in which C&E research endeavors were not featured as distinct programs. As will be more fully explored in chapter 7, the present inquiry distinguishes positivist and interpretive research along their ontological and epistemological assumptions and C&E research is not associated with any particular set of these assumptions (cf. Cecez-Kecmanovic 2011, pp. 445–446; Stahl 2008a, pp. 58–60; 2008b, p. 139). The present inquiry adopts the perspective that C&E research is distinguished from non-C&E inquiries by the intention of the researcher, that is, on the axiological dimension (see also Alvesson and Deetz 2000, p. 20; Avgerou 2005, p. 104; Cecez-Kecmanovic 2005, pp. 22–23; Cecez-Kecmanovic, Klein, and Brocke 2008, p. 125; Cecez-Kecmanovic 2011, p. 442; Iivari, Hirschheim, and Klein 1998, pp. 175–176; McGrath 2005, p. 86; Ngwenyama 1991, p. 268; Stahl 2008a, p. 9–11, 189; 2008b, pp. 139–140, 144; Walsham 2005b, p. 114, and chapter 7). Both, positivist and interpretive research

> "leave out and exclude from justification value judgements and normative implications of the findings and recommendations. They can do so as they remain committed to 'value-free research' (positivist) and 'value-neutral research' (interpretivist). The former excludes values due to their 'subjective' and 'irrational' character, thus seeing no place for

31. Following Burrell and Morgan (1979), Hirschheim and Klein (1989) describe it as one of four research approaches. However, this distinction is not widely accepted, although Cecez-Kecmanovic (2011, pp. 443–444) briefly touches on the neo-humanist and the post-humanist strand of C&E research in IS.

> normative theorizing in strictly scientific social science. The latter assumes that everything, including research, is value-laden and is satisfied with description and interpretive understanding while avoiding normative argumentation or moral judgments [sic] as part of knowledge claims and theorizing" (Cecez-Kecmanovic 2011, p. 445).

C&E research in contrast, is explicitly concerned with "an overt political struggle against oppressive social structures" (Harvey [1990] 2011, p. 17) to enhance the capabilities of human beings. In this view the tripartite framing based on ontological, epistemological, and methodological differences of research approaches is misleading (see also Bohman and Rehg 2011, p. 9; Stahl 2008a, p. 9–11; 2008b, pp. 139–140):

> "[C]ritical research may use qualitative methods or be based on a positivist/realist ontology. Similarly, research looking at power issues, using a Foucauldian angle and a participative methodology, can still be non-critical. The *most important characteristic of critical research is the critical intention*, the wish to improve the situation of people who are caught up in injustices [. . .], and the desire to promote emancipation. The other aspects [associated with C&E research] are consequences of the critical intention [emphasis added]" (Stahl 2008b, p. 144).

Therefore, all, or at least most of the research programs briefly touched in the preceding section can be pursued with a critical intention. Nevertheless, to stay in the tripartite framing in ISR, positivist inquiries, considered to be instruments to maintain the status quo (e.g. Guba and Lincoln, 1989, pp. 64–66), could, in principle, be carried out with a critical intent. However, not all researchers share the assumption that even positivist research can be critical, because "the idea of a unitary, consensual body of knowledge in which different world views coexist peacefully is a mirage. Rather knowledge is contested and reflects different interests" (Richardson and Robinson 2007, p. 264). Such an argument misses the crucial point that

> "reason is wholly instrumental. It cannot tell us where to go; at best it can tell us how to get there. It is a gun for hire that can be employed in the service of whatever goals we have, good or bad. It makes a great difference in our view of human condition whether we attribute our difficulties to evil or to ignorance and irrationality—to the baseness of goals or to our not knowing how to reach them" (H. A. Simon 1983, pp. 7–8).

For example, positivist research endeavors could be and, as discussed more thoroughly in section 10.3, are employed to challenge assumed essentialism that underpins prejudices and biases (cf. Allport 1954, pp. 9, 13–14; Sayer 2000, pp. 81–86, and section 10.3). However, this would imply a revision of the logic of positivist enterprises that generally focus on establishing, despite the principle of falsification, regularities (see section 7.1) and publication practices. Partially due to these problems and due to the lack of a dedicated C&E method (see section 2.1), most C&E research endeavors in ISR fall back on qualitative and hermeneutic methods that are closely associated with interpretive research (cf. Cecez-Kecmanovic 2011, pp. 444–445; McGrath 2005, p. 86; Ngwenyama 1991, p. 272; Stahl 2008b, p. 143) or adapt/appropriate originary interpretive research methods[32]. In fact, the current state of C&E research in ISR can be described, in reference to McGrath (2005, p. 92), as 'interpretive research with a critical intent'. The most recent and, due to the 'top' journal in which it is published, influential example is the set of principles for C&E research in IS, summarized in

32. Classic examples of such adaptations are methods such as the critical ethnography (cf. Foley and Valenzuela 2005; Myers 1997; J. Thomas 1993; R. I. Simon 1986, the second for an application to ISR) or the critical discourse analysis (cf. Alvarez 2005; Fairclough 1995, the former for an application to ISR).

table 5.2, proposed by Myers and Klein (2011). These principles are based on the 'Framework for Critical Research' (Alvesson and Deetz 2000, pp. 139–165) that distinguishes three moments of C&E research (see Doolin and McLead 2005, for a similar division): insight, critique, and transformation. Myers and Klein (2011) suggest principles only for the latter two moments, leaving out the first moment, because the knowledge that is gained in this phase is "virtually identical to the insight that is provided by interpretive research" (p. 24), covered in one of their earlier reports (Klein and Myers 1999). This view is compatible with the view of the authors of the underpinning framework:

> "Critical research may have different emphases; interpretive work aiming for insight may be central, complemented by limited elements of critique and transformative re-definitions. Critique may also dominate, but if so the empirical case study is typically used for more limited, illustrative purposes. Transformative re-definition should not dominate empirical research. Texts dominated by this tend to be Utopian and this quality is not salient in studies with research ambitions" (Alvesson and Deetz 2000, p. 153).

This clarification of the three moments in C&E research has at least the following two implications: (i) it suggests, in line of the above argument, that interpretive research, underpinned by social constructivism (see section 7.2), is the basis for C&E research and (ii) that the transformative moment *should* play only a minor role to avoid to be 'utopian'. Both these implications are, as the following will explicate, over-restrictive and limit the potential of C&E research.

Table 5.2: Principles for C&E Research, source: Myers and Klein (2011, pp. 25–29)

The Element of Critique
1. The Principle of using Core Concepts from Critical Social Theories suggests that C&E research should be underpinned by one or more critical social theories, i.e., the data collection and analysis is guided by the core concepts and ideas of those theories.
2. The Principle of Taking a Value Position demands to explicate the value position underpinning the C&E research study. Together with the theoretical foundation (first principle) the value position provides the basis for the remaining principles.
3. The Principle of Revealing and Challenging Prevailing Beliefs and Social Practices suggests that C&E research should (i) identify prevailing and taken for granted assumptions, beliefs, values, and social practices and (ii) challenge them with potentially conflicting counter arguments and/or exposing the biased or insufficient nature of supporting evidence.
The Element of Transformation
4. The Principle of Individual Emancipation suggests that all critical social theory is oriented toward facilitating the realization of human needs and potential, critical self-reflection, and associated self-transformation[33]. In other words, this principle reminds that C&E involving desired and lasting change depends on the capacity for self-reflection and the self-transformation of individuals.
5. The Principle of Improvements in Society complements the fourth principle by reminding that individual's self-transformation is not sufficient for societal improvements, but requires changes in social practices. Furthermore, the principle proposes that C&E should go beyond identifying injustices, it 'should lead to improvements in social practices and society as a whole'.
6. The Principle of Improvements in Social Theory

Continued on Next Page

33. This principle is mainly based on Alvesson and Willmott (1992, pp. 433–434).

Table 5.2 – Continued from Previous Page

	advocates, based on the insight that all knowledge is potentially fallible, that C&E researchers subject their research to 'self-critique' and seek to enhance and improve critical social theories underpinning C&E research.

In regard to the first issue, it can be argued that equalizing C&E research with interpretive research with a critical intent confines the scope of projects to the exploration of social side-effects caused by the realization of technical systems (cf. Iivari 2007, p. 55; Kvasny and Truex III 2000, p. 279). Although such endeavors are important, this inhibits C&E research to realize its full potential—especially in respect to ISR. Briefly exploring the rationale that underpins this claim does not only connect this section to the preceding one, but it also allows to explicate the tension that the Ph.D. thesis' methodical proposal (see section 8.1) resolves. In anticipation of the discussion in section 7.2, there are various weaknesses interpretive research inherits from its underpinning ontological and epistemological assumptions, which in the philosophy of science are discussed under the heading of (radical) social constructivism (see Frank 2006, pp. 27–29; Orlikowski and Baroudi 1991, p. 181; Robson 2002, pp. 22–26, and section 7.2). The presently relevant shortcoming is the conceptualization of social reality as 'interpreted social action' (Robson 2002, pp. 23–25). This perspective is based on the ontological assumption that an independent social reality does not exist or is inaccessible. From this follows the epistemological principle that reality can be understood only by exposing and exploring the meaning that the subjects of investigation attribute to their actions (Wynn and Williams 2012, p. 793). In combination with the assumed inaccessibility of social reality, these elicited interpretations cannot be true or false; they are simply more or less informed/sophisticated particular perspectives to view reality (Guba and Lincoln 1994, p. 111; Robson 2002, p. 26). In respect to C&E research, these assumptions have serious consequences. Firstly, although it is pointed out by, for example, Guba and Lincoln (1989, pp. 64–66) that the recognition of values, demarcating interpretive research clearly from the 'value free' positivist stance, makes interpretive research comparatively well suited for C&E research, there is also a dark side to the adopted 'value-neutral' position. The lack of an 'independent' basis to assess interpretations implies that all interpretations and values have to be treated as equally 'right' or important (cf. Cecez-Kecmanovic 2005, p. 25). This entails the danger of relativism (Sayer 2000, p. 18), which not only allows to justify the status quo, the criticism interpretive proponents put forward against positivist research (cf. Guba and Lincoln, 1989, pp. 64–66), but it can even be misused to defend any kind of horrible ideology[34] and it follows that "truth becomes meaningless and, if that is the case, liberatory praxis has no purpose other than to win for the sake of winning" (Kincheloe and McLaren 2005, p. 327). From this point of view, interpretive research does not inevitably have a C&E nature just because it is not a positivist account. Alvesson and Deetz (2000) as well as Myers and Klein (2011) recognize this by including the two further moments of the C&E enterprise: critique and transformation. Whereas the former mainly refers to the employment of critical social theory, discussed after the following critical reflection, the latter is its positive counterpart:

> "Critique may, however, primarily lead to a rather negative and gloomy view. Action implications may be unclear. Even though critical research refrains from authoritatively telling people what to do, transformative

34. The prime examples to demonstrate how an equal weighting of worldviews can be misused are the relativistic arguments Hitler and Mussolini, two key actors in one of the largest tragedies in human history, used to defend their respective ideologies. For an extensive discussion see Sayer (2000, pp. 47–51), H. A. Simon (1983, pp. 8–11), and Law (1991, pp. 3–4).

> re-definition adds to critique clearer indications of a more positive future or, more cautiously alternative routes towards engagement with the world [...]. Transformative re-definition must in some way connect to the ideas, opinions and orientations expressed by the people being studied. Without any openings in terms of discursive pluralism [...] the process of transformative re-definition appears fruitless. Discovering cracks in a seemingly solid, uniform, dominant discursive formation of social reality enables critical research to go beyond critique" (Alvesson and Deetz 2000, pp. 152–153).

Implicit within this quote is a second limitation that interpretive research inherited from social constructivism: conceptualizing social reality as interpreted action neglects that individuals are socialized in an already existing society and that this process of socialization not only configures individuals' worldviews but also creates 'material' constraints (see sections 5.5 and 7.3). In other words, it neglects social structures (cf. Orlikowski and Baroudi 1991, p. 19), which constrain human freedom by curtailing the set of actions individuals can possibly exercise. Such constraints can hardly be overcome just by 'discovering cracks' to change individuals' worldviews, who in turn, if possible, might change their actions. In fact, the goals of C&E research are reduced to the more modest, nevertheless important, goal of criticism, i.e., the explication of contradictions in ideologies (see also Alvesson and Deetz 2000, p. 153; Cecez-Kecmanovic, Klein, and Brocke 2008, p. 123; Lyytinen and Klein 1985, p. 219):

> "It seems to be true of CRIS [critical research in information systems], then, that it is not radical, that it does not aim to overthrow society but is *content with pointing out the contradictions in society*. This leaves CRIS in the uncomfortable position of being distinctly close to interpretive research. And it may well be that the distinction between CRIS and interpretive research is less clear-cut than one might think. In the end, there is not even a strong reason to assume that critical research must be fundamentally different from a positivist stance, as even positivists may research discrepancies between claims and reality [emphasis added]" (Stahl 2008a, pp. 188–189).

The quote, besides underlining the afore-mentioned critical intent as a characteristic feature of C&E research in the last part, summarizes the impact of interpretive research with a critical intent in the emphasized part: point out contradictions. This contrasts sharply with the actual goal that gave rise to C&E research emanating from critical social theory (see also Finlayson 2005, pp. 2–4):

> "The critical theory of society [...] has for its object men as producers of their own historical way of life in its totality. The real situations which are the starting-point of science are not regarded simply as data to be verified and to be predicted according to the laws of probability [...]. [T]he critical theory in its concept formation and in all phases of its development very consciously makes its own that concern for the rational organization of human activity which it is its task to illumine and legitimate. For this theory is not concerned only with goals already imposed by existent ways of life, but with men and all their potentialities [...]. It is not just a research hypothesis which shows its value in the ongoing business of men; it is an essential element in the historical effort to create a world which satisfies the needs and powers of men. [...T]he theory never aims simply at an increase of knowledge as such. Its goal is man's emancipation from slavery" (Horkheimer [1972] 2002, pp. 244–247).

Before discussing the details of this characterization and the role critical social theory plays in C&E research in general as well as the present inquiry in particular, a more or less brief critical reflection of the foregoing discussion is inserted to locate the Ph.D. thesis' methodical proposal in the overall methodological context: in contrast to the active goal of critical social theory to 'create a world which satisfies the needs and powers of men', the goal to 'point out contradictions' paints a more passive picture of C&E research. Such a re-active conceptualization is particularly limiting in ISR. Not only because ISR is naturally forward-directed due to technological development and progress (Hevner et al. 2004, p. 99), but also because values are materially represented as rules and procedures in enacted technical systems. For example, the algorithmic gatekeepers in search engines, the Facebook newsfeed, and various news sides select which information is relevant for people to see, without the people themselves being able to influence the selection process, which in turn creates 'filter bubbles'[35] (for an extensive discussion of various other areas see Brey 1998, pp. 68-73; 2010; Fleischmann 2007; Friedmann and Nissenbaum 1996; Introna and Nissenbaum 2000; Kvasny and Truex III 2000, p. 284; Nissenbaum 2001, pp. 118–120). In addition, enhancing the capabilities of one group by developing technical systems often goes hand in hand with the disempowerment of other groups (cf. Kvasny and Truex III 2000, p. 278, and section 5.5). In contrast to critical social theory's demand to actively create a world, the current conceptualization of C&E studies in ISR, which claims to originate from this tradition (cf. Cecez-Kecmanovic 2011, p. 442; Ngwenyama 1991, p. 268; Ngwenyama and Lee 1997, p. 150; Silva 2007, pp. 171–172; Stahl 2008b, p. 142), is being content with pointing out contradictions afterwards. The research program, which in principle could help to create a better world is, as outlined in the preceding section, bound through an over-restricting conceptualization of 'relevance' and a narrow definition of 'rigor'. This can in reference to Marcuse ([1964] 1970, pp. 19–20) be called the transformation of ISR into a political instrument to maintain the status quo (cf. McGrath 2005, pp. 87–88). To counterbalance this tendency the methodical proposal of the present inquiry exploits the flaws of the conventional notion of DSR in IS to open up the possibility to build on and complement the insights gained in the interpretive-dominated avenue of C&E by making constructive and progressive proposals that show alternatives to the goals and visions articulated by powerful gatekeepers or 'important stakeholders'. However, as Alvesson and Deetz (2000, pp. 152–153) have stated in the above quote, such endeavors have 'utopian' qualities that are "not salient in studies with research ambitions" and they have a paternalistic flavor by "authoritatively telling people what to do". Both these claims, if accurate, would be serious challenges that render the study's proposal inconsistent with its actual aim. As the following illustrates this is not the case.

The reluctant attitude of academics to 'utopias' stems from two different directions: on the one side, there is the understanding that utopias are "blueprints for the society as a whole" (Popper 1967b, p. 140), which often requires radical shifts and transformations to achieve the defined goal, manifesting itself in the blueprint. The dangers associated with such utopias are extensively discussed by Popper (1967b, chap. 9). Any debate about utopias is buried prematurely with the reference to the failure of Marxism as Avgerou (2005) points out in the reflection on McGrath's (2005) attempt to argue for equalizing C&E research and interpretive research with a critical intent as outlined above:

> "Nevertheless, as she [McGrath] notices, the interpretive epistemology is suitable for hermeneutic understanding and, to a lesser extent, pro-

35. This term is borrowed from the TED talk of Eli Pariser which is available at: `http://www.ted.com/talks/eli_pariser_beware_online_filter_bubbles.html`, accessed May 25, 2015

ducing critique, but less appropriate for transformative redefinition—all three being valid objectives of critical research. Her brief historical account of critical research shows that in the socio-political conditions of earlier periods critical IS research was more concerned with transformative redefinition, which was seen as better served by positivist methods. This form of critical thought and practice may now be seen in Western academia as fostering utopian visions and—to the extent that it was associated with Marxist thought that aspired to the social engineering of emancipation and was usurped by totalitarian regimes—has been discredited in Western society at large" (Avgerou 2005, p. 105).

However, Steele (1992, p. 355) in his criticism of Marxist historical materialism points out that utopianism does not contradict scientific working; contrary, the reoccurring claim that capitalism is dead or in a crisis "could have been kept within bounds if the Marxists had been more utopian and therefore more scientific". In other words and in line with the introductory quote of Kant ([1793] 1974, p. 275), Marxists would have been more scientific if they had worked on the theory to 'change the world' (Marx [1845] 1969, p. 7), instead of merely 'waiting for the death of capitalism', inevitable in the idea of historical materialism. Although the terms differ, the argument is in line or at least compatible with the 'piecemeal engineering' that in contrast to the 'Utopian engineering' focuses on fighting "the greatest and most urgent evils of society" by constructing "blueprints for single institutions" (Popper 1967b, pp. 139–140). A second, but probably intertwined, line of argument for the rejection comes from the confusion of two different meanings of utopia in the literature (Steele 1992, p. 352): on the one side, utopias are treated as per definition infeasible, which directly excludes any rational assessment of the utopia, and on the other hand, there is a conception that leaves open whether a utopia is realizable or not. The second meaning is compatible with the 'piecemeal engineering' suggested by Popper (1967b). However, as the former meaning tends to prevail in literature, the present inquiry adopts the term 'possible world' (D. K. Lewis 1986) to distinguish utopias infeasible per definition and utopias that are potentially realizable (see section 5.1). Such 'possible worlds', to counter the first of the two aforementioned challenges for the present inquiry's proposal, are a vital element of critical social theory as (implicitly) indicated in the above characterization of Horkheimer ([1972] 2002), and they used to be important in C&E ISR:

> "Critical social theory [. . .] is concerned with finding alternatives to existing social conditions which more adequately address human desires. Its research focuses on the emancipation of individuals and the human species in general" (Ngwenyama 1991, p. 268).

Furthermore, they are also implicit in interpretive research with a critical intent, although proponents of C&E ISR do not adequately acknowledge their existence:

> "[a]ny criticism presupposes the possibility of a better way of life; to expose something as illusory or contradictory is to imply the possibility and desirability of a life without those illusions and contradictions [. . .]. If we develop an explanatory critique of something but can see no feasible or desirable alternative, then the force of the critique is weakened, to say the last" (Sayer 1997, pp. 476–477).

However, Sayer (1997, pp. 476–477) also points out that the lack of an alternative, impairing the force of the argument, is an important first step in the endeavor to devise solutions that are able to overcome the respective difficulties—a reversion of "if the starting point of all change is perfect and good, then change can only be a movement that leads away from the perfect and good" (Popper 1967b, p. 30). This suggests that criticism and the construction of alternatives are actually 'two sides of the same coin' (Frank 2006, p. 55). However, not all alternatives are equally desirable, an issue addressed more thoroughly in section 10.2; they have to be desirable *and realizable/feasible* (Sayer 1997, p. 474). In the words of Stahl (2008b, p. 140): "[r]esearch with well-meaning emancipatory aims that stands *no chance of making a practical difference* [...] cannot claim to be critical [emphasis added]" (see also Stahl 2008a, p. 39; 2008b, p. 157).

Within the conventional conceptualization of DSR this feasibility is addressed by the demand to evaluate the construction in the practical setting from which the requirements guiding the building process were elicited. In C&E research there is a similar tendency to apply gained knowledge in practical settings to justify the research output: the "critical social theory approach was never intended to be an abstract philosophy. It was to bring about real change in the human condition" (Ngwenyama 1991, p. 276). Elsewhere in the report Ngwenyama (1991, p. 273) puts it even more drastically: "separating theory from practice, and narrowing the focus to issues of theoretical interest, a grave sin has been committed against the philosophy of critical social theory". However, this demand for application, the second of the afore-mentioned challenges, is not without criticism. Besides the practical challenges of getting access to settings and receiving financial support (see section 5.2), there are at least four further issues associated with this demand to create real world change: firstly, it is a challenging and highly contested theoretical question of how C&E research can be emancipatory without "forcing emancipation on subjects who do not wish to be emancipated, which could render the liberating idea of emancipation an act of intellectual oppression" (Stahl 2008a, p. 4). Secondly, even if it is assumed that subjects want to be emancipated, it tends to be a heroic assumption that, even despite the good intentions, C&E researchers are always successful and leave behind a more desirable system when they go back to their ivory tower (Heusinger, forthcoming). This argument rests on the complexity of the social system in which C&E researchers intervene (see also Merton 1936): "The extraordinary degree of interconnection or integration of modern societies is such that piecemeal changes have multiple unintended and sometimes damaging consequences" (Sayer 1997, p. 485). Thirdly, to carry out C&E research projects it is necessary to build long-term relationships with the individuals involved in the project (Walsham 2005a, p. 238). Correspondingly, even if the former two issues could be appropriately resolved, a C&E project takes several years in preparation—excluding Ph.D. projects, which are inevitably limited in resources such as time. Finally, demanding a practical application puts C&E research projects, measured in the required efforts to carry out such a project, in a comparatively unequal position:

> "A further problem of concentrating on the emancipatory outcomes of critical research is that it would put an additional onus on critical scholars which would put them at a disadvantage when compared to others. Assuming that it is possible to judge the emancipatory qualities of critical research (a shaky assumption at the best of times), the reliance on this measure for the *evaluation of the success of critical research means that there would have to be an additional research cycle attached to each project*. In practice this would make critical research more burdensome and it would be detrimental to the entire critical enterprise, at least in so far as it moves within the given boundaries of western academic institutions [emphasis added]" (Stahl 2008a, p. 189).

Partially due to these reasons and partially to the forceful arguments following from the work of Habermas ([1981] 1987a, [1981] 1987b) and his communicative rationality, other researchers adopt a different avenue to 'evaluate' the outcomes of C&E projects. From their perspective, the outputs are more an 'incitement to discourse' (Lather 1993, p. 674) that needs to be evaluated according to 'catalytic validity', which is defined as (see also Kincheloe and McLaren 2005, pp. 327–328)

> "the degree to which research informs and enlightens those it studies, assists them in gaining self-understanding and self-direction and *enables them to comprehend and change the world* [...] [emphasis added]" (Cecez-Kecmanovic 2005, p. 37).

In other words, the present inquiry perceives the realization of change as an initiative of people themselves. In the terminology of Habermas ([1971] 1973, pp. 28–32) this can be described as a 'therapeutical discourse'[36] in which affected individuals should have the final authority (see also Alvesson and Deetz 2000, p. 152; Carlsson and Berkes 2005, p. 74; Mathews 2013, p. 150; Habermas [1983] 1990, p. 67; [1981] 1987b, p. 51; Horkheimer [1972] 2002, p. 244; Lasswell 1968, pp. 181–183). The designed 'possible world' is therefore seen as an input to practical discourses in which real changes are discussed by the people affected by these changes. This implies that a justification based on the correspondence theory of truth[37] is rejected for normative and practical reasons, the latter inter alia manifested in the inaccessibility of 'possible worlds' to conventional techniques in the context of justification (cf. Frank 2009, pp. 171–172; forthcoming). Instead, the present inquiry relies on a combination of the coherence and the consensus theory of truth. Whereas the latter, i.e., the afore-mentioned practical discourse, is external to the research project, the former refers to the coherence of the 'possible world' with the scientific literature (see section 2.3). This coherence provides a suitable argument for the feasibility of the 'possible world', which is a necessary supportive argument in its discussion within a practical discourse. However, it useful to distinguish two different ways in which alternatives can be feasible (Sayer 1997, p. 477): on the one hand, it needs to be assessed how a certain state can be reached and how individuals can be motivated to participate, and on the other hand, whether the suggested alternative to the present status is practical and free of inconsistencies. Whereas the former clearly reflects the questions of a practical realization of the suggested proposal, partially addressed by the 'IS as intervention' approach (see section 5.2), the latter, the primary focus of the design of 'possible worlds', is concerned with the feasibility of the result. This latter, non-practical application perspective is fully compatible with the less radical focus of C&E research that accepts the creation of inspiring knowledge as valid research output:

> "The liberatory and emancipatory purposes as a hallmark of the critical approach has, however, been disputed in IS research. Charges range from utopianism, to arrogance, to illegitimacy of research objectives, to the impossibility of achieving the desired emancipatory outcomes. Objectives [...] may indeed appear utopian. Nevertheless, critical IS researchers believe that such objectives are worthy of pursuit even if they are only partially achieved. *The desired outcomes may not necessarily be achieved in a particular research context but the issues raised by critical research, knowledge gained and lessons learned may inform*

36. The term 'therapeutical' is in no way meant to connote that subjects of research are 'patients', similar to the criticism of the terms 'poverty', 'need', and 'poor' in section 5.5. The terminology is derived from the praxis of therapists, who merely inform subjects in a communicative practice about different perspectives of how to see social reality and providing options for changing things considered to be problematic.

37. See Frank (2006, pp. 14–15) and Glanzberg (2013) for a distinction of the correspondence, consensus, and coherence theories of truth.

and enlighten other actors in other contexts [emphasis added]" (Cecez-Kecmanovic 2005, pp. 23–24).

However, this acceptance of knowledge as valid research output, the view to inform people about possible options instead of authoritatively telling them what to do as the second argument, not only applies to 'possible worlds', but it also brings back in critical (social) theory from which C&E researcher draw to criticize the unit of analysis of their respective research project. Within the discussion of critical (social) theory in C&E research (cf. Cecez-Kecmanovic 2011, p. 442; Ngwenyama 1991, p. 268; Ngwenyama and Lee 1997, p. 150; Silva 2007, pp. 171–172; Stahl 2008b, p. 142) the most frequently noticed tradition is the Frankfurt School (among others: Horkheimer, Marcuse, Apel, Wellmer and Habermas), but other highly influential thinkers such as Bourdieu[38], Foucault[39], Marx, or Rorty are also mentioned. This is by no means meant to be a comprehensive list of thinkers in the school of critical social theory (for an overview see Bohman 2013; Held [1980] 1990; Howcroft and Trauth 2005; Kincheloe and McLaren 2005; McGrath 2005; Wiggershaus [1986] 2001); it is merely a selective list of those individuals who shaped, in one or the other way, the bounded thinking of the present inquiry's author as manifested in the crudely incomplete list.

Although the present inquiry draws heavily on the work of Habermas ([1981] 1987a, [1981] 1987b)[40], the following discusses the general aspects of critical social theory to complement the first part of the background outlined in the preceding section to lay the foundation for the methodical proposal developed in section 8 and to explicate the presuppositions that underpin the present inquiry. For the convenience of the discussion the general characterization of critical social theory is replicated here:

> "The critical theory of society [...] has for its object men as producers of their own historical way of life in its totality. The real situations which are the starting-point of science are not regarded simply as data to be verified and to be predicted according to the laws of probability [...]. [T]he critical theory in its concept formation and in all phases of its development very consciously makes its own that concern for the rational organization of human activity which it is its task to illumine and legitimate. For this theory is not concerned only with goals already imposed by existent ways of life, but with men and all their potentialities [...]. It is not just a research hypothesis which shows its value in the ongoing business of men; it is an essential element in the historical effort to create a world which satisfies the needs and powers of men. [...T]he theory never aims simply at an increase of knowledge as such. Its goal is man's emancipation from slavery" (Horkheimer [1972] 2002, pp. 244–247).

The most fundamental aspect in this explication is that C&E research is underpinned by the general assumption that human life can and should be made worth living and it is concerned with organizing and utilizing the historically given resources of a certain society in a way that provides 'optimal' development[41] (Marcuse [1964] 1970, pp. 11–13). The content

38. See Kvasny and Truex III (2000) for a good introduction to the core aspects of Bourdieu's theory as well as for an application of it to ISR.

39. See S. K. White (1986) for a critical reflection of Foucault from a Habermasian perspective. See Myers and Klein (2011, pp. 21–23) for an IS-related comparison of Bourdieu, Habermas, and Foucault.

40. It has been argued that one of the problems applying the 'ideal speech situation' "is how to move from abstractions to fruitful application and empirical analysis" (Richardson and Robinson 2007, p. 262) (see also Hirschheim and Klein 1989, p. 1209). This study addresses this challenge in respect to devising how ICT can be leveraged to support the 'ideal speech situation' required for the political process of sustainable human development (SHD).

41. Ngwenyama (1991, pp. 268–269) discusses the following five assumptions that underpin C&E research: "1. People have the power to change their world. 2. Knowledge of the social world is value laden. 3. Reason and critique are inseparable. 4. Theory and practice must be interconnected. 5. Reason and critique must be reflexive in practice". However, this mixes characteristics of C&E with ontological and epistemological assumptions of research

of 'optimal' is derived from the improvement of the living conditions of the underprivileged such as inhabitants of the 'Fourth World' (see also Habermas 1998, pp. 122–123):

> "The Fourth World comprises large areas of the globe [...]. [I]t is also present in literally every country, and every city, in this new geography of social exclusion. It is formed of American inner-city ghettos, Spanish enclaves of mass youth unemployment, French banlieus warehousing North Africans, Japanese Yoseba quarters, and Asian megacities' shanty towns. And it is populated by millions of homeless, incarcerated, prostituted, criminalized, brutalized, stigmatized, sick, and illiterate persons. They are the majority in some areas, the minority in others, and a tiny minority in a few privileged contexts. But, everywhere, they are growing in number, and increasing in visibility, as the selective triage of informational capitalism, and the political breakdown of the welfare state, intensify social exclusion. In the current historical context, the rise of the Fourth World is inseparable from the rise of informational global capitalism" (Castells 2010, pp. 169–170).

Such a goal differs sharply from the perspective outlined in the preceding section, in which goals of research are articulated by powerful actors in business organizations. This implies that researchers cannot detach from the value judgments of goals and focus on the means to achieve given goals. Although it might be argued that such endeavors go beyond the disciplinary boundary, the arguments in the foregoing discussion as well as the following acknowledgement of leading figures in the IS community in the *Communications of the Association for Information Systems*, the publication of the international association for IS researchers, justifies that such projects are acceptable in ISR (see also the call of the Federal Ministry of Education and Research to the *Wissenschaftsjahr 2014*: 'the digital society'[42]):

> "The underlying premise of the authors [Avital et al.] is that information and communication technologies can serve agents of social innovation in underserved communities and that their consideration is vital to the success of many efforts that pursue global and sustainable change. We also submit that *such issues ought to be integrated more centrally into the practice and scholarly mission of the IS discipline* [emphasis added]" (Avital et al. 2007, p. 567).

Closely related to this aspect of C&E research is the different meaning of the term 'theory' that diverges considerably from the usual connotation, which is mainly informed by the empirical-quantitative research tradition (cf. Kuipers 2007, pp. 26–27; Niiniluoto 2007, pp. 175–178). Instead of being an abstract representation of the 'factual world' that is constructed using verified data to create a prediction device, in the C&E context it is more of a device that helps to think about the 'factual world' to enhance human capabilities (see also Alvesson and Deetz 2000, p. 37; Cecez-Kecmanovic 2005, p. 35; Kincheloe and McLaren 2005, p. 306):

> "To uncover and expose the hidden layers of social reality, critical researchers need to undertake a purposefully designed inquiry. Critical social theory provides theoretical concepts for such an inquiry and serves as a map or guide to social reality. However, it does not impose a way of seeing reality. Instead it motivates and directs the researcher to dig deeper, beyond surface appearances, and explore hidden structures, conflicts and contradictions inherent in social reality that shape and determine social actions" (Cecez-Kecmanovic 2005, pp. 29–30).

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in general, therefore, they are not specific to C&E and they are not universally shared by all C&E researchers as will be discussed in the following.

42. The website is available at: `http://www.digital-ist.de/`, accessed May 25, 2015.

In other words, critical social theory provides the normative foundation for carrying out the research project (Cecez-Kecmanovic 2011, p. 443) and as such, it also constrains in a certain way what the researcher exposes to criticism (Avgerou 2005, p. 107). Correspondingly, the critical intent as central characteristic of C&E research is guided by the selection of a critical social theory, which in turn is based on the 'political convictions and moral values' of the researcher (see also Avgerou 2005, p. 105; Walsham 2005b, pp. 112–113). Although C&E research is generally concerned with democratic purposes (cf. Cecez-Kecmanovic 2005, p. 19; Hirschheim and Klein 1994, p. 84), the selection of a theory and therefore the direction of the research comprise a certain degree of subjectivity, similar to the selection of the research problem[43] or the unit of analysis (see section 2.1). As indicated in part I, the present inquiry is underpinned by the idea of 'deliberative democracy'—a reconcilement of the republican and liberal ideas of democracy based on discourse theory (cf. Habermas [1992] 1996, pp. 99–104; 1996; 1998, pp. 113–114, 251; Goven et al. 2012, pp. 156–157; Rummens 2009)[44].

A third aspect, also already implicated by the name, is that critical social theory is concerned with criticism. Although this tends to be a fundamental aspect of research in general (cf. Alvesson, Bridgman, and Willmott 2009, p. 8; Cecez-Kecmanovic 2011, p. 442; Frank 2006, p. 36), C&E research goes beyond this skeptical attitude of research and directs its criticism against social reality, that is, it is socially critical (Avgerou 2005, p. 108; Cecez-Kecmanovic, Klein, and Brocke 2008, p. 129; Cecez-Kecmanovic 2011, p. 442; Walsham 2005b, p. 112). The general orientation, admittedly more moderate, is indicated by Hessel, a highly decorated French diplomat in his bestselling book *Time for Outrage: Indignez-vous!:*

> "We, veterans of the French Resistance and the combat forces that freed our country, call on you, our younger generations, to revive and carry forward the heritage and ideals of the Resistance. Here is our message: It's time to take over! It's time to get angry! Politicians, economists, intellectuals, do not surrender! The true fabric of our society remains strong. Let us not be defeated by the tyranny of the world financial markets that threaten peace and democracy everywhere" (Hessel 2011, p. 6).

His call to be 'outraged', comprises two important aspects addressed by C&E researcher: on the one side, it refers to the need to challenge the dominance of instrumental rationality (cf. Alvesson and Willmott 1992, p. 433; Avgerou 2005, p. 107; Cecez-Kecmanovic 2011, p. 442; Howcroft and Trauth 2005, p. 4), the argument employed in the critical reflection of the conventional conceptualization of DSRIS. Within C&E endeavors in ISR this manifests itself in adding a social dimension to otherwise solely technical focus (e.g., the studies of Hirschheim and Newman 1991; Klecun 2005). For example, Cecez-Kecmanovic (2005, p.

43. For a discussion of general research problems that are tackled by C&E IS researchers see Cecez-Kecmanovic (2005, pp. 22–24), Cecez-Kecmanovic, Klein, and Brocke (2008, pp. 125–127),Cecez-Kecmanovic (2011, pp. 447–451), Howcroft and Trauth (2005, pp. 2–5),Kincheloe and McLaren (2005, pp. 306–312), Mitev (2005, p. 75), Myers and Klein (2011, p. 19), Richardson and Robinson (2007, pp. 254–255), Stahl (2008a, pp. 11–13),Stahl (2008b, pp. 140–141), and Stahl and Brooke (2008, p. 52).

44. The central argument of Habermas (1998, pp. 251) is that the private autonomy, manifesting itself in negative individual rights (liberal idea), and the public autonomy in the form of positive political rights (republican idea) are co-original, that is, there is no primacy because both presuppose each other (cf. Habermas [1992] 1996, p. 104; 1994, pp. 112–113; [1992] 1996, p. 95; 1998, pp. 120, 240–241, 258–262), and therefore legitimate modern law has to guarantee both (see also Habermas [1992] 1996, p. 33; 1998, p. 215): "Once moral principles must be embodied in the medium of coercive and positive law, the freedom of the moral person splits into the public autonomy of co-legislators and the private autonomy of addressees of the law, in such a way that they reciprocally presuppose one another" (Habermas 1998, p. 101). Habermas ([1992] 1996, p. 103) argues that the internal connection, neglected by both positions lies "in the normative content of the very *mode of exercising political autonomy* [emphasis in the original]". This co-originality in turn allows to "dissolve the paradox in the emergence of legitimacy from legality" (p. 123), because it indicates that the legitimacy of law is internally related to democracy: legitimate law emerges from the institutionalized discursive opinion- and will-formation in the public sphere (see Habermas [1992] 1996, pp. 103–104; 1998, pp. 249–250, and section 2.1).

30) argues that “as performance improvement goals are taken for granted, the focus of IS design is narrowed to functional and technical aspects of IS” (see also Avgerou 2005, p. 107). This tendency is clearly reflected in the dominating (cf. Kautz et al. 2013, p. 111; Richardson and Robinson 2007, p. 262) and narrow conceptualization of IS discussed in section 5.1. On the other hand, the call and its reference to the ‘financial markets’, which might be exaggerating, can be interpreted to encompass itself a criticism of the market as universal solution to all sorts of problems (see also section 5.5). Similar but more general, C&E research is concerned with the investigation and rejection of believed to be essentialist features of the social world (see section 7.3). In other words, C&E research is “not only [critical about] the established order but the proposition that the established order is immutable” (Grey 2005, pp. 186–187). This is underpinned by the assumption that

> “the present is not determined by the nature or truth of things; it seeks to ‘denaturalize’ the apparent natural order of things, thereby questioning the inevitability of the social status quo, and positing as a preliminary contingency of social orders” (Mitev 2005, p. 76).

The final aspect of critical social theory is the goal as specified by Horkheimer ([1972] 2002), that is, emancipation. Emancipation, in addition to criticism, is considered to be a central element of C&E research (cf. Alvesson and Willmott 1992, pp. 434–435; Howcroft and Trauth 2005, p. 3; Stahl 2008a, p. 8). As this term is often (wrongly) used interchangeably with ‘empowerment’ a brief clarification is inserted to point out that there are considerable differences. Generally, empowerment refers to attempts that help individuals to overcome power structures[45]. This can be interpreted as the enhancement of an individual’s capabilities (cf. Johnstone 2007, pp. 76–77). Although empowerment of individuals is considered to be an important part of C&E research (e.g., Alvesson and Willmott 1992, p. 432; Stahl 2008a, p. 51), there is also a complementary aspect, which is often not adequately acknowledged:

> “The problem is often not that people or groups have too little freedom but that they have too much freedom from responsibilities. Recently fashionable concern with ‘empowerment’ suffer from the same problem—it implies having fewer constraints and more resources and is silent on responsibilities, and sometimes on the disempowering effects on others (though these may of course be justifiable). It is of course always easier to talk of rights than responsibilities. To reply that obligations are the flip side of rights and therefore already implied on the discussion of rights can easily serve as an evasion of the question of just what the obligations should be” (Sayer 1997, pp. 483–484).

Emancipation, on the other side, is a much broader term than empowerment (Alvesson and Deetz 2000, p. 1; Inglis 1997, p. 4; Jönsson 2010, pp. 396–399; Stahl 2008a, p. 11): whereas the latter is concerned with developing capabilities within given social structures, the former focuses on “identifying progressive aspects and tendencies within [. . . society], to help transform society for the better” (Finlayson 2005, p. 4)—the following will, in reference to Wellmer (1969, p. 41), refer to these progressive aspects as ‘draft meanings’. For example, the methodological prescription of DSRIS as well as the associated guidelines to determine adequate and appropriate DSR, complemented by the structural prescriptions of Gregor and Hevner (2013), which can be published in ‘top’ journals, can be together interpreted as such a social structure:

> “It is an iron low of PhD programmes that good research has to make

45. For an excellent IS-related overview of approaches to research ‘power’ see Silva (2005, 2007).

> explicit use of a research method [. . .]. [I]t seems mandatory to opt for a certain *given* method. While this may be appreciated as helpful guideline by some, others may regard it as akin to paternalism that jeopardizes their perception of academic freedom [emphasis in the original]" (Frank, forthcoming).

In this view, the present inquiry, by making a methodical proposal to carry out C&E DSR projects in IS, can itself be seen as a form of emancipation from these structures. This methodical proposal, to summarize the discussion of this and the preceding section, is based on the synthesis of C&E ISR and DSR. More specifically: in the critical reflection of DSR it was pointed out that the context of discovery as well as the context of justification need to be broadened to carry out C&E DSR projects. The methodological suggestions of C&E research, that is, the division of research projects into three phases, provides an adequate basis for accomplishing the first of these two tasks. In anticipation of the discussion in part III, it is suggested that the insight phase, based on different ontological and epistemological assumptions, provides a suitable way to circumvent the problem of getting access to organizational settings for C&E projects. Furthermore, the second phase, i.e., critique, provides an equally valid substitute for the problems and opportunities articulated by important stakeholders. This provides the basis for initiating C&E DSR projects. However, these projects do not, in contrast to the conventional conceptualization of DSR, depend on a 'post-construction evaluation' in practical settings, but are based on a 'within-construction justification' established through the synthesis of 'draft meanings' from the existing body of knowledge. As indicated in section 5.1 this results in a set of social system-options that specify feasible alternatives to factually existing IS. Without the need to instantiate the designed artifact for evaluative purposes, the paternalism of authoritatively telling people what is good for them is circumvented. The technical system accompanying the 'possible world', therefore, takes the form of a reference architecture covering these multiple options. A more detailed analysis of this term and its relationship to the 'possible world' is explored in the next section.

5.4 Reference Architectures and their Development

After the preceding sections have specified the methodological foundation of the design for 'possible worlds', the subject of this section is to detail the technical system that can be developed based on 'possible worlds', i.e., of software reference architectures (hereinafter: reference architecture). As a commonly agreed definition of the term is missing (Angelov, Grefen, and Greefhorst 2012, p. 418), this analysis unfolds by delineating reference architectures from closely related terms (see figure 5.7). This approach has the additional advantage of being able to locate this type of technical system and its development more clearly in the general software engineering process.

As can be seen in figure 5.7 a reference architecture is closely related to, or often used interchangeably with (cf. Garlan and Shaw 1994, p. 5), software architectures, architectural patterns, and reference models. The following discusses the relationship between reference architectures and each of these three concepts in turn.

Firstly, although the literature about software architectures (hereinafter: architectures) is not as vague as the one dealing with reference architectures, there is no common agreement upon definition (IEEE 2000, p. 2; Fowler 2003g, p. 1; Clements et al. 2008, p. 2; 2011, p. 3, see also table 5.3). Bass, Clements, and Kazman (2003, pp. 25–26) even argued that a precise

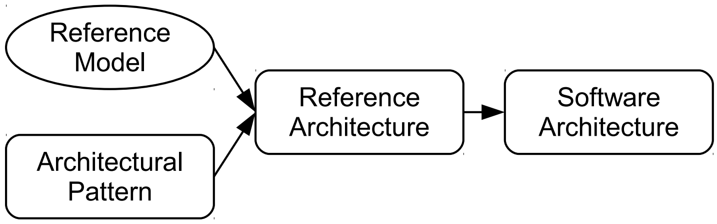

Figure 5.7: Reference Architectures and Related Elements, source: Bass, Clements, and Kazman (2003, p. 26)

definition is of secondary nature, because the employed metaphor 'lets one intuitively grasp' what it refers to. The 'intuitive grasp' is that it is a 'blueprint' for the construction of concrete software or ICT applications. From this perspective, reference architectures and architectures differ in their degree of abstraction (cf. Angelov, Trienekens, and Grefen 2008, p. 230; Angelov, Grefen, and Greefhorst 2012, p. 418)—whereby abstraction must not be mistaken with unrealistic or far from reality; instead, it is a goal-oriented process that captures the necessarily related entities of reality and excludes all only contingently related elements and processes[46] (see Brown, Slater, and Spencer 2002; Danermark et al. 2002, sect. 3; Rozanski and Woods 2005, pp. 159–161; Sayer 1992, sect. 3–4; 2000, sect. 5; Stachowiak 1973, p. 132, for excellent discussions). Correspondingly, the architecture can be seen as a refined reference architecture (cf. Pressman 2010, p. 228). However, an architecture—as a blueprint for the construction of concrete ICT applications—is itself an abstraction. The relationship is further complicated as there is no one-to-one correspondence between reference architectures and architectures, i.e., a reference architecture can be refined or operationalized in different ways (cf. Clements et al. 2008, p. 374). Therefore, an additional characteristic needs to be introduced as demarcation criterion. Borrowed from the International Organization for Standardization (ISO) standard for System and Software Quality Models (ISO 2011), this is the context coverage, which ISO (2011, p. 9) defines as the "degree to which a product or system can be used with effectiveness, efficiency, freedom from risk and satisfaction in both specified contexts of use [i.e., context completeness] and in contexts beyond those initially explicitly identified [i.e., flexibility]". This allows to distinguish reference architectures from architectures as follows (cf. Angelov, Grefen, and Greefhorst 2012, p. 418; Hassan and Holt 2000, p. 150): whereas an architecture is an abstraction of a concrete ICT application which is developed for and used in a specific context and therefore aims mainly at a complete context description, a reference architecture is an abstraction used for the design of different architectures, supporting the development of architectures in a domain by focusing on flexibility across multiple contexts. In the following the term '*domain*' is used to denote the abstraction of multiple contexts. This suggests that reference architectures are essentially architectures, which, due to the domain focus, differ in the number and specifity of captured entities (cf. Becker, Rosemann, and Schütte 1995, p. 436): on the one side, reference architectures can contain more entities than architectures to account for variability across contexts (hereinafter: abstraction by inclusion), and on the other hand, reference architectures can contain more abstract entities to exclude the concrete operationalization in different contexts (hereinafter: abstraction by exclusion). However, such a content-wise refinement presupposes that there

46. The prime example to illustrate the difference between necessary and contingently related aspects are maps: a tube map, for instance, is created with the intention to help users to get from A to B. In this case, necessary elements are stations and lines, contingently related elements are the distance between stations, the 'real' course of tracks, etc.

is—at least to a certain degree—agreement about the entities captured in architectures. The chronologically ordered list of frequently cited architecture definitions[47] in table 5.3 provides the basis for such an investigation.

Common to nearly all of these definitions is the inclusion of a structural perspective (i.e., the reference to elements, relationships between elements, and properties of both) as well as the insight that multiple perspectives are required to represent an architecture adequately. Despite the variety of different representation frameworks (see Greefhorst, Koning, and Vliet 2006, for an overview)[48], all of which make slightly different recommendations, there tends to be a convergence or consensus that at least three structures are required for a minimal representation[49] of architectures (Bass, Clements, and Kazman 2013, pp. 4–5, 358): (i) the static module structure capturing the system's decomposition into separate 'modules'[50], (ii) the component and connector structure capturing dynamic interactions between or the run-time behavior of modules, and (iii) the allocation structure describing the relationship between modules and contextual elements. Correspondingly, an architecture is a set of those structures, often presented using the semi-formal diagrams provided by the Unified Modeling Language (UML) as international standard for representations of software systems (cf. ISO 2012a, 2012b), that capture at least three important perspectives of technical systems, which are required, inter alia[51], for the construction of concrete, context-specific ICT applications. Reference architectures can thus be seen as a domain-specific set of structural perspectives, created through abstraction of inclusion or exclusion, that facilitate the development of context-specific architectures (cf. Garlan and Shaw 1994, p. 15).

Table 5.3: Definitions of the Term 'Software Architecture'

Source	Definition of Software Architecture …
IEEE (2000, p. 3)	
	"[t]he fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution".
Bass, Clements, and Kazman (2003, p. 21)	
	"the structure or structures of the system, which comprise software elements, the externally visible properties of those elements, and the relationships among them [footnote excluded]".
Rumbaugh, Jacobson, and Booch (2004, p. 170)	

Continued on Next Page

47. For further, less often used definitions see the website of the Software Engineering Institute (SEI) at the Carnegie Mellon university, which lists more than 60 different definitions: `http://www.sei.cmu.edu/architecture/start/glossary/`, accessed May 25, 2015.

48. Well-known frameworks making recommendations in regard to the perspectives required to represent a software architecture sufficiently are the "'The 4+1 View Model of Architecture"' proposed by Kruchten (1995), the 'Agile Modeling' approach suggested by Ambler (2002), or the international standard ISO (2007), which distinguishes multiple, purpose-related views (see also Bass, Clements, and Kazman 2013, chap. 18; Clements 2005; Clements, Kazman, and Klein 2002, pp. 4–9; Clements et al. 2008, 2011; IEEE 2000; Rozanski and Woods 2005, chap. 3–4 and appx. 'Other Viewpoint Sets').

49. The term 'minimal representation' refers to the minimal representation of the modules, their relationships, and properties of both. This, however, does not suggest that this is a complete description of an architecture. The *Recommended Practice for Architectural Description of Software-Intensive Systems (IEEE 1471-2000)* states that, inter alia, the following elements should be included in addition to the structural descriptions (IEEE 2000, p. 8): meta-data, relevant stakeholders and their concerns, description of inconsistencies between different views, and a rationale for the selection of the architecture.

50. The term 'module' refers to a work package assigned to a developer or a team of developers (cf. Parnas 1972, p. 1054; Parnas, Clements, and Weiss 1985, p. 260). Hence, a module does not refer to a particular software construct such as class, package, etc. (cf. Rozanski and Woods 2005, pp. 18–19), but it can, in reference to Booch et al.'s (2007, p. 13) 'relative primitives', be described as a relative term, that is, depending on the context it can refer to a single artifact or a set of artifacts.

51. Software architectures are not only used for constructing ICT applications; rather, they are also useful tools in, for example, employee training or certification (see ISO 2007, p. 8, for an overview).

Table 5.3 – Continued from Previous Page

	"[t]he organizational structure of a system, including its decomposition into parts, their connectivity, interaction mechanisms, and the guiding principles that inform the design of a system".
Clements et al. (2008, p. xxv)	
	"the structure or structures of the system, which consists of elements, their visible properties and the relationships among them".
Meier et al. (2009, p. 3)	
	"a structured solution that meets all of the technical and operational requirements, while optimizing common quality attributes such as performance, security, and manageability".
Clements et al. (2011, p. 1)	
	"the set of structures needed to reason about the system, which comprise software elements, relationships among them, and properties of both".
Bass, Clements, and Kazman (2013, p. 4)	
	"the set of structures needed to reason about the system, which comprise software elements, relations among them, and properties of both".

The second concept, closely related to reference architectures, is the term 'architectural pattern', a special class of the well-known design patterns, which were introduced to informatics by Gamma et al. (1995)[52], that can be defined as follows (see also Esposito and Saltarello 2009, pp. 86–88; Soundarajan et al. 2008, p. 71):

> "A pattern for software architecture describes a particular recurring design problem that arises in specific design contexts, and presents a well-proven generic scheme for its solution. The solution scheme is specified by describing its constituent components, their responsibilities and relationships, and the ways in which they collaborate" (Buschmann et al. 1996, p. 8).

In other words, a pattern is a context-independent, reusable solution for problems that often arise during the context-specific construction of technical systems or their architectures (see also Bass, Clements, and Kazman 2003, p. 24). There is a huge amount of literature that provides extensive list of patterns (e.g., Buschmann et al. 1996; Buschmann, Henney, and Schmidt 2007a, 2007b; Fowler 2003g; Gamma et al. 1995; Kienzle and Elder 2002; Kienzle et al. 2002a; Kircher and Jain 2004; D. C. Schmidt et al. 2000; Schumacher et al. 2006), which can, in respect to their level of granularity, be grouped into three categories (cf. Buschmann et al. 1996, pp. 11-15; Rozanski and Woods 2005, pp. 137–140): architectural patterns, design patterns, and idioms. Whereas idioms are programming language specific solutions to design issues and design patterns are "descriptions of communicating objects and classes that are customized to solve a general design problem in a particular context" (Gamma et al. 1995, p. 13), architectural patterns, in this case referred to as architectural styles, can be defined as (see also Rozanski and Woods 2005, p. 138)

> "the vocabulary of components and connectors that can be used in instances of that style, together with a set of constraints on how they can be combined. These can include topological *constraints* on architectural descriptions (e.g., no cycles). Other constraints—say, having to do with execution semantics—might also be part of the style definition [emphasis in the original]" (Garlan and Shaw 1994, p. 6).

From this point of view, the two focal terms can be distinguished as follows (cf. Angelov, Grefen, and Greefhorst 2012, p. 419): whereas architectural patterns are domain-independent problem solutions, often focusing on quality attributes [i.e., the non-functional requirements

52. The idea of design patterns originated in 'architecture' in its original sense and was initially proposed by Alexander et al. (1977).

Table 5.4: Reference Architecture Classification Schema, source: Angelov, Grefen, and Greefhorst (2012, pp. 420–421)

Dimensions	Manifestations					
Context						
(C1) Intended Recipients	Single Organization			Multiple Organizations		
(C2) Involved Stakeholders	Organizational Groups/Types of People			Types of Organizations		
(C3) Timing	Preliminary			Classical		
Goal						
(G1) General Goal	Standardization			Facilitation		
Design						
(D1) Described Elements	Compo-nents	Connec-tors	Inter-faces	Proto-cols	Algo-rithms	Policies/ Guidelines
(D2) Level of Detail	Detailed		Semi-Detailed		Aggregated	
(D3) Level of Abstraction	Abstract		Semi-Concrete		Concrete	
(D4) Form of Representation	Informal		Semi-Formal		Formal	

of a system (see Barbacci et al. 1995; McConnell 2004, pp. 463–466; Pressman 2010, pp. 400-406, and table 8.9, p. 152)], reference architectures primarily focus on functional aspects in a domain. However, a reference architecture can and often does make use of architectural patterns to resolve domain-relevant issues emerging during the construction process. In other words, a reference architecture adopts architectural patterns to the specifity of a domain.

The domain is captured in the reference model, the third element in figure 5.7, which Bass, Clements, and Kazman (2003, p. 25) define as the "division of functionality together with data flow between pieces" that is mapped through the reference architecture on modules and their interactions. The definition of reference models resembles the specification of action or social systems in section 5.1. However, a reference model is not a context-specific social system, but an abstract social system that captures the 'essence' of multiple different, context-specific social systems (i.e., of a domain). It has to be noted that the term 'reference', used more or less intuitively in the foregoing discussion, has two different but interlinked connotations (cf. Rosemann and Schütte 1997, p. 16; O. Thomas 2006, p. 485): whereas the relationship between reference architectures and architectures mainly emphasized the prescriptive character of the term (see also Clements et al. 2011, p. 12), the focus now rests on the relational character, i.e., the reference model is the reference point for the construction process. In relation to the discussion in section 5.1, 'possible worlds' can thus be interpreted as domain-specific reference points for the construction of reference architectures.

Before going into the details of an approach for building reference architectures, the insights gained in the foregoing discussion can be used to explicate the meaning of the term reference architecture that is underpinning the present inquiry: a *reference architecture*, devised from the analysis of a reference model, is a domain-specific, pattern-informed, goal-driven, prescriptive set of structural perspectives that inform the development of context-specific architectures, which in turn function as 'blueprints' for the design of concrete technical systems that support the processes within social systems, i.e., those contexts covered by the domain-specific reference model. Correspondingly, reference architectures are an input to concrete software engineering projects, which, for analytical purposes, can be described as a linear sequence[53] of communication, planning, modeling, construction, and deployment (e.g., Pressman 2010, p. 33; Esposito and Saltarello 2009, p. 26). Although building reference architectures is not itself a phase of this process, it is an activity that informs, discussed more thoroughly in chapter 9, the first three phases within which the architecture for the concrete technical system is designed. This resembles closely the specification of technical alternatives in the ETHICS approach (see section 5.2).

This understanding of reference architectures is, however, only one of multiple understandings as pointed out by Angelov, Grefen, and Greefhorst and their framework for the analysis and design of reference architectures. Their central argument is that reference architectures can be characterized along three dimensions (Angelov, Grefen, and Greefhorst 2012, pp. 417–418): architectural goals (i.e., goal), the design context and the intended application context (i.e., context), and the reference architecture's design and specification (i.e., design). The three defining characteristics, their dimensions, and possible manifestations, summarized in tables 5.4 and 5.5[54], span the space of 'congruent reference architectures', which are defined as follows:

> "We [Angelov, Grefen, and Greefhorst] call a reference architecture 'congruent' if its goals are relevant for the context [i.e., the domain in the present inquiry] of the reference architecture and its design properly reflects both the architecture context and goals, i.e., we require congruence between context, goals, and design [. . .]" (p. 418).

Table 5.5: Definition of the Design Elements of a Reference Architecture, based on: Angelov, Grefen, and Greefhorst (2009, p. 146), Angelov, Grefen, and Greefhorst (2012), and Rumbaugh, Jacobson, and Booch (2004, pp. 69–70, 73–75, 281–283, 413–418)

Design element	Definition
Components & Connectors	whereas the former are reusable modules of technical systems, whose internal implementation is hidden and which are, in order to avoid dependencies, accessed and request functionalities via defined interfaces, the latter specifies the relations between different modules in a system
Interfaces	are abstract, purpose-specific contracts between modules that serve to hide the internal implementation of a module
Protocols	is a specification of the way modules interact with each other
Algorithms	are the description of the internal operation of components
Policies/ Guidelines	are the description of implementation guidelines for components

Based on the evaluation of more than one dozen existing reference architectures (cf. Angelov, Grefen, and Greefhorst 2009) Angelov, Grefen, and Greefhorst (2012, p. 421) argue that congruent reference architectures are characterized by specific combinations of the manifestations summarized in table 5.4, which leads them to the distinction of the five types, including four variants, of congruent reference architectures depicted in figure 5.8.

Although figure 5.8 omits the design dimension (see table 5.5), each of these types or

53. Within chapter 11 different nonlinear, agile approaches for the development of technical systems are discussed (see Pressman 2010, chap. 2–3, for an overview of different approaches).

54. A detailed explanation of the respective terms can be found in Angelov, Grefen, and Greefhorst (2009, 2012) and table 5.5 below.

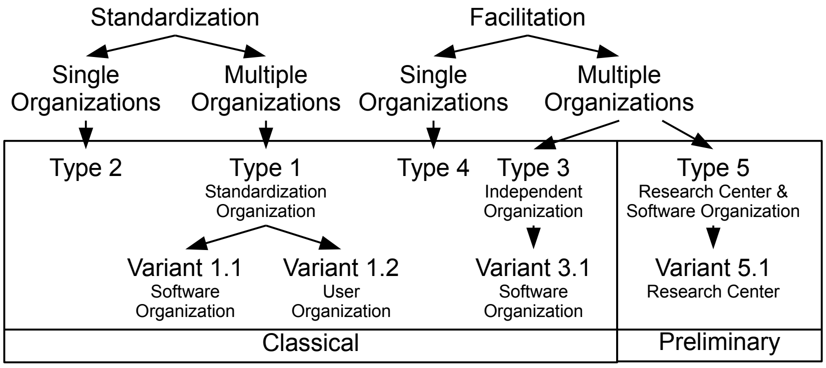

Figure 5.8: Congruent Reference Architectures, based on: Angelov, Grefen, and Greefhorst (2009, 2012)

variants is characterized by a specific combination of manifestations in this dimension as well. This is particularly relevant if the framework is not used for the analysis, but for the design of reference architectures (cf. Angelov, Grefen, and Greefhorst 2012, pp. 425–426), since a specification of sub-dimensions in the goal and context dimension indicates which manifestations a congruent reference architecture demands in the design dimension. This is the core of the process suggested for the design of congruent reference architectures depicted in figure 5.9. However, as can be seen in this process description the framework does neither cover the eliciting of requirements from 'reference models', their translation or mapping on modules and interactions in the reference architecture, nor the selection of appropriate architectural patters to ensure non-functional quality attributes. In fact, the framework makes 'only' recommendations in respect to the granularity and the type of structural perspectives that characterize a congruent reference architecture. In respect to the present inquiry this is particular important as this indicates which information is most relevant to the users of the reference architecture, an information that otherwise has to be gathered in interviews from representative users (Clements et al. 2011, p. 45). This does not imply that such interviews cannot enhance the reference architecture development or should not be carried out in future applications of the design of 'possible worlds'; rather, as the central focus of the present inquiry is the development of the method and the exemplary illustration in which a reference architecture is developed serves as an additional argument for the former, this allows to make the exemplary application more realistic. Nevertheless, to carry out the actual design the suggested reference architecture design process needs to be complemented by traditional software engineering approaches, which are examined more thoroughly in chapter 11.

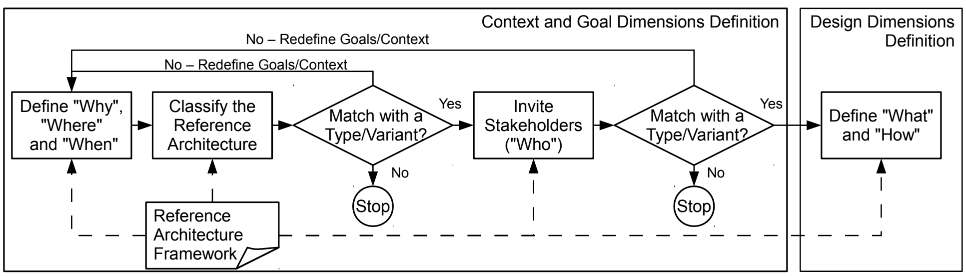

Figure 5.9: Reference Architecture Design Process, source: Angelov, Grefen, and Greefhorst (2012, p. 426)

Table 5.6: SD and HD Defined

Sustainable development (SD) is defined as	Human development (HD) is defined as
development that "meets the needs of the present without compromising the ability of future generations to meet their own needs [. . . , implying] limits—not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities" (WCED 1987, p. 24).	"both the *process* of widening people's choices and the *level* of their achieved wellbeing. It also helps to distinguish clearly between two sides of human development. One is the formation of human capabilities, such as improved health or knowledge. The other is the use that people make of their acquired capabilities, for work or leisure [emphasis in the original]" (UNDP 1990, pp. 10–11).

Within the next section the general context for the exemplary application of the method for the design of 'possible worlds' is presented. This complements the foundation of part IV and completes the review of the existing body of knowledge.

5.5 Sustainable Human Development

"To the degree that we have universal knowledge of all the goods and services provided by ecosystems, that we are able to attach a price to them and can replace trust in exchanging these goods and services by perfect contracts, and perfect rationality, economic efficiency is a useful principle. Unfortunately that is not the case."

Gatzweiler (2006, pp. 303–304).

As outlined in the introduction to the research program, many of the most challenging problems humanity has to face in the 21st century are discussed under the umbrella of SHD, a concept that, as understood in the present inquiry, is essentially the synthesis of human development (HD), i.e., the practical application of the capability approach (CA)[55] (cf. Alkire 2010, p. 22), and sustainable development (SD). The following examination of SHD aims to fill the abstract model of the public sphere in chapter 2 (see figure 2.1, p. 8) with concrete content, that is, SHD is perceived as a political discourse, which, as indicated by the thesis of the colonization of the lifeworld, is dominated by economic interests and transforms the communicative endeavor in one of instrumental rationality. Although this exploration might be of interest to IS scholars, who are concerned with the contribution of ISR to sustainable development (SD) and/or human development (HD) (see the generic IS audience specified in section 3.1), the central aim is to present the background for the exemplary application of the method developed in the next section. In other words, the following presents the context that serves as reference point for anchoring community-driven SHD initiatives as a contribution to the strengthening of civil society, thereby addressing a gap in the development literature pointed out by Chambers (2006, p. 39), as well as for relating the designed 'possible world' to the central challenges of the 21st century.

Framing SHD as synthesis of two, well-established development approaches involves a shift of thinking, which according to Sen (2009, p. 122) is a dual task (see also Habermas [1981] 1987b, pp. 29–31): using a conformist language to communicate clearly, while simul-

55. Depending on the underpinning seminal work, research on and with the CA is often divided into two, not necessarily incommensurable, research streams: one side stems from the more theoretical work of Sen (1999), whereas the other side leans toward the more practical work of Nussbaum (2000). The present inquiry focuses on the former, more prominent approach, but enhances the discussion, if appropriate, by insights originating from the latter (for more details of Nussbaum's approach see Nussbaum 2000, 2011; Schultz et al. 2013; Watene 2013). For an ICT-related perspective of the CA see Johnstone (2007) and Bass, Nicholson, and Subrahmanian (2013).

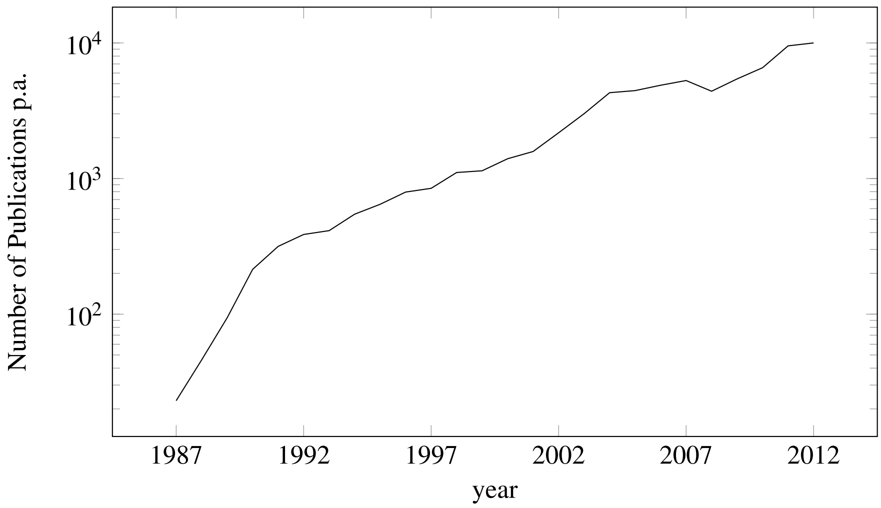

Figure 5.10: ‘Sustainable Development’ Publications between 1987 and 2012, data retrieved: March 12, 2013 from `Scopus.com` using ‘Sustainable Development’ as query string

taneously expressing non-conformist ideas. Therefore, it tends to be most fruitful to explore the non-conformist idea of SHD by starting from the conformist ideas of SD and HD. This has the additional advantage to simultaneously address the superfluous claim, which states that the concerns of SD are already comprised in the HD approach (e.g., Neumayer 2012, pp. 561–562) and vice versa. Although this might have been true for the original proposals, both approaches have been subjected to considerably reframing or specialization—or ‘watering down’—within the last decades (Heusinger 2013b, pp. 16–17). Despite some early integration attempts (e.g. Speth 1994, p. 5–6; UNDP 1990, p. 7), research streams remained largely separated (Crabtree 2013, pp. 40–41). A clear indicator of this rationalization is the way in which both approaches have been institutionalized in the United Nations (UN): whereas the United Nations Environment Programme (UNEP) is strongly associated with SD, the United Nations Development Programme (UNDP) is more devoted to HD concerns. Contrary to the superfluous claim, there are also scholars that raise doubts about the compatibility of both approaches (e.g., Costantini and Monni 2005, p. 332; Schultz et al. 2013, p. 115). Within the following elaboration[56], starting from the definitions given in table 5.6, both these issues will be explored, while simultaneously re-constructing the concept of SHD.

Although HD in various different forms, not necessarily the one defined in table 5.6, has been on the political agenda for much longer time, SD has received considerable attention in the past two decades (see figure 5.10). It was devised as an all-encompassing, broad development approach (cf. Schultz et al. 2013, p. 116) that tried to integrate the concerns of HD[57] with two further issues. In result SD, as defined in table 5.6, referred to development

56. The discussion presented in the following is a substantially extended and revised version of the argument presented in Heusinger (2013b).

57. Costantini and Monni (2005, p. 330), in their attempt to illustrate the incompatibility of both approaches, suggest that the demand to give “overriding priority [. . .] to the world’s poor” (WCED 1987, p. 54), the inclusion of ‘needs’ and ‘abilities’, and the implicit call to improve the ‘social organization’ within the SD definition indicate a close relationship between both development approaches. However, rather than substantiating the ‘superfluous claim’, exactly these ‘obvious connections’ have been heavily criticized by HD proponents. For example, the concept of ’needs’ is criticized, because it carries the meaning of humans as passive rather than active agents (Alkire 2010, p. 16; Chambers 2006, p. 33; Fukuda-Parr 2005, p. 120; Krantz 2001, p. 22; Neumayer 2012, p. 563; Sen 2005a, p. 3; 2013, pp. 8–9) and because an “individual’s conception of needs may adapt downwards as a result of continual deprivation” (Sen 2013, p. 11); see also Basu (2013) and the recently gathered empirical evidence for the impact of ‘poverty’ on cognitive functions discussed by Mani et al. (2013) and Vohs (2013). In fact, all of the ‘obvious connections’ Costantini and Monni (2005, p. 330) discuss to support their incommensurability thesis are indeed an

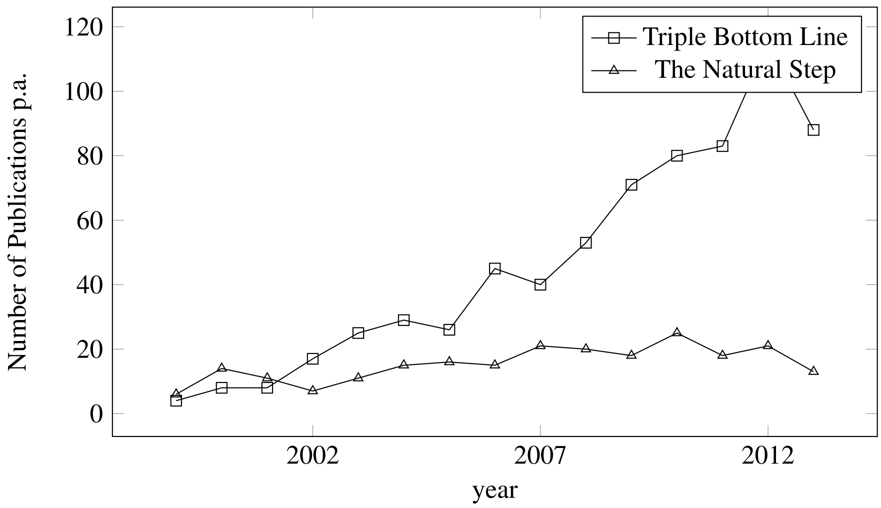

Figure 5.11: 'Triple Bottom Line' and 'The Natural Step' Publications between 1987 and 2013, data retrieved: December 26, 2013 from `Scopus.com` using 'Triple Bottom Line' and 'The Natural Step' as query string

that takes three inextricably linked aspects into account (Crabtree 2013, pp. 41–42): (i) inequalities within the present generation (intra-generational justice) as captured by the HD approach, (ii) obligations toward future generations (inter-generational justice), and (iii) the linkage between the former two and the biophysical environment (ecological justice). Although the Brundtland report (WCED 1987) laid out a convincing rationale that these three issues are inextricably linked, this conceptual milestone had to be operationalized to guide practice (cf. Dao, Langella, and Carbo 2011, p. 64; Nattrass and Altomare 2001, p. 6). Work in this direction lead to the development of various frameworks; two relatively prominent contributions, see figure 5.11, are the 'Triple Bottom Line (TBL)' (Elkington 1999) and 'The Natural Step' framework (Robèrt 2002) (see Hodge 1997; Robèrt 2000, for overviews).

Without going into the details of these frameworks, they help to illustrate the watering down or reduction of the meaning of SD to merely environmental or economic concerns (cf. Crabtree 2013, p. 52; Gladwin, Kennelly, and Krause 1995, pp. 876–877; Harlow, Golub, and Allenby 2011, p. 9; Neumayer 2012, p. 564; Pelenc et al. 2013, p. 77; Schultz et al. 2013, p. 116)[58]. The former is most obvious in the 'The Natural Step' framework (Robèrt 2002), which is probably the reason why it received considerable less attention in literature (see figure 5.11). Within this framework sustainability is defined as follows:

> "In the sustainable society, nature is not subject to systematically increasing . . .
>
> 1. . . . concentrations of substances extracted from the Earth's crust;
> 2. . . . concentrations of substances produced by society;
>
> or
>
> 3. . . . degradation by physical means
>
> And in that society . . .
>
> 4. . . . humans needs are met worldwide.
>
> " (Nattrass and Altomare 2001, p. 23).

inadequate basis for an integration; however, the following will explicate a different direction for a synthesis.

58. For a possible explanation see Lessmann and Rauschmayer (2013, pp. 105–106) or Gibbs and Krueger (2012, p. 375). Furthermore, Schlosberg and Rinfret (2008) provide an extremely insightful reconstruction of the reductionist discourses in the USA and countries of the European Union (EU) respectively.

The first three of the four listed conditions specify ecological principles similar to the ones proposed by, for example, Daly (1990b, 1990a), which underlines the framework's environmental focus. Not only the number of principles, but also the unintegrated nature of the appended social condition (Brown, Dillard, and Marshall 2006, p. 7), indicates that social facets are dominated by ecological factors. The TBL (Elkington 1999), on the other side, is the prime example for the reduction of SD to economic considerations (Richardson 2004, pp. 41–42). This semantic shift originating from the TBL is most obvious in the impact assessment (IA) literature, which provides the methodical extension of the TBL by devising techniques that allow to measure the bottom lines' performance. The oldest and most well-established form of IA is the environmental IA (Bond and Pope 2012, p. 2; IAIA 2009, p. 1). Initially the term 'environment' was intended to cover ecological, socio-economical, and further aspects such as culture and health (Sadler 1996, p. 22; Vanclay 2004, p. 268). However, over the years the meaning of environment was reduced to ecological issues (Vanclay 2004, p. 269). The neglect of social aspects gave birth to social IA, which was intended to be the lost, all-inclusive framework (p. 273). However, as Vanclay (2004, pp. 273–277) points out this attempt equally failed and social IA soon became (socio-)economic IA, which focused on the distribution of economic benefits (Boothroyd 1995, p. 86). Studies that derive their conceptualization of SD from reductionist approaches such as the TBL, often produce strange and bizarre outcomes (see also Hermans and Knippenberg 2006, pp. 301–302):

> "So we might reasonably ask [...] companies that have claimed to believe in the 3BL [TBL]—what their social bottom line actually was last year. But just posing this question conjures up visions of Douglas Adams's comic tour de force, *The Hitchhiker's Guide to the Galaxy*, in which the greatest of all computers is asked to come up with an answer to 'the great question of Life, the Universe and Everything.' That answer, which takes seven-and-a-half million years to calculate, is '42.' [emphasis in the original]" (Norman and MacDonald 2004, pp. 249–250).

In other words, approaches such as the TBL are underpinned by the assumption that everything can be measured in aggregatable, mainly monetary units (p. 246). This fosters business-as-usual thinking with damage mitigation promises (Gibson 2006, p. 265) by allowing for trade-offs, which, unfortunately, are often made, seldom adequately acknowledged, at the expense of social and/or environmental concerns (Adelle and Weiland 2012, p. 29; Bond, Morrison-Saunders, and Pope 2012, p. 55; Ridder et al. 2007, p. 427; Gibson 2006, p. 263; Pope 2006, p. vi; Sadler 1996, p. 16; Therivel et al. 2009, p. 165). Illustrated by the above quote, this sounds extremely bizarre in the case of social issues, but even the reduction of ecological systems to monetary units is a questionable practice. This is not to discredit inquiries, e.g., the famous study carried out by Costanza et al. (1997), which try to estimate the economic value of services provided by ecological systems. Raising awareness that these services are costly to replace is important to correctly assess humanity's technological capacities. However, the practice is often used to disguise inevitable value judgments and the demand for public reasoning behind the smokescreen of alleged objectivity (see Hunt 1993, pp. 77–80; Spash 2008, 2011, for an extensive critical reflection). These value judgments center, among others, around the two concepts compounded in the term 'SD' (cf. Daly 1990a, pp. 32–33; Dobson 1996, pp. 406–408; Graedel and Klee 2002, p. 534; Hediger 1999, p. 1129; Khagram, Clark, and Raad 2003, pp. 298–299): (i) "What of the natural environment needs to be sustained for human well-being (or future generations)?" and (ii) "What can be developed to improve well-being?". Emphasizing different aspects in answer-

Table 5.7: Conceptualizations of Sustainability, adapted from: Hediger (1999, pp. 1120–1129) and H. A. Simon (1996, pp. 2–3).

Conceptualization	Weak Sustainability		Strong Sustainability	
Interpretation	Very Weak	Weak	Strong	Very Strong
What to sustain?	Production Capacity	Total Capital Stock	Stock of Ecological Capital[a]	Stock of Natural Capital[b]
What to develop?	Productive Capacity of Economy	Decisions are Made for Individual Cases, Involving Value Judgments and Trade-Offs		Stationary State Principle[c]
Worldview	Artificial	Ecological		Natural

[a] Ecological capital refers to all renewable resources, the natural living space, and the determinants of the ecological system's carrying capacity (Hediger 1999, pp. 1124–1128).
[b] Natural capital comprises ecological capital and non-renewable resources (Hediger 1999, p. 1124).
[c] This implies zero population and economic growth.

ing these questions gives birth to various viewpoints in the SD discourse. The complexity of the continuum originating from possible responses is often reduced to the four analytically distinct positions summarized in table 5.7. A contrast of these stances allows to explicate vital aspects of the SD discourse, which are relevant to the idea of SHD underpinning the present examination[59].

Seen from the perspective of the two 'very' extreme positions, the first question, dealing with substitutability, allows to distinguish very weak and very strong sustainability as follows: whereas very weak sustainability grants nearly complete substitutability[60], limited only by irreversibility considerations captured in the concept of 'critical natural capital' (cf. Dobson 1996, pp. 413–414; Ekins et al. 2003; Lindenmayer, Laurance, and Franklin 2012), very strong sustainability demands a constant stock of the capital types comprised by the natural capital category (see the footnotes in table 5.7), i.e., it does not allow to reduce one capital type to enhance another (cf. Daly 1990b, pp. 2–3; 1990a, p. 36). As those extremes are hardly defendable, mitigated views are more common. For example, strong sustainability, which allows consuming non-renewable resources if the depletion is compensated by an equal increase of renewable resources, thus, maintaining the overall natural capital stock (cf. Daly 1990a, pp. 37–38; Hediger 1999, p. 1125), tends to be more feasible. Nevertheless, to avoid adding unnecessary complexity in outlining the main argument the following discussion is confined to the two extreme positions.

An answer to the next question, the second row in table 5.7, presupposes assumptions about the pace and direction of social-technological progress (cf. Daly 1990b, pp. 3–4; 1990a, p. 37; Graedel and Klee 2002, p. 528; Hilty, Lohmann, and Huang 2011, pp. 21–24; Hilty and Ruddy 2010, p. 18; Holdren 2008; Huesemann 2003; Meadows, Randers, and Meadows 2004, pp. 54, 203; Schlosberg and Rinfret 2008, p. 254; Sen 2013, pp. 8–9; UNDP 2011, pp. 15, 17). Whereas very weak sustainability tends to be more optimistic by assuming that all instrumentally important aspects of ecological systems can be replaced, if necessary, through social-technological advances, very strong sustainability is not only more pessimistic in this

59. For more detailed discussions see (Daly 1990a; Dobson 1996; Ekins et al. 2003, pp. 167–169; Gladwin, Kennelly, and Krause 1995; Graedel and Klee 2002; Hediger 1999; Hiwaki 1998; Khagram, Clark, and Raad 2003; Kjell 2011; Pelenc et al. 2013, pp. 81–83; UNDP 2011, pp. 15–16).

60. The TBL and its 'balancing' of the social, economic, and environmental dimension, which are all measured in monetary terms, fits perfectly with the (very) weak conceptualization of SD.

respect, but it further recognizes that ecological systems and/or constitutive elements can have an intrinsic value or form an essential part of a group's identity (e.g., A. R. Edwards 2005, pp. 14–15; Folke, Holling, and Perrings 1996, p. 1018; Hill et al. 2010, p. 77; Morrison-Saunders and Therivel 2006, p. 283; Ohlson et al. 2008, p. 431; Soulé 1985, pp. 731–732; Spak 2005, p. 235; Taylor 1981, p. 198; Pelenc et al. 2013, pp. 80–81; Vatn 2010, p. 1248).

Obviously, answers to these questions are intertwined with certain values and interests (cf. Dietz, Ostrom, and Stern 2003, p. 1907), which manifest themselves in a certain vision of the world in which the well-being of current and future generations can be ensured: within the *artificial* worldview the relationship between humanity and ecological systems is merely seen as an intermediary step in the successive creation of man-made environments that uncouple humanity's development from the constraints imposed by Mother Earth and nature in general (e.g., mega-cities or space stations). In stark contrast to this stance, the *natural* system worldview frames nature as a complex network of interacting elements. Humanity, as one of these elements, aligns with the larger system's processes (e.g., the noble savage). However, nowadays only a few places in remote outlands (e.g., Antarctica, the Sahara, or Siberia) can be considered as truly natural. Most natural systems have been replaced, especially in urban centers, by ecological systems, which are the product of years of human influence (Bolund and Hunhammar 1999, p. 294)—the natural system worldview is a foreclosed option. Correspondingly, the real antagonist of the artificial worldview is an *ecological* perspective that envisions a world in which humanity and ecological systems form a more or less symbiotic relationship. It allows to adapt ecological processes to human purposes and to create non-interfering artificial processes (e.g., organic agriculture, green buildings), but limits these human activities if they endanger the overall system's stability and integrity.

Even this brief and simplified juxtaposition of different conceptualizations of SD reveals that there is, and probably never will be a single interpretation of SD (cf. Kajikawa 2008, pp. 218–219). SD is a "flexible and pluralistic field that enables diverse framings" (Khagram, Clark, and Raad 2003, p. 299), depending on what people have reason to value (Dietz, Ostrom, and Stern 2003, p. 1907), and that does not refer to a fixed state but a process of negotiation and re-negotiation (Dale and Newman 2006, p. 20; Graedel and Klee 2002, p. 528). In short, SD is inevitably a normative concept of social change (Bond, Morrison-Saunders, and Pope 2012, p. 54; Hilty 2010, p. 417; Hilty and Ruddy 2010, pp. 7–8; Kelly, Caputo, and Jamieson 2005, p. 307; Pelenc et al. 2013, p. 84; Rosenau 2003, p. 14; Schultz et al. 2013, p. 117–118; Soma and Vatn 2010, p. 32). For the present inquiry these insights are important in two respects: on the one side, they suggest that SD has to be seen as a discursive, political process (Pelenc et al. 2013, p. 86; Schultz et al. 2013, pp. 117–118), and on the other side, they indicate that the meaning of SD is context-dependent and subjective, that is, the understanding of SD revolves around what people judge to be a valuable living (cf. Damodaran 2006, p. 66; Devuyst 1999, p. 473; Gatzweiler 2006, p. 302; Henocque 2013, p. 66; Pigram 2000, p. 222; Stern 2005, p. 976).

However, this is not to discredit the highly important literature devising techniques and tools to measure adverse effects of social practices on ecological systems (e.g. ISO 1998, 2000a, 2000b, 2000c, 2002, 2003, 2004, 2006a, 2006b, see also the above quoted IA literature) or applied research that is concerned with directly lessening the adverse effects of these practices on ecological systems, as for example research on 'green ICT' (see Ahola et al. 2010; Hilty and Ruddy 2000; Hilty, Lohmann, and Huang 2011; Hird 2008; Melville 2010;

Sorensen 2010, for excellent overviews)[61]. These research streams are important, because SD has a material dimension. The prime example is the carbon dioxide emission induced climate change (cf. J. Cook et al. 2013; Rockström et al. 2009; Running 2012). The challenging aspect here is that local actions often do not have a directly observable side-effect and the impact of an individual's action is relatively small. However, the aggregated effect of all local actions feeding into the global ecological network (Lovelock [1979] 2000, pp. 30–43), might exceed, as in the case of carbon dioxide emissions, a threshold of emissions the global system can absorb. This triggers, often delayed, second order effects, which are not directly relatable to local actions. Such relationships become perceivable only if larger scales and aggregated effects are taken into account (cf. Heusinger 2013b, p. 9; Lessmann and Rauschmayer 2013, p. 104; Schultz et al. 2013, pp. 118, 121). In this respect research focusing on the ecological facets of development is instrumentally important to inform the political process, but this does not change the political nature of the process itself. Therefore, sustainability frameworks such as the TBL or, more relevant to the present inquiry, the 'Integrated Sustainability Framework' (Dao, Langella, and Carbo 2011) have to be looked at with caution. For example, although the general intention of Dao, Langella, and Carbo (2011, p. 63) to go beyond greening initiatives (e.g., reducing energy consumption) is laudable; their claim to have laid the theoretical foundation for ISR on SD by having integrated social facets through the consideration of human resource management (p. 75) is misleading—if not normatively questionable. Considering people solely as human resources, not disputing the instrumental importance of these capacities, reduces people to an input factor of the economic production function and neglects the normative facets of the concept by treating the goals of development—human beings—as instruments (see the introductory quote of Kant, Anand and Sen 2000, p. 2039; Fukuda-Parr 2005, p. 118; Nicholls 2000, p. 157; Rosenau 2003, pp. 16, 24; Sen 1999, chap. 2; UNDP 1990, p. 11, and section 10.3). In other words, such approaches subordinate social aspects to economic concerns, indicating a colonization of the lifeworld (see section 2.1). However, a dominance of environmental concerns as indicated in 'The Natural Step framework' (Robèrt 2002), on the other side, has to be critically reflected as well:

> "[T]he concept of sustainable development is much broader than the protection of natural resources and the physical environment. It includes the protection of human lives in the future. *After all, it is people, not trees, whose future options need to be protected* [emphasis added]" (UNDP 1990, pp. 61–62).

To overcome this limitation of the SD discourse a more appropriate consideration of the social facets of development is required. As suggested in the introduction the CA or its practical application—the HD approach—is a direction in which such an extension might proceed. Until recently, this stream of research evolved relatively independently (Crabtree 2013, pp. 40–41); however, the *Journal of Human Development and Capabilities*, the flagship publication of research in this area, dedicated a special issue to explore this avenue (cf. Crabtree

61. Research can be divided into two broad areas (cf. Bachour and Chasteen 2010, p. 1; Molla et al. 2008, p. 671): (i) 'green in ICT', concerned with ICT infrastructure's impact on ecological systems (e.g., Bianzino, Raju, and Rossi 2011; Butler 2012; Molla and Cooper 2009; Molla, Cooper, and Pittayachawan 2011; Müller et al. 2011; N.-H. Schmidt et al. 2009a, 2009b; Watson, Boudreau, and Chen 2010; Watson et al. 2011), and (ii) 'green through ICT', concerned with reducing the impact of economic activities on ecological systems and with enabling ecologically friendly economic activities (e.g., Bose and Yan 2011; Bose and Luo 2011; Fedra 2000; Hedman and Henningsson 2011; Hilty 2010; Hilty and Ruddy 2010; Kersten, Mikolajuk, and Yeh 2000; Simmons 2000; Tomlinson 2010; Vodacek 2000).

2013; Hirvilammi et al. 2013; Lessmann and Rauschmayer 2013; Peeters, Dirix, and Sterckx 2013; Pelenc et al. 2013; Sen 2013; Schultz et al. 2013; Watene 2013). The central element of the HD definition in table 5.6 is that of 'capabilities', which Sen (2005a, p. 5) (reprint of Sen 1989, 1990) defines as the "various combinations of functionings (doings and beings)" a person can achieve (see also Satz 2012, pp. 286–287; Sen 1992, p. 40). He further defines 'functioning' as the achievement of a person, i.e., a particular way of living. In this view, the capability set of a person reflects the freedom to choose between different ways of living (real opportunities) (Sen 1999, pp. 74-76). Development in this perspective is then defined as the widening of people's capabilities and the level of functioning achievement; correspondingly, 'poverty', as the underlying notion to decide what needs to be developed (McCaston and Rewald 2005, p. 9), can be defined as the lack of capabilities to achieve a minimally acceptable level of basic functionings (UNDP 1997, pp. 15–16)[62]. The inclusion of 'choice', itself considered to be an intrinsically valuable aspect of living (Sen 2005a, p. 8), recognizes that human beings are not solely the passive beneficiaries of development; rather, they are active agents, who make decisions and perform actions (cf. Chambers 2006, p. 33; Fukuda-Parr 2005, p. 120; Krantz 2001, p. 22; Sen 1999, p. 17; 2005a, p. 3; 2013, pp. 8–9), making them the end and primary mean of development (cf. Deneulin 2008, p. 107; Sen 1999, p. 53). This adds 'agency', defined as "a person's ability to pursue and realize goals that she values and has reason to value" (Alkire and Deneulin 2009, p. 37), as a third component, manifesting itself as a process perspective, to the HD approach:

> "The perspective of human development incorporates the need to remove the hindrances that people face through the efforts and initiatives of people themselves. The claim is not only that human lives can go very much better and be much richer in terms of well-being and freedom, but also that human agency can deliberately bring about a radical change through improving societal organization and commitment. These are indeed the two central ideas give cogency to the focus on human development" (Sen 2005b, p. vii).

In sum, those three core concepts allow to highlight two characteristics of the HD approach, which distinguish it from conventional development wisdom[63] (cf. Alkire 2010, p. 47; Alkire and Deneulin 2009, p. 23): (i) the unit of analysis is shifted from the economy to individuals and their agency and (ii) the evaluative space is shifted from income or wealth to the freedom of individuals, which implies a multi-dimensional conception of poverty (see also Alkire and Foster 2011; Alkire and Santos 2009; Comim 2008, pp. 180–183; DFID 2000a, p. 1; Farrington 2001, p. 4; Krantz 2001, pp. 21–22; Laderchi 2008). Both these aspects have engendered criticism relevant to the present inquiry. Therefore, before turning to the critical reflection of this approach and the presentation of the synthesized SHD idea, these issues are briefly discussed (see Heusinger 2013b, pp. 10–14, for a more detailed discussion).

Firstly, recognizing the agency of human beings inevitably makes the HD approach abstract (e.g., Fukuda-Parr 2005, p. 121; Sen 2005a, pp. 5–6; 2012, pp. 332–333; Qizilbash

62. To avoid unfavorable connotations such as 'passive beneficiaries' or 'patients' implied by the term 'poverty' (cf. Alkire 2010, p. 16; Chambers 2006, p. 33; Fukuda-Parr 2005, p. 120; Neumayer 2012, p. 563; Sen 2005a, p. 3; 2013, pp. 8–9), the literature sometimes suggests to replace the term 'poverty' with 'vulnerability' or 'resilience' (cf. Chambers 1989, 2006; Chambers and Conway 1992; Watts and Bohle 1993). Within the present inquiry these terms are used interchangeably as they all refer to the risk of falling or staying below a certain level of capabilities required to achieve a minimally acceptable level of basic functionings (UNDP 1997, pp. 15–16).

63. This corresponds closely to the double-shift in international development thinking (cf. Frankenberger, Drinkwater, and Maxwell 2000a, p. 3; 2000b, pp. 67–69; McCaston and Rewald 2005, pp. 6–8): from poverty alleviation (welfarist) over poverty reduction (needs-based) to poverty eradication (rights-based).

2008, p. 62; Robeyns 2008, pp. 86–91, 94), because it its incompatible or 'paternalistic' to define a fixed list of specific capabilities, to assign priorities to these capabilities, and to specify comparative weightings of these capabilities, in some context-independent setting such as the 'ivory tower'. Such an 'incompleteness' of the approach raises concerns in regard to is ability to guide practice (cf. Satz 2012, pp. 288–292). For example, Nicholls (2000, p. 160) argues that there is a theory-practice gap, because the HD approach is "essentially a philosophical framework comprising complex and abstract principles" and it "has never been fully fleshed out" (p. 158). She concludes that there is a discrepancy between the HD approach "as a theory and as a realistic development strategy or action plan [. . .]" (p. 159), which makes the concept *vague* and allows to defend almost every intervention as a contribution to HD (p. 159). Although there are several proposals to 'complete' the HD approach (e.g., Alkire 2002; Nussbaum 2011, pp. 33–34; 2000, pp. 78–80), the observed theory-practice gap does exist; however, it exists for good reasons. Similar to the contribution of research on the ecological facets of development, proposals to complete the approach are 'just suggestions'. There is no 'objective', invariant answer: valuations vary from person to person, from context to context, and through time (cf. Watts and Bohle 1993, pp. 56–57). Furthermore, development is essentially an "initiative of people themselves" (Sen 2005b, p. vii). Therefore, concretizing or completing the framework is an intra-discursive activity (see also Johnstone 2007, p. 77; Sen 2012, pp. 332–333); everything else entails the danger of 'paternalism'. In short, the HD approach is deliberately abstract; it relies, similar to what was implicitly suggested in the foregoing SD discussion, on a scrutinizing public discourse in which people have the final authority. 'Public' in this case refers to a "perspective from which the citizens *mutually* convince one another of what is just and unjust by the force of the better argument [emphasis in the original]" (Habermas 1998, p. 64).

Second, a further aspect debated in the HD literature follows from the chosen unit of analysis: it is argued that focusing on the individual neglects the importance of social structures. The two central concepts in this dispute are 'ethical individualism' and 'collective capabilities'. The former refers to the demand of evaluating moral issues in respect to their effects on individuals:

> "[Ethical individualism] does not imply that we should not evaluate social structures and societal properties, but [. . . it] implies that these structures and institutions will be evaluated *in virtue of* the causal importance that they have for individuals' well-being [emphasis in the original]" (Robeyns 2008, p. 90).

The role and effects of social structures in the HD approach are discussed in terms of 'collective capabilities'[64] and 'conversation factors' (pp. 88–90). Whereas 'conversation factors', such as personal heterogeneities, environmental diversities, and variations in social climate (cf. Robeyns 2008, pp. 84-85; Sen 1999, pp. 70–72; 2002, pp. 82–83), which affect the individual's ability to transform resources into functionings, are uncontroversial[65], the ability of the HD approach to deal with larger social structures is hotly debated. One the one hand, it is argued that the approach needs to be extended by 'collective capabilities', that is, by a concept that captures "the capabilities that individuals would not be able to enjoy, di-

64. In addition to 'collective capabilities' this stream of literature also uses the terms 'group capabilities' or 'socio-historical agency' to refer to this concept (cf. Alkire 2008; Deneulin 2008; P. Evans 2002; Ibrahim 2006; Stewart 2005; Pelenc et al. 2013, pp. 87–88).

65. They are not only uncontroversial, but they are considered to be vital peculiarities of any approach that does not overlook injustices within social units such as families (cf. Robeyns 2008, pp. 90–94; Sen 2002, pp. 82–83).

rectly or indirectly, *except* through their participation in the group [emphasis in the original]" (Alkire 2008, p. 38)[66]. On the other hand, such an extension is opposed, because (i) the perception of 'collective capabilities' depends on the valuation of individuals, (ii) assuming that all group members value the collective capability uniformly, it tends to overlook intra-group heterogeneities and inequalities, and (iii) individuals belong to different groups and therefore have multiple identities (Alkire 2008, p. 40; Robeyns 2008, p. 92; Sen 2002, pp. 80–81, 84–85; 2009, pp. 246–247).

The rationale from which 'collective capability' proponents start their argumentation rests on the fact that human beings are inevitably embedded in social relations and that groups affect individuals in three respects (cf. Deneulin 2008, p. 107; Ibrahim 2006, pp. 401–405; Kelly 2012, pp. 299–302; Stewart 2005, pp. 187–189): (i) they have direct impacts on human well-being, because they open up opportunities for fulfilling social desires (e.g., belonging) and their real or perceived status affects an individual's self-esteem; (ii) they are instrumentally important, because they coordinate activities to achieve greater benefits for group members; and (iii) they impose a particular worldview, defined and shared within the group, on the individual and thereby shape her or his preferences and behavior. As eloquently summarized in the following quote, these three effects suggest that an extension is justified (see also Kelly 2012, p. 299; S. White 2009, p. 258):

> "[i]ndividuals are not the *only* unit of moral concern. Structures of living together are units of moral concern *too*. Failing to include them explicitly in the evaluation of state of affairs leads to the loss of important information for development [emphasis in the original]" (Deneulin 2008, p. 115).

The key concern, Deneulin (2008, p. 106-107) argues, is that the demand of 'ethical individualism' creates a tension between individuals and society, which can survive only on a theoretical level, but it cannot be maintained if the HD approach is guiding practice. However, Heusinger (2013b, p. 12–14) suggests that there is no real tension[67] if 'individual capabilities', whatever they may be, and 'group capabilities' are seen in the reproduction-socialization cycle, which is discussed more thoroughly in section 7.3[68]. The rationale is as follows: if social structures are defined as relatively stable relationship between social units that manifest themselves in observable coordinated human interaction (Hodgson 2006, p. 17), then the afore-mentioned 'group capabilities' refer to those capabilities that are produced by stable social structures. Stability, in this case, depends on an inter-subjectively shared interpretation of interactions representing the social structure (cf. Habermas [1981] 1987b, pp. 11–68). In other words, human beings produce social structures through their actions, which, in turn, are guided by an inter-subjectively shared interpretation of the involved interactions (see the lifeworld discussion in section 2.1). Exactly these inter-subjectively shared agreements are used for social-categorization and therefore represent a constitutive element of what is referred to as group or collective identity (Stewart 2005, p. 186). On the other side, individuals are always embedded in social groups and within these social groups the inter-subjectively shared interpretation is not only transferred between different generations through the process of socialization, but it also gets materially represented (cf. Archer 1995, pp. 65-92; Bhaskar 1998b, pp. 34–41; Sayer 2000, p. 18). The time dimension and the

66. Examples given in literature include public service provisioning such as clean water, education, social security or leisure time (Ibrahim 2006, p. 412).

67. For another attempt to resolve this tension see Alkire (2008, p. 30) and Alkire and Deneulin (2009, pp. 42–43) as well as the discussion in Heusinger (2013b, p. 12).

68. For an even more detailed discussion see Archer (1995, pp. 65-92), Bhaskar (1998b, pp. 34–41), Habermas ([1981] 1987b, pp. 11–68), Sayer (2000, p. 18), and Schmid (2004, pp. 8–11).

resulting ‘objectivation’ are an important, but often forgotten aspect, which helps to reconcile the tension: capabilities, in particular in a society characterized by a high degree of division of labor, only emerge through the existence of social structures, but these social structures, on the other hand, are also the factor constraining human opportunities (cf. Bass, Nicholson, and Subrahmanian 2013, p. 22; DFID 1999, p. 17; 2001b, p. 1):

> “A child raised in an environment without freedom of speech or religion does not develop the same political and religious capabilities as a child who is raised in a nation that protects these liberties [. . .]. I [Nussbaum] insist on the twofold importance of material and social circumstances [. . .]” (Nussbaum 2000, pp. 85–86).

Correspondingly, they are the ‘material’ of development efforts, that is, capabilities are enhanced or increased by changing social structures. However, such a change of social structures is most often a collective effort (DFID 1999, p. 4), in which changes are negotiated by trying to reconcile the different perspectives of the individuals involved. As such each individual evaluates the proposed options for change in respect to her or his capabilities as Robeyns (2008, p. 90) indicates in the afore-mentioned quote. This implies that capabilities “are not properties of persons only but of persons in particular circumstances, where those cricumstances include both inner and out dimensions” (Johnstone 2007, p. 86). This perspective tends to be perfectly compatible with the main points ‘collective capabilities’ proponents try to make:

> “The main point [. . .] is that one needs to examine (and develop policies towards) group capabilities if one is concerned with political stability, as well as from the perspective of individual well-being. Of course, ultimately political stability is desirable because of the benefits for individuals, but to understand how to achieve it one must focus on group behavior and influences, and how they may lead to non-valuable capabilities” (Stewart 2005, pp. 194–195).

However, the ‘one’, who examines the social structures from which her or his opportunities emerge, is every individual, who has to translate her or his individual evaluation of the scrutinized option into arguments that shape the discursive process in which the respective development option is framed. This, in turn, connects this issue to the abstract nature of the HD framework, because within the afore-mentioned process individuals not only present their arguments, but they also learn about different capabilities, priorities, and comparative weightings. This learning is ideally guided—in accordance with the demand to give “overriding priority [. . .] to the world’s poor” (WCED 1987, p. 54) in the initial version of SD—by a moral obligation to focus on the worst off (see the ‘differences in relational perspective’ in Sen 2009, pp. 255-256), which is often illustrated using the ‘appear in public without shame’ example (cf. Smith [1759] 1984, chap. 2). Correspondingly, the HD approach not only suggests a multi-dimensional poverty concept, but also a relative one (cf. Sen 1983; 1992, pp. 114–116). However, as Heusinger (2013b, p. 16) argues, social structures not only provide and constrain individuals’ opportunities, they also constitute the linkages between different individuals, who categorize themselves as a distinctive group based on an inter-subjectively shared understanding, and across these groups. This in turn suggests that changing social structures to enhance the opportunities of the worst off might also affect opportunities of other individuals, turning options to address the worst off into ‘wicked problems’ (Rittel and Webber 1973) that affect multiple-groups. Although the following analysis, discussed more thoroughly below, is not directly concerned with these wicked social problems, it equally applies here (see also H. A. Simon 1978b, pp. 8–9):

> "When important new policies must be formulated, public and official attention must be focused on one or a few matters. Other concerns, no matter how pressing, must wait their turn on the agenda. When the agenda becomes crowded, public life begins to appear more and more as a succession of crises. When problems become interrelated, as energy and pollution problems have become, there is the constant danger that attention directed to a single facet of the web will span solutions disregard vital consequences for the other facets [...]. It is futile to talk about substantive rationality in public affairs without considering what procedural means are available to order issues on the public agenda in a rational way, and to ensure attention to the indirect consequences of actions taken to reach specific goals or solve specific problems" (H. A. Simon 1988, pp. 72–73).

In other words, despite the important insights the HD approach provides, it does not adequately consider the intertwined nature of opportunities, i.e., the freedom of one can be someone else's restriction. In reference to Chambers and Conway (1992, p. 21) this issue can be called the 'opportunity competition'. However, before suggesting a constructive extension, a different, closely related aspect for which the HD approach has been criticized should be mentioned: it does not consider the consequences of enhancing or maintaining existing capabilities (Crabtree 2013, p. 43); a serious shortcoming in respect to the predicted population growth (UN-DESA 2011, p. 2). What the SD discourse brings into the HD approach is the insight that removing inequalities in freedom cannot be solved by solely extending and increasing opportunities, because the creation of capabilities through 'transient structures' (Bots 2007, p. 384) as well as turning capabilities into functionings has environmental impacts that might adversely affect different ecosystems and people as well as future generations (cf. Heusinger 2013b, p. 26; Meadows, Randers, and Meadows 2004; UNDP 2011, p. 15). Although Haq (2005, p. 19), one of the leading figures in the HD approach, nominated 'sustainability' as one of the central pillars of the framework, this mainly refers to the durability of the current generation's capabilities. This neither recognizes the opportunity competition or the inherent contradiction in turning every increasing freedom into functionings, nor does it account for the possibility of obligations toward ecological systems as suggested by a life-centered perspective[69] (but see UNDP 2011, p. 17); for a critical reflection of environmental ethics and asthetic see Habermas ([1991] 1994, pp. 105–11). Whereas the latter can, and probably should, be included in the public discourse, the former two suggest that a freedom-oriented approach cannot be freed from taking aspects of ecological and inter-generational justice into account. Although there is a certain degree of overlap between both these facets, i.e., ecological conservation, an important aspect of ecological justice, is inextricably linked with the inter-generational justice discussion (cf. Anand and Sen 1994, p. 3), the remainder treats them as separate concepts.

Firstly, although the ecological system's role in development was frequently mentioned in the Human Development Report (HDR) (e.g., UNDP 1990, p. 7; 1994, p. 19; 2010, p. 2; 2011, p. 14), see also (Alkire 2010, pp. 20–22; Khagram, Clark, and Raad 2003, pp.

69. For example, Taylor (1981, p. 198) argues that "we have prima facie moral obligations that are owed to wild plants and animals themselves as members of the Earth's biotic community. We are morally bound (other things being equal) to protect or promote their good for *their* sake [...]. Such obligations are due those living things out of recognition of their inherent worth. They are entirely additional to and independent of the obligations we owe to our fellow humans. Although many of the actions that fulfill one set of obligations will also fulfill the other, two different grounds of obligation are involved. Their well-being, as well as human well-being, is something to be realized *as an end in itself* [emphasis in the original]".

294–295), until recently human freedom has been the dominating concern (Crabtree 2013, p. 46)[70]. However, at least since the HDR 2011 (UNDP 2011), titled *Sustainability and Equity: A Better Future for All,* paralleled by the *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication* (UNEP 2011), the *Inclusive Green Growth: The Pathway to Sustainable Development* (World Bank 2012), and the *Towards Green Growth* (OECD 2011), sustainability considerations are a top priority on the HD agenda. The reports of both UN agencies emphasize that a 'green economy'[71] is a key ingredient to solve global problems (cf. UNDP 2011, p. 16; UNEP 2011, p. 15), but the HDR report wants to take the agenda even further by adding equitable development to the 'green growth' approach (UNDP 2011, p. 18). However, the idea of a green economy is underpinned by the assumption that SD, in the narrow version outlined before, and economic growth are compatible, if economic investors receive the right information and are provided with the right incentives (cf. OECD 2011, p. 11; UNDP 2011, p. 16; UNEP 2011, p. 17; World Bank 2012, p. 23). Based on the models and estimations used to illustrate this compatibility[72], proponents of the green economy hypothesize that

> "[t]he green economy makes a convincing argument for continued economic growth, but in a way that does not harm the environment. This is especially important for alleviating poverty and addressing the job losses associated with the financial crisis. Models estimating green job growth have shown very promising predictions. Of particular importance to developing countries is the emphasis in the reports on the social pillar of sustainability and poverty reduction through the green economy. Added to this is the growing concern over global climate change. The proposition that the green economy can limit and/or reverse environmental degradation while not slowing economic growth makes it attractive to governmental and business leaders alike" (Borel-Saladin and Turok 2013, p. 219).

Nevertheless, despite the apparent congruence of thinking, manifesting itself in the simultaneous publication of 'green economy' reports by several international key actors, there is a considerable amount of powerful criticism. The attempt to internalize[73] effects of economic

70. There are two possible explanations for this lack of consideration: (i) the challenges of integration and (ii) the instrumental importance of HD. However, none of these claims hold. In regard to the former, Costantini and Monni (2005, p. 332) argue that integration efforts are hopeless, because the utilitarian nature of SD is incommensurable with the freedom-oriented perspective of the HD framework. Although this 'weak sustainability' conceptualization (Neumayer 2012, p. 565) dominates the discourse, probably due to the prevalence of neo-classical economics (Rosenau 2003, p. 24), this is only one of the various possible positions (see table 5.7). Even Anand and Sen (2000), who use this economic view as underpinning of their investigation, recognize the need for a broader perspective (p. 2037) and emphasize that there are no theoretical reasons preventing an integration: both are universal concepts that acknowledge a decent life for everyone (Anand and Sen 1994, p. 3; 2000, pp. 2029-2030) and they share the aim to change the status quo for the better of all human beings (Anand and Sen 2000, p. 2033; Dale and Newman 2006, p. 18; Hediger 1999, p. 1126; Pope 2006, p. vii; Tiwari and Ibrahim 2012, pp. 71–72; WCED 1987, pp. 25, 51). The second line of reasoning is based on the idea that HD is an instrument to achieve 'sustainability' (Anand and Sen 1994, pp. 35–38; 2000, pp. 2030, 2038). The rationale goes as follows: if poverty is the underlying cause for substantial amounts of impacts on ecological systems (cf. Brundtland 1991, p. 43; UNDP 1990, p. 7; UN 1972, pp. 3, 70), then the improvement of HD in less 'developed' regions will lead to 'environmental investments' that reduce these adverse impacts (Sen 2009, pp. 249–250; World Bank 1992, pp. 31-32). However, investigations such as the ones carried out by Neumayer (2012) and Sachs and Tilman (2007) indicate that the life style of more 'developed' countries is among the main drivers of ecological degradation.

71. See Tienhaara (2013) for a discussion of 'green economy' in relation to the supplanted concepts 'green new deal' and 'green stimulus'.

72. Victor and Jackson (2012) provide an insightful and detailed critical reflection of the models used to make these predictions.

73. Note that the problem of externalities is associated with neoclassical economics. Within the tradition of the 'new institutional economics' (North 1990; Ostrom 1990; Schmid 2004; O. E. Williamson 2000) externalities are substituted by the problem of interdependence (cf. Paavola 2007, p. 94). In the former case externalities are internalized by extending existing or creating new markets (cf. Gatzweiler 2006, p. 296), the latter is more 'open' in respect to the institutions that are established to resolve the conflict emerging from the interdependence of actors (cf.

activities into the cost of production is criticized for (i) praising exactly these mechanisms as solutions that created the problems in the first place (cf. Bina and La Camera 2011, p. 2311; Brand 2012, p. 30; Meadows, Randers, and Meadows 2004, p. 43; Spash 2012, pp. 95–96); (ii) encouraging the thinking that growth is the only adequate solution (Spash 2007, p. 4); (iii) allowing the financial industry to extend their speculations into the ecological realm (Tienhaara 2013, p. 9); (iv) masking the complexity of ecological systems by transforming single services into individual units of trade, which, by implication, neglects that ecological systems are place-based and that they, or more specifically, the elements that constitute an ecological system, are interrelated (cf. Daly 1992, p. 109; Kosoy and Corbera 2010, pp. 1231–1232; Sandberg 2007, p. 614–617); and (v) underestimating the difficulties entailed in ensuring that different value positions in the path-dependent institutional arrangements are equally well integrated into the market (cf. Kosoy and Corbera 2010, pp. 1232–1233; Sandberg 2007, p. 614), that is, for not recognizing or neglecting existing power differentials as well as the competitive logic that underpins the market-mechanism (see also Brand 2012, p. 30; Kosoy and Corbera 2010, pp. 1233–1234; McGranahan et al. 2005, p. 816; Spash and Lo 2012, p. 81):

> "The authors of this report [(UNEP 2011)] appear to live in a fantasy world in which governments are democratic and make their decisions based on the will of the majority and the welfare needs of current and future generations. They seem to believe (or they would have us believe) that the existing political regimes and the so-called 'policy formulators', are able to impose norms of behaviour on the corporations and the financial markets. They seem to assume that finance capital and the transnational corporations that are operating as active agents of the accelerated devastation of the planet, do so not because that is how they seek to maximise their profit margins in the short term, but because they do not have enough information, or because the signals they receive from the regulatory frameworks within which they operate are not clear enough" (Lander 2011, p. 9).

In respect to the present inquiry, the criticism that economic growth, conceptually and practically different from development (cf. Daly 1990a, p. 33; 2008, p. 513), is proposed as the solution to all sorts of problems (cf. Bina and La Camera 2011, p. 2314; Brand 2012, p. 30), despite the acknowledgement that development tends to be more important in some areas (cf. Graedel and Klee 2002, p. 523), is most relevant:

> "Progress continues to fall short of what is deemed necessary. In a world of increasing complexity and uncertainty, the wisdom whereby problems and solutions are framed primarily (or even exclusively) through the lens of one single discipline, let alone a predominant theory therein, must surely be questioned. It is the link between the economy, the environment and society that is at the heart of these crises, not the economy or economics alone. And the link is not only one of scarcity and externalities. It is one of dependency, of the economy and society on the environment. Refusal to acknowledge biophysical limits and the responsibility that comes with uncertainty in spite of cumulative scientific evidence over decades, has led to economic policies that deliver injustices, within and across nations" (Bina and La Camera 2011, p. 2314).

In other words, although the present inquiry recognizes that 'green' economic growth is important and needs to be fostered, it nevertheless emphasizes that it cannot solve all prob-

Colding et al. 2013, pp. 1040–1042; Paavola 2007, p. 94; Sandberg 2007, p. 613; Vatn 2010, p. 1245).

lems. Especially in more ‘developed’ countries unqualified growth tends to deliver only marginal returns in respect to the actual goal of economic development—enhancing the quality of life for human beings. This relationship is captured in Max-Neef’s (1995) ‘threshold hypothesis’ (see also Meadows, Randers, and Meadows 2004, p. 224). This hypothesis states

> “that for every society there seems to be a period in which economic growth (as conventionally measured) brings about an improvement of quality of life, but only up to a certain point—the threshold point—beyond which, if there is more economic growth, quality of life may being to deteriorate” (Max-Neef 1995, p. 117).

Although the initial study was criticized for some shortcomings (e.g., Neumayer 2000), methodical refinements in further inquiries provide considerable empirical evidence that the threshold hypothesis is not fictional (i.e., Alexander 2012; Beça and Santos 2010; Kubiszewski et al. 2013; Lawn and Clarke 2010; Nourry 2008; Posner and Costanza 2011; Wilson and Tyedmers 2013). However, such findings, mainly using aggregated data for national economies, do not indicate that threshold points on national and sub-national levels necessarily correspond, nor do these findings exclude the possibility that a different type of economic development can elevate the threshold point. Correspondingly, from this perspective green economic growth might solve some of the problems humanity has to face in the 21st century. Nevertheless, there is some empirical evidence that economic growth, no matter in which form, alone is insufficient to address the adverse effects of the ‘community cohesion’ (Cantle 2001, p. 9)[74] or social fragmentation problem (UNDP 2009, p. 8), it might even cause them (see section 2.1). Both gain in importance in more ‘developed’ countries (cf. Bannister and O’Sullivan 2013, p. 100; Gaffikin and Morrissey 2011, pp. 1090–1091; Geneva Declaration 2010, pp. 10–14; 2011, chap. 5; Mason 2010, p. 873; UNDP 2009, p. 14). As they are underpinned by trends that are expected to increase in the coming decades, i.e., immigration (Putnam 2007, p. 128) and urbanization (see Mincey et al. 2013, p. 554; UN-DESA 2011; Yang 2013, p. 310, and section 6.1), it tends to be necessary to tackle the associated adverse effects on already achieved HD (Heusinger 2013b, pp. 33–34). Although both differ in some respects, they share important commonalities that allow to address them in a similar way (see section 10.3): the key mechanism to address both these issues is, according to the ‘contact hypothesis’ (Allport 1954), meaningful contact between individuals belonging to different groups[75]. Fostering contact in a particular way not only has the potential to reduce intergroup biases and build ‘bridging social capital’ (Putnam 2000, pp. 22–24), but it also can facilitate the creation of an additional ‘global identity’, which is characterized by a strong attachment to humanity and the recognition of obligations, following from one’s own freedom, to others far away (Phelps et al. 2011, p. 405). A global identity or emancipated, ‘real’ citizenship

> “is not a monistic identity that is completely apart from or transcends other identities important to citizens. These group identities are ever present and each group has a right to be part of the civic whole and to speak up for itself and for its vision of the whole” (Modood 2008, p. 449).

In other words, SHD as understood in the present inquiry goes beyond equitable and

74. Synonyms used in the literature are ethnic and/or religious ‘separatism’ (e.g. Dovidio, Gaertner, and Saguy 2007, p. 306) or ‘pluralism of monocultures’ (e.g., Sen 2006, pp. 28–29).

75. It has to be noted that this approach is underpinned by an often unacknowledged assumption, that is, of cultural or ethical commensurability, which differs from cultural or ethical incommensurability (e.g., S. P. Huntington 1993). However, institutions such as the UN or the EU indicate that cultures are, at least to certain degrees, commensurable.

‘green’ economic growth as proposed in the afore-mentioned reports (OECD 2011; UNDP 2011; UNEP 2011; World Bank 2012) by suggesting that SHD inevitably depends on meaningful interaction between citizens, not only on the ‘greening’ of economies. Fostering this contact facilitates the process of creating a global identity, supplementing not supplanting other identities as suggested by the ‘common ingroup identity’ (Gaertner et al. 1993) or ‘dual identity’ (Dovidio, Gaertner, and Saguy 2007, p. 305) theory, that helps to prevent the decline of achieved HD in more ‘developed’ countries caused by the colonization of the lifeworld. Furthermore, promoting meaningful interaction to create a global identity can also contribute to the removal or mitigation of inter-generational inequalities as discussed in the following.

Inter-generational justice is an intricate problem, because it adds a temporal dimension that streches into an unknown future. There are various more or less sophisticated attempts to integrate this issue into the SD and HD approaches as outlined above. However, there is a common core that can be illustrated based on the ‘four-step model’ proposed by Lessmann and Rauschmayer (see figure 5.12).

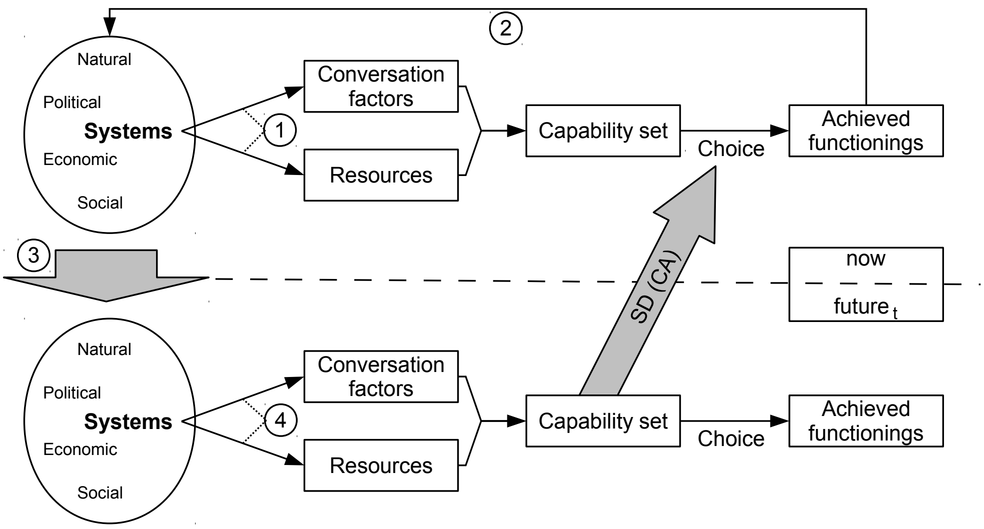

Figure 5.12: The Four-Step Model of SD based on the CA, source: Lessmann and Rauschmayer (2013, p. 99)

This model relates the above-described elements of the HD approach to a general system, which itself comprises four subsystems. The conditions of this system define the conservation factors and the resources that together delimit an individual’s capability set (1). The choice to turn opportunities into functionings, that is, to choose a particular life style has—as described above—an impact on system conditions, which in turn affects an individual’s capability set (2)[76]. Besides the minor difference of the exclusion of ‘transient structures’ (Bots 2007, p. 384) this can be interpreted as an integration of environmental justice considerations into the HD approach. To account for inter-generational justice considerations the model proposes that different generations are connected via system conditions left behind for

76. Despite the explicit environmental focus this model is very similar to the sustainable livelihood approach (SLA) models developed based on the concept of a sustainable livelihood introduced in WCED (1986, pp. 1-5), which was created in preparation of WCED (1987). The initial models (Carney et al. 2000, p. 47), which later formed the foundations for various development agencies are proposed by Chambers and Conway (1992, p. 7) and Scoones (1998, p. 4). For example, the Cooperative for Assistance and Relief Everywhere (CARE)’s Livelihood Security Model (Frankenberger, Drinkwater, and Maxwell 2000a, p. 5) and the Department for International Development (DFID)’s Sustainable Livelihoods Framework (DFID 1999, p. 1) are two models, based on the former two seminal papers, which are closely related to the idea underpinning the ‘four step model’.

future generations (3): "systems are the carriers of changes between current and future, non-overlapping generations" (Lessmann and Rauschmayer 2013, p. 98). As the conditions of the system, analog to (1), define the opportunity set of future generations (4), it is principally possible to consider the cumulative effect of (2) and (3) on (4) when making a choice to turn opportunities into functionings. As Lessmann and Rauschmayer (2013, pp. 101–102) readily acknowledge, there are several difficulties in determining the 'sustainability' of a certain life style. However, it tends to be unlikely that those 'difficulties' can, even in principal, be resolved. An initial, not fleshed out but sufficiently strong version of the underpinning rationale goes as follows: a constitutive element of social systems is knowledge, which implies that to anticipate changes of the social system requires to predict future knowledge. However, as Popper ([1957] 2002, p. xii) argues, "if there is such a thing as growing human knowledge, then we cannot anticipate today what we shall know only tomorrow" and therefore we cannot "predict the future course of human history". To circumvent this issue and to allow for mechanical calculations, respective inquiries and reports, assume that (i) system conditions change in a 'foreseeable, conservatively estimated way' and that (ii) preferences are time invariant. In addition to these questionable assumptions, (iii) an arbitrary number of years is specified[77] and (iv) the inevitable interrelatedness of ecological elements is completely faded out (cf. Daly 1992, p. 109; Kosoy and Corbera 2010, pp. 1231–1232; Sandberg 2007, p. 614–617). There are striking parallels to what Albert (1967) termed the 'model platonism' of economics (see section 7.3): together these assumptions create a favorable context that allows to transform wicked problems into issues solvable in a 'substantively rational' way (H. A. Simon 1976, pp. 130–131); see the above quote of H. A. Simon (1988, pp. 72–73). Furthermore, the goal of 'sustaining' the system, which can be 'unproblematically' derived from the selected SD definition, completes the technical reframing, leading to a situation in which "rational behavior is determined entirely by the characteristics of the environment in which it takes place" (H. A. Simon 1976, p. 131). This, in conclusion, hides all the normative aspects involved behind rational calculations that promise 'objective' solutions. For example, one of the neglected issue is the 'non-identity problem' explicated by Parfit (2011, pp. 217–231). The core of this problem can be seen as an extension of the afore-mentioned 'opportunity competition': changes to social structures not only affect the opportunities of currently living individuals, but they also might affect, at least partially, "*who it is* who will later live [emphasis in the original]" (p. 218). A different value judgment faded out is the question if probably existing people, people who not yet exist and might or might not exist in the future, whose preferences are unknown, can be accorded the same status as people currently existing. There are various other problems involved (see Gosseries 2008; Hubin 1976; Mulgan 2006; O'Neill 1993; Pasek 1992), which suggests that a pure (paternalistic) technical, top-down approach is morally questionable.

Without going further into the details of these wicked moral problems, the present inquiry, as will be discussed more thoroughly in section 10, adopts the concept of 'procedural rationality', which H. A. Simon (1976, pp. 131–137) distinguished from the afore-mentioned substantive rationality. In this view, behavior is rational "when it is the outcome of appropriate deliberation" (p. 131). In line with the foregoing discussion, the deliberative process leading to rational decisions and actions is, inter alia, appropriate if actions can be justi-

77. For example, Bond, Morrison-Saunders, and Pope (2012, p. 59) suggest to use 10-20 years, because this is the timescale of policy making, Graedel and Klee (2002, p. 524) propose 50 years as this allows to develop substitutes, Lessmann and Rauschmayer (2013, p. 99) use 100 years "to keep things simple", or the UNDP (2011, p. 14) prefers 100 to 1000 years to indicate a long period.

fied toward the following generation, i.e., the presently living children, using arguments that ‘cannot be reasonably rejected’ (Scanlon 1982, p. 116; 1998). This should not be developed into a fully fleshed out ‘social’ or ‘generational contract’[78]; rather, this shift of perspective makes the above issues subject to the deliberative process. The basic idea is derived from the obligations parents have toward their own children (cf. Habermas [1981] 1987b, pp. 54–68; Sen 2008, pp. 335–336; 2009, pp. 205–207; Watene 2013, pp. 31–32), enriched by two concepts from the HD approach literature, viz. ‘responsibility’ and ‘positional objectivity’. Firstly, distinguishing capabilities from functionings and prioritizing real opportunities over achieved functionings suggests a certain responsibility for the chosen way of living (Robeyns 2008, p. 91). More specifically: there exists an ex-post responsibility and an ex-ante responsibility. Whereas the former refers to accountability, the latter is defined as the “capacity to exercise self-restraint on a voluntary basis in order to satisfy obligations towards others” (Pelenc et al. 2013, p. 86). Secondly, ‘positional objectivity’ (Sen 1985, pp. 182–184; 2009, pp. 156–160) refers, in contrast to the conventional understanding of ’objectivity’ as position independent, to position-relative, person-invariant reflections. This ‘positional objectivity’ is included in the above definition of ex-ante responsibility by the demand that individuals hold themselves accountable for their actions by taking the position-relative arguments of *others* into account (cf. Habermas [1991] 1994, p. 49).

In addition to the afore-mentioned elements these concepts allow to specify the appropriateness of a rational deliberative process as follows: having the responsibility to hold ourselves accountable for the effects that our chosen way of living has on the next generation, in addition to the present generation, it suggests to adapt a risk adverse behavior as suggested by the ‘precautionary principle’ (cf. Arrow and Fischer 1974; Dethlefsen, Jackson, and Taylor 1993; Som, Hilty, and Köhler 2009] ; UN 1993). This is a principle that cannot be ‘reasonably rejected’ (Scanlon 1982, p. 116; 1998), even in the light of new scientific evidence or other insights (e.g., J. Cook et al. 2013; Rockström et al. 2009; Running 2012, in the case of human induced climate change). In other words, we are morally responsible for consequences of actions and inactions that are known in the light of current knowledge (Crabtree 2013, p. 52) and the precautionary principle provides a secure guideline to make decisions in view of the considerable difficulties to make prognoses of future states. The asymmetric power relationship between grown-up- and growing-up-generations not only makes a strong argument for adopting this principle, but also for getting actively involved in the prevention of changes that might have adverse effects on the next generation. However, borrowing the Kantian ‘ought implies could’, Stewart (2005, pp. 189–190) points out that choices are often not made in a vacuum, but preferences and behavior are partially influenced by norms and values of the group to which individuals belong (see also Chambers and Conway 1992, p. 6; Deneulin 2008, pp. 117–119; Pelenc et al. 2013, pp. 86–88) and by the opportunities available to them. This insight questions individuals’ autonomy and, by implication, responsibility. Rather than freeing all individuals from their obligation, those individuals, who have the opportunity to engage in the political discourse, are burdened with the responsibility to exercise this freedom (cf. Sen 2008, pp. 335–333; 2009, pp. 205–207). As such the intra- and inter-generational considerations culminate in the demand to challenge constraining social structures to enhance the opportunity of all human beings to fulfill their responsibility toward the next generation. Even if it is a legitimate, but questionable, choice not to make

78. See also the “Generationen Manifest” (Eng. generational manifesto) created in preparation for the German national elections in 2013: `http://www.generationenmanifest.de`, accessed May 25, 2015 (German).

use of the intrinsically valuable freedom to participate in deliberative processes, obligations toward the next generation make a strong argument for doing so.

In sum, a global identity, emanating from meaningful interaction between citizens, can contribute to the removal of inter-generational inequalities through its strong attachment to humanity and the recognition of obligations to distant others (Phelps et al. 2011, p. 405). That is, individuals with a global identity are more likely to proactively act on their moral obligations, pivotal to both intra- as well as inter-generational justice. Therefore, fostering meaningful interaction between citizens is a key measure to make progress in terms of SHD, which, in turn, strengthens the civil society and the public sphere. However, neither the SD nor the HD literature have explored this alternative or complementary way and its potential to contribute to the decoupling of high levels of HD from ecological degradation—the 21st century's central challenge (Neumayer 2012, p. 576). Examining this neglected facet is the central theme of the stream braided with the present inquiry's methodical proposal: as the discussion in section 10 explicates, a certain form of *community-driven* SHD, following from the meaningful interaction between citizens, is the missing link that brings together the threads spanning the different aspects of justice covered in the initial version of SD. Shifting attention to the involved processes allows disciplines such ISR to go beyond the 'greening agenda' without falling into the reductionist trap.

The exemplary application of the present inquiry's methodical proposal in part IV provides an instance of such a 'beyond the greening agenda' contribution of ISR and, more importantly, an instance of how ISR can contribute to the unfinished project of modernity. However, before the study turns to these discussions, which serve as supporting argument for the method developed in the next part, the succeeding chapter closes the background part by refining the research program, more specifically the research purposes, outlined in part I.

Chapter 6

Specification of the Research Program

"The world we have created today as a result of our thinking thus far has problems that cannot be solved by thinking the way we thought when we created them."

Albert Einstein

Based on the elaboration on the study's background in the preceding chapter, this final chapter of the second part specifies the research program outlined in part I in two steps: firstly, the research problems stated in section 2.1 are refined into the concrete research questions that guide the next two parts of the inquiry (section 6.1), and secondly, these questions are broken down into the research objectives (section 6.2), that is, the main tasks that need to be carried out to answer the research questions. The next two parts then report the results of the completed activities.

6.1 Research Questions

As indicated in the introduction in part I, the present inquiry pursues a dual strategy and therefore has two research problems. Correspondingly, there are also two research questions unfolding on this background: one guiding the construction of the method for the design of 'possible worlds' and another for the exemplary application of the method, which in virtue of the former is a self-contained research project.

In regard to the first research problem, the central focus of the study, the research question, based on the limitations of design science research in information systems (DSRIS) and critical and emancipatory (C&E) ISR carved out in sections 5.2 and 5.3 respectively, can be stated as follows:

> *Which steps are required to design desirable, feasible, and constructive alternatives to factually existing information systems (IS) that can inspire and inform participants of practical discourses about potential options for the changes debated in these discourses?*

One constraint that accompanies the endeavor of answering this question is the focus on communicative action instead of instrumental/strategic action to allow for the design of alternatives or 'possible worlds' in the civil society without furthering the colonization of the lifeworld (see chapter 2). As this is the focal concern of the method, its exemplary application unfolds in this realm. However, in contrast to the first research problem, which has already comparatively clear boundaries, the second research problem, despite the refinement of the political process in which the community-driven SHD initiatives (hereinafter: initiative) are embedded, i.e., the discussion of the general context in section 5.5, is still too broad to derive a specific research question from. In contrast to Habermas, who is specifically concerned with the construction of 'supranational political agencies', similar to the UN or the EU that do not have a legitimacy deficit, to outbalance the power of multinational corporations that either evade or, at least partially, determine societal development by influencing the political climate of nation-states (Habermas 1998, p. 124), the present inquiry focuses on the creation of public spheres within civil society organizations to strengthen the formation of public opinions directing political and administrative processes, i.e., the democratic political system that acts, or should act, on a formed public opinion instead of 'staging' it. In other words, the initiatives and the public sphere emerging within its boundaries are intended to mediate between "the institutionalized discourses and negotiations in the state arenas on the one hand, and the episodic and informal everyday conversations of potential voters on the other", which is important to direct state action "by selecting the matters which are relevant for political decision-making, reworking them into statements of problems and aggregating them into competing public opinions through more or less well-informed and reasoned arguments" (Habermas [2008] 2009, pp. 135–136), see also (Habermas [1962] 1991, pp. 66, 74, 117; [1964] 1974, p. 49).

However, this is a relative broad description, which can be further refined through the two central aspects of the 'unfinished project of modernity'[79] briefly sketched in chapter 2 (cf. Habermas [1981] 1997): there is the project of reconnecting ever increasing specialized knowledge to everyday life on the one side and the integration of the moral dimension in the project of scientific Enlightenment to 'finish modernity' on the other side. For research projects unfolding in this context this has, inter alia, the consequence that researchers have to see themselves simultaneously as researchers and as subjects. In other words, the study evolves around or within the lifeworld in which the researcher is a participant—"in a process of enlightenment there can only be participants" (Habermas [1971] 1973, p. 40). In respect to the present inquiry, more specifically the author's background, this implies that the exemplary application can be spatially confined to urban centers[80] in Western, i.e., 'more developed',

79. Habermas's theory of modernity follows the analysis of Weber and his *Economy and Society* (cf. Habermas [1981] 1987a, pp. 225–366). Within this theory modernity is conceptualized as a process (cf. Habermas [1981] 1997, pp. 39–40), heavily influenced by the (positivist) Enlightenment, within which religious and metaphysical worldviews (*Weltbilder*) are gradually 'demystified' (cf. Habermas 1998, pp. 7–12). This causes the three value spheres, formerly coalesced in religious-metaphysical worldviews, to spread out, resulting in the emergence of three worlds (cf. Habermas [1981] 1997, pp. 45–46; [1983] 1990, p. 58; [1985] 1987, pp. 313–314; [1981] 1987a, pp. 79–84): (i) the objective world as the totality of shared facts, (ii) the social world as totality of shared, legitimate, norm-regulated interpersonal relationships, and (iii) the subjective world as a totality of the non-shared experiences to which the individual has privileged access. The differentiation is paralleled by the institutionalization of three cultural subsystems, i.e., science and technology, law and morality, and art and criticism, each of which is concerned with a world-specific 'learning process' that is underpinned by a specific type of rationality (i.e., cognitive-instrumental, moral-practical, and aesthetical-practical rationality Habermas [1981] 1987a, pp. 329–330). The characteristics motivating Habermas to call this process of modernization an 'unfinished project' are the following two: on the one side, there are the separated learning processes within which experts amass specialized knowledge largely detached from the lifeworld (Habermas [1981] 1997, pp. 45–46) (i.e., modernity as project in which specialized knowledge needs to be reconnected to the everyday life), and on the other side, there is the danger of an 'one-sided process of modernization' or a 'selective pattern of rationalization' (cf. Habermas [1981] 1997, p. 44; [1981] 1987a, p. 329), which circumscribes the imbalanced development or institutionalization of the three learning processes (Habermas [1981] 1997, p. 44) (i.e., modernity as *unfinished* project in which the moral learning process needs to be strengthened).

80. There is no generally accepted definition of urban and even the differentiation of rural and urban areas is often arbitrary in literature. Characteristics used to distinguish urban and rural areas include higher population density, existence of large facilities (e.g., hospitals, universities), branches of higher level administration, a higher share of built-up land, higher income, and less occupancy in agriculture (McGranahan et al. 2005, pp. 798, 800); however,

democratic countries. This restriction of the scope fits perfectly with the strengthening of civil society in respect to the political process of SHD. Firstly, although merely an indicator of the study's relevance, but as depicted in figure 6.1 (see also Mincey et al. 2013, p. 554; Yang 2013, p. 310), urban centers are increasingly important in comparison to rural areas, which indicates that the inquiry's results have a relatively broad scope of application. Secondly, democratic countries ensure political rights such as freedom of association or the right to assemble, which are prerequisites for the creation of civil society organizations. Thirdly, urban centers are not only considered to be the ground on which the problems outlined in section 5.5 emerge, but they are also the focal point to address these issues (cf. Rees 2003, p. 130; UN-HABITAT et al. 2013, pp. 3–4). Whereas the community cohesion problem and social fragmentation are clearly associated with urban areas, because they are related to the Fourth World citizens within urban areas, environmental concerns are often not treated as urban-specific, because there are relatively few ecological systems in urban areas. However, it has been argued that urban areas have adverse effects on peri-urban[81] and rural areas, because increasing urbanization demands more intensive cultivation, fosters mono-cultures, and destroys ecological systems to make place for new residential or business complexes (McGranahan et al. 2005, pp. 805–806). Correspondingly, the failure to address the SHD of and in urban areas leads to 'literally cast in stone' facts (UN-HABITAT et al. 2013, p. 2). Finally, the central role of urban centers in modern societies grants them the status of a catalyst: they are able to influence distant developments. In literature this is captured by the term 'phantasmagoric' (Giddens 1990, p. 19), which Giddens (1990, p. 21) describes as "the disembedding of social systems [..., i.e.,] the 'lifting out' of social relations from local contexts of interaction and their restructuring across indefinite spans of time-space" in modern societies. In other words, within modernity local places are increasingly shaped by distant influences, which in turn suggests that urban areas can have a radiating influence beyond their own boundaries.

Correspondingly, the research question for the exemplary application of the method developed in part III can be stated as follows:

> *Is a community-driven SHD initiative, if possible at all, able to contribute to the resolution of the issues associated with SHD and, based on an affirmative answer of the former, how can it be supported by information and communication technology (ICT) applications?*

However, the exemplary application is carried out mainly to demonstrate the methods feasibility. This allows to refine the second part of this research question, because it merely serves illustrative purposes. Therefore, the exemplary application can concentrate on the development of a technical system that supports one process, which indicates that it is feasible to use the 'possible world' as domain model for the design of reference architectures. Within the present inquiry the decision-making process is selected to demonstrate the endeavor. The underlying rationale is, adopting the arguments from the SD literature, that this process is one of the key processes within such initiatives: the decision-making process within these initiative is considered to be challenging as the involved systems are highly complex, inextricably interlinked, and not well understood (cf. Kajikawa 2008, pp. 231–232; Kates 2011, p. 19450; Kates et al. 2001, p. 641; Seager 2008, pp. 449–450). This allows to restate the

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the borders are not clear cut. Furthermore, following UN-HABITAT et al. (2013, p. 1), the terms 'city' and 'urban area' are used interchangeably in the remainder of the inquiry.

81. Following McGranahan et al. (2005, p. 806) the term 'peri-urban' is used to denote the surrounding of urban areas, which is becoming more urban, because it gradually loses its rural characteristics (e.g., built-up land).

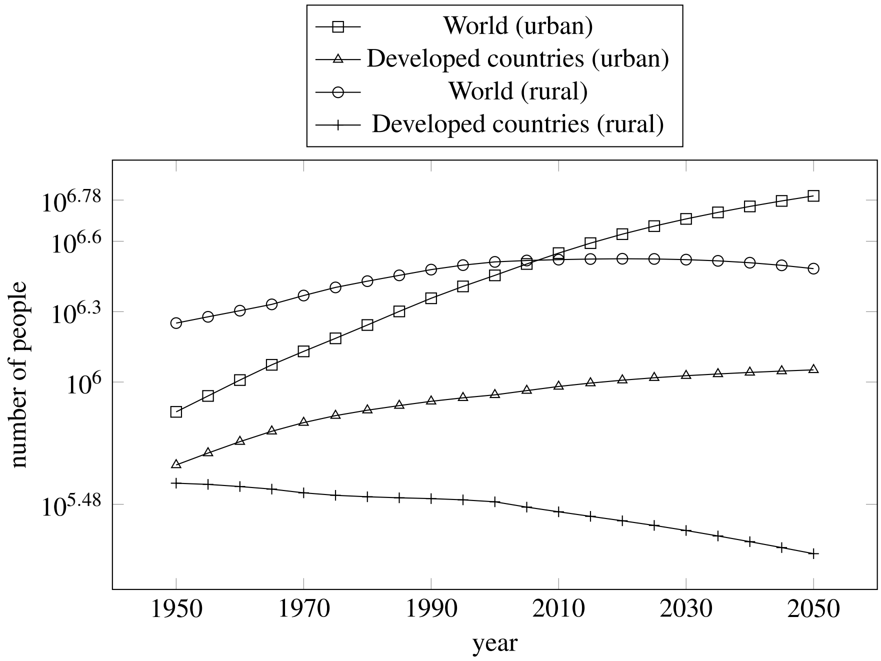


Figure 6.1: Urban and Rural Population (1950-2050), data source: UN-DESA (2011)

above research question for the exemplary application as follows:

> *Is a community-driven SHD initiative, if possible at all, able to contribute to the resolution of the issues associated with SHD and, based on an affirmative answer of the former, how can its decision-making processes be supported by ICT applications?*

The next section breaks both afore-mentioned research questions down into more specific research objectives and, thereby, outlines the range of tasks the following two parts, each dedicated to one of the two questions, are concerned with.

6.2 Research Objectives

Research objectives are defined as the main tasks that need to be achieved in order to answer the research question (Altinay and Paraskevas 2008, p. 139). For the first research question stated in the preceding section, this involves the following aspects:

Firstly, as explicated in sections 5.2 and 5.3, the methodological suggestions of C&E ISR, especially the first two of the three phases, constitute the basis for the initiation of C&E DSR projects. However, it was pointed out that the ontological and epistemological assumptions of interpretive research, underpinning primarily the first phase, limit the transformative potential of C&E ISR. Therefore, the first research objective is to discuss alternative underpinnings that allow for more constructive proposals without running in a presupposition failure by objectifying social reality or falling into the trap of value relativism. Secondly, within the discussion that lead to the first research objective, it was also mentioned that the 'post-construction evaluation' of DSR is inadequate for the design of 'possible worlds' and needs to be replaced with a 'within-construction justification'. Correspondingly, the second research objective in regard to the construction of a method for the design of 'possible worlds' is to suggest an adequate technique within the context of justification. Thirdly, the method itself, that is, the sequence of steps to design a ‘possible world’, needs to be re-constructed using the background knowledge explicated in chapter 5 as well as the insights gained in the realization of the first and second research objectives. This is the key objective to answer the research question stated in the preceding section. Finally, the method for the design of ‘possible worlds’ has to be related to the existing methodical repertoire of ISR to explicate its scope of applicability. This last research objective serves mainly the purpose to anchor the method in the overarching disciplinary discourse and relate it to other research endeavors.

This, however, is by no means a complete list of activities carried out in the next part; rather, it is an explication of those points that are of vital importance to the overall endeavor. Other activities such as the description of a method for the design of reference architectures, although important, are not as central as the four afore-mentioned research objectives.

In respect to the second research question the following two broad, preliminary research objectives can be identified: on the one side, the developed method needs to be applied in the context specified in the foregoing discussion, and on the other side, the designed ‘possible world’ should be used as a domain model for the elicitation of requirements for the construction of a reference architecture to support the decision-making process within the ‘possible world’. A more detailed elaboration of research objectives is not possible at this point as this requires to anticipate several aspects that unfold only in the next part. Correspondingly, a more detailed description of these research objectives is postponed till part IV, where it will be incorporated in the introduction.

Part III

A Method for the Design of 'Possible Worlds'

Chapter 7

Worldview or Disciplinary Matrix

"The worst thing that intellectuals can do—the cardinal sin—is to try to set themselves up as great prophets vis-à-vis their fellow men and to impress them with puzzling philosophies. Anyone who cannot speak simply and clearly should say nothing and continue to work until he can do so."

Popper ([1984] 1994, p. 83)

In line with the argument of Popper ([1984] 1994, p. 83), methodical[82] sections in dissertation theses or research reports in general are relatively short and are often able to live without an exploration of 'puzzling philosophies'. This applies to nearly all well-established methods for which methodical discussions have already been fought. In these cases assumptions are taken for granted[83], what is of concern is that method is applicable in regard to the study's object of investigation and purpose (cf. Sayer 1992, p. 4). However, the present inquiry's focus is on the development of a method for the design of 'possible worlds' and its application. The primary focus of this part is to re-construct this method. This implies, in accordance with good scientific practice (see chapter 2), that the underpinning philosophical position should be explicated[84]. The issue is, unfortunately, further complicated as, already indicated in the foregoing discussion, the design for 'possible worlds' is essentially a synthesis of insights of two relatively well-established research traditions in information systems research (ISR): design science research in information systems (DSRIS) and critical and emancipatory (C&E) research. In chapter 5 it has been claimed that none of these traditions, due to their incompatible presuppositions, is suitable for the design of 'possible worlds'. This rather superficial critical reflection was made in anticipation of a discussion of the respective philosophical underpinning. Therefore, the present chapter has the dual task (i) to expand on the claims made in chapter 5 and (ii) to present the underpinning of the methodical development in the succeeding chapters.

Before going into the details of a discourse that is as old as science, it should be em-

82. The term 'method', as used in the present inquiry, refers to the general procedure involved in conducting a study, which is different from the concrete research strategy, technique, or method in the narrow sense used to collect and analyze data (see Cecez-Kecmanovic 2005, pp. 37–38; Chmielewicz 1994, pp. 36–41; Comstock 1982, p. 370; Heusinger, forthcoming; Sayer 1992, pp. 2–4).

83. It has to be stressed that these 'taken for granted' assumptions are not only vital for the conduct of research; rather, they have important consequences for the applicability of results in practice (cf. Guba and Lincoln 1994, p. 112). Therefore, within an applied discipline such as information systems research (ISR), which is specifically concerned with results applicable in practice (cf. Galliers and Land 1987, p. 901; Orlikowski and Baroudi 1991, pp. 11-12), such a discussion or at least awareness for the often far-reaching implications of particular assumptions tends to be extraordinarily significant.

84. This demand follows from the incompleteness theorems of Gödel (1931), which, if appropriated for the present context, suggest that methodological discussions cannot be decided within the realm of methodological disputes but need to refer to a higher system, i.e., the disciplinary matrix.

phasized that there is no 'correct' position; rather, multiple perspectives, comprising derived methods, can enrich the understanding of complex phenomena such as information systems (IS) (cf. Chmielewicz 1994, pp. 38–41; Frank 2006, pp. 1, 3–4; Feyerabend [1975] 1993; Galliers and Land 1987, p. 901; Orlikowski and Baroudi 1991, p. 1). Nevertheless, the unit of analysis as well as the purpose of research render particular positions more suitable than others. The following will point out, based on the contributions of many great thinkers, which philosophical position is adequate for the design of 'possible worlds'. As it would be presumptuous and out of place to try to make a valuable contribution to this debate, the remainder will be merely a—necessarily—non-exhaustive summary of convincing arguments.

Generally, the underlying assumptions can be described as the ones of a realist, more precisely, of a critical realist. However, there are various flavors of realism[85]. As it is not only unfeasible but nearly impossible to elucidate on all of these positions and their differences (see Chakravartty 2013; Kuipers 2007, pp. 27–32; Ladyman 2007, pp. 329–357, for excellent discussions), the following focuses on the philosophical stance underpinning the present inquiry, viz. critical realism. This position was pioneered by (Bhaskar 1998b, 2008, 2011) and received further substantial elaboration in philosophical and social science terms (cf. Archer et al. 1998; Danermark et al. 2002; Robson 2002; Sayer 1992, 1997, 2000) as well as an ISR-related refinement (cf. Carlsson 2007, 2009, 2010, 2012; Carlsson et al. 2011; Klein 2004; Wynn and Williams 2012). Although a presentation of critical realism on its own would be suitable to realize the afore-mentioned task (ii), that is, explicate the underpinning of the methodical development, it would be insufficient to expand on the claims of chapter 5, i.e., to complete task (i). Furthermore, Sayer (1992, p. 5) points out that worldviews are not "self-contained but exist through their position to a range of alternative positions" (see also Frank 2006, pp. 13–14; Morgan and Smircich 1980, p. 492). Hence, the defended philosophical position is explicated in relation to the two better-known schools of thought in science and ISR in particular, viz. (post-)positivism and (radical/social) constructivism[86]. It should be noted that both terms are used as umbrella terms for various facets that can be found in social sciences research. Similar to the argument above, it is (nearly) impossible to explicate all different variations. Therefore, the chapter abstracts from the differences of the various positions and polarizes the discussion using the stylistic device of the 'dialectic movement', which is often attributed to Hegel ([1807] 1910). In other words, the three stances are contrasted in a particular way: the two worldviews used as thesis and antithesis are 'extremified' to present critical realism as synthesis[87]. Correspondingly, it would be a mistake to associate one of the referenced authors, who in addition often changed their mind themselves

85. For example: critical realism (Bhaskar 1998b, 2008, 2011), observational realism (Schlick 1938; Toulmin 1953), constructive realism (Fraassen 1980, 1989), scientific realism (Leplin 1997), theory realism (Niiniluoto 2010; Popper [1935] 2002), essentialist realism (Harré 1986), and many more.

86. Constructivism is a label used with different meanings in various disciplines. In particular, the social constructivism presented here has to be distinguished from philosophical constructivisms such as the Erlanger constructivism. In the present case, constructivism is recited, mainly following Guba and Lincoln (1989), as a coherent worldview (cf. Chua 1986; Orlikowski and Baroudi 1991) that can be contrasted with other positions. However, it has to be acknowledged that 'universal constructivisms' (Hacking 1999, pp. 24–25), that is, a constructivism as the one presented in the following, is seldom found in the practice of science. Hacking (1999, pp. 24–25) argues that it is more of a question which social phenomenon is socially constructed [e.g., Berger and Luckmann (1966) were mainly interested in the social construction of everyday life reality], which needs to be distinguished from universal constructivisms. Nevertheless, the text explicates the rationale that underpins this 'extremification'.

87. It is acknowledged that there are other approaches to classify different worldviews. The most prominent is a distinction along the objective-subjective continuum (e.g., Burrell and Morgan 1979; Holden and Lynch 2004; Morgan and Smircich 1980). However, as Sayer (2000, pp. 58–62) convincingly argues, such differentiations are misleading, because both terms have at least three logically independent meanings and (usually) more than one is involved in these typologies. Hence, it is impossible to squeeze the discussion in this dichotomic framing (see also Bourdieu 1988, pp. 780–782).

during their career (e.g., Popper 1967a, 1967b), with one of the positions as portrayed in the following. Furthermore, it is unknown if there are researchers who are proponents of these 'extremified' positions; however, this does not impair the dialectic contrast—the underlying ideas do not depend on their practical exercise.

The discussion, as suggested by the dialectic movement, starts with a presentation of (post-)positivism as thesis (see section 7.1), followed by the antithesis in form of constructivism (see section 7.2). Critical realism is, as intended, framed as the emerging synthesis (see section 7.3). The elaboration of these three positions follows, with minor extensions, the consensual arrangement along ontological[88] and epistemological[89] assumptions (cf. Burrell and Morgan 1979; Chua 1986; Frank 2006; Guba and Lincoln, 1989, 1994; Holden and Lynch 2004; Iivari 2007; Iivari, Hirschheim, and Klein 1998; Morgan 1980; Morgan and Smircich 1980; Orlikowski and Baroudi 1991; Rossi and Sein 2003). Further elements (e.g., relationship of research and knowledge, employed metaphors, conceptualizations of theory), often following from the former two assumptions, are discussed, if necessary, en passant.

7.1 (Post-)Positivism as 'Thesis'

Inquiries underpinned by (post-)positivist assumptions are comparatively well represented in research in general (Danermark et al. 2002, p. 16) and ISR in particular (cf. Chen and Hirschheim 2004, p. 197; Richardson and Robinson 2007, p. 252). This prominence rests, at least partially, on its relatively long history: the outline of positivism as a coherent position is commonly attributed to Comte ([1848] 1908, [1851] 1875, [1852] 1875, [1853] 1876, [1854] 1877). He envisions social evolution as a three stage process at the end of which, in the spirit of Enlightenment, positive technocrats realize the motto of positivism: 'Order and Progress' (Comte [1848] 1908, p. 115), i.e., progress to develop order. As indicated in chapters 1 and 3, science, or more specifically the researcher as a neutral observer (Orlikowski and Baroudi 1991, p. 9), is expected to guide humanity in questions of life; thereby, replacing religious institutions' prerogative of interpretation. The main point of this early account in respect to the present discussion is the claim of the 'unity of the scientific method', i.e., that the scientific method, the pivotal element to ensure neutrality, is applicable to all sciences:

> "[The Positive spirit] exercised for a long time a modifying influence upon theological and metaphysical principles, which has gone on increasing ; and since the time of Descartes and Bacon it has become evident that it is destined to supersede them altogether. Positivism has gradually taken possession of the preliminary sciences of Physics and

88. Ontological assumptions refer to metaphysical questions concerning the nature of being, which includes the very essence of natural kinds, their properties, and their relationships (cf. Burrell and Morgan 1979, p. 1; Ladyman 2007, pp. 303–304; Holden and Lynch 2004, p. 398; Wynn and Williams 2012, p. 789). In social sciences such reflections have to be done mainly in respect to social reality, although in the current case, i.e., the physical components of information systems (IS) suggest physical reality considerations as well. The latter tend to be unproblematic, because most tend to accept that the physical world exists mind-independently as opposed to the perspective of solipsism that assume only the self exists. The ontological status of social reality, in contrast, is a more intricate problem. Whereas positivism would essentially attribute the same status to social reality (realism), constructivism would reject the ontological primacy of society (relativism or anti-realism), i.e., it assumes that social reality does not exist mind-independently (Chua 1986, pp. 614-615).

89. Epistemology is generally defined as the theory of knowledge (Ladyman 2007, p. 303). Correspondingly, this term is used as umbrella for assumptions in regard to, for example, the nature of knowledge and its validity (cf. Burrell and Morgan 1979, p. 1; Chua 1986, p. 604; Ladyman 2007, p. 303; Orlikowski and Baroudi 1991, p. 8). Epistemological considerations are the link between ontological assumptions and methodical considerations, because they function as an intermediary that describes how the practice of knowledge creation is related to the source of knowledge.

> Biology, and in these the old system no longer prevails. All that remained was to complete the range of its influence by including the study of social phenomena" (Comte [1848] 1908, p. 12).

In respect to the intended contrast with constructivism, it is exactly this claim of positivism[90], shared with postpositivism, which gave rise to the criticism that eventually culminated in the development of different positions. Although this is merely a methodological facet, it is the basis for re-constructing the set of ontological and epistemological assumptions that form the coherent disciplinary matrix, which the present inquiry labels 'positivism'[91]. However, to carve out these aspects it is required to be more specific about the scientific method. The most prominent version, in a qualified variant shared by postpositivism, is the conceptualization as search for 'constant conjunctions of events' (Hume [1888] 1965) or causal relationships. This search is underpinned by the idea to limit scientific knowledge to contemplative observations or experience, i.e., empirically testable observations (cf. Hobbes [1651] 1909, chap. 1; Mach [1897] 1914, chap. 1; Mill [1843] 1882, §4). Although postpositivism softened this skepticism by including logical and mathematical testability, both have in common the rejection of meta-physical propositions. A well-known example of this extremely empiricist view is Hume's 'general proposition' or 'copy principle', which states:

> "[t]hat all our simple ideas in their first appearance are deriv'd from simple impressions, which are correspondent to them, and which they exactly represent" (Hume [1888] 1965, p. 4).

In short, the copy principle suggests that human thinking cannot transcend experience, even complex 'ideas', which might be called concepts nowadays, are, in their last instance, reducible to sensations. In other words, it is rejected that (invisible) theoretical entities ('abstract ideas') are 'real' in a positivist sense (cf. Robson 2002, p. 20), that is, they are not particulars that leave 'simple impressions' (cf. Hume [1888] 1965, pp. 17–25). However, these basic 'ideas' can be combined to more complex ones through 'universal principles' (pp. 10–15). Hume ([1888] 1965, p. 74) argues that, because it allows humans to go beyond what is directly perceivable, the most important of these principles is the cause-effect relationship, underpinning the 'regularity theory of causation': a cause-effect 'belief' relates two conjointly experienced simple impressions to each other[92]. Correspondingly, the theoretical entities or concepts are merely 'beliefs', that is, helpful classification devices that are not 'exactly represented' or do not correspond to entities in the mind-independent world. This can, in reference to DeLanda (2002, p. 47), be called a 'flat ontology', i.e., it is assumed that only one type of ontological 'natural kind', the sensational or experienceable event, exists in different spatiotemporal scales. Although it could be argued that positivism, because of its (extreme) empiricism (cf. Orlikowski and Baroudi 1991, p. 9; Robson 2002, p. 20), conflates

90. It should be noted that this quote, at least implicitly, rejects the idea of reductionism, that is, the assumption that everything can be reduced to some basic physical laws. This view was introduced much later (e.g., Mach [1897] 1914, pp. 6–7; Mill [1843] 1882, pp. 606–608). Nowadays, however, this idea has largely been abandoned (cf. P. W. Anderson 1972; Popper 1967a, pp. 85-94, and section 7.3).

91. It has to be emphasized that positivism is often used interchangeably with the project of Enlightenment. However, the present inquiry distinguishes between the two and the label (post-)positivism is used as heading for the ontological and epistemological assumptions pointed out in the following.

92. The relation between two perceivable events can be called a cause-effect relationship, if the following conditions are met (Hume [1888] 1965, pp. 73–106): (1) the cause must be present when the effect takes place ('contiguity'), (2) the cause must precede the effect ('succession'), (3) the cause and the effect have been (several times) experienced to be conjoined ('constant conjunction'), and (4) there is a 'belief' relating cause and event, i.e., there is no direct 'impression' of a necessary connection between cause and event. This last addition, that is, the lack of a necessary connection, can be considered the quintessence of Hume's ([1888] 1965, pp. 86-94) 'problem of causation' and 'problem of induction' (see also Sayer 1992, pp. 92–100, 153–160).

ontology and epistemology (cf. Danermark et al. 2002, p. 8), the key point is that the focus on 'direct representation' implies that sensations are mind- and theory-independent, i.e., they "are what they are independently of whatever people happen to believe or desire" (Ladyman 2007, p. 307). This phenomenalism has later been replaced by physicalism/materialism[93] (cf. Neurath 1931). Today, however, postpositivists recognize that observations are theory-dependent[94] (see Popper 1967a, pp. 219–220; [1935] 2002, pp. 88–94), i.e., observations are made from within a 'language community'[95] that shares those concepts that mediate or enable perceptions (cf. Kuhn 1996, pp. 126–130). The latter are distinguished from sensations: "We may have 'sensations' without concepts, but we have no perception without concepts" (Sayer 1992, p. 52). In other words, the inclusion of a 'language community' replaces theory-independent sensations with theory-dependent perceptions as an authoritative knowledge source. Nevertheless, the ontological assumption of a mind-independent reality[96] and the epistemological position manifested in a variant of the 'regularity theory of causation'[97] are still prevalent in postpositivism. The shift from the traditional to the 'modern' understanding of causation can be described as follows:

> "Without waiting, passively, for repetitions to impress or impose regularities upon us, we actively try to impose regularities upon the world. We try to discover similarities in it, and to interpret it in terms of laws invented by us. Without waiting for premises we jump to conclusions. These may have to be discarded later, should observation show that they are wrong" (Popper 1962, p. 46).

In this perspective knowledge takes the form of laws or theories about the mind-independent reality (cf. Popper 1957, pp. 61–63, 97–105; [1935] 2002, pp. 37–38). The underlying idea of this reversed perspective is conceptualized in the Hempel-Oppenheim schema (see figure 7.1), also known as the hypo-deductive, deductive-nomological, or covering law model (cf. Chmielewicz 1994, pp. 151–155; Godfrey-Smith 2003, p. 236; Hempel and Oppenheim 1948, pp. 136–140; Popper [1935] 2002, pp. 38–40)[98].

As can be seen in figure 7.1 the schema comprises three elements: the antecedent or initial conditions, the general laws or universal statements, and the phenomena to be explained. Because the model assumes a symmetric relationship between 'explanation' and prediction, i.e., given a general law and either certain conditions or an observed phenomena, it is possible to predict the phenomena which will occur or 'explain' the observed phenomena by explicating the conditions which have to have existed respectively (cf. Popper 1957, p. 124). In other words, predicting unobserved phenomena based on past experience, manifested in the general laws, is considered to be the only 'valid' way how we can, using Hume's ([1888] 1965, p. 74) terminology, go 'beyond our senses'. The core of this schema is the distinction of concepts

93. Stoljar (2009, chap. 1) argues that although physicalism and materialism have different origins as well as might be used by some with different connotations, these differences are merely nuances and both terms are often used and can be used interchangeably.

94. An excellent discussion of theory-dependence can be found in Sayer (1992, chap. 2). Two notable examples, because they come from positivism's role model discipline physics, are the investigation of the nature of light (Einstein 1905) and the 'indifference principle' (Heisenberg 1927); both question the possibility of theory-independent observations (see also Fischer 1998, pp. 131–132; Popper 1967a, pp. 219–220).

95. The term 'language community' is based on what Wittgenstein called a 'language games' (cf. Habermas [1981] 1987a, [1981] 1987b, and chapter 2); a term that "bring[s] into prominence the fact that the speaking of language is part of an activity, or of a form of life" (Wittgenstein 1958, §23), which equally applies to scientific inquiries.

96. For example, the three worlds of Popper are an analytical distinction of ontologically existing realms that constitute the areas in which mind-independent observations can be made (see Popper 1978, and section 5.2).

97. See Ladyman (2007, pp. 316–318) for an interesting discussion of different and further accounts.

98. Although the Hempel-Oppenheim schema makes sense only in a positivistic framework that is downplaying explanation and that is pro-observation, anti-cause, and anti-theoretical entity, i.e., that rejects metaphysics (Hacking 1983, pp. 41–57), it is still used by, for example, Altinay and Paraskevas (2008, p. 75) in unsuitable domains.

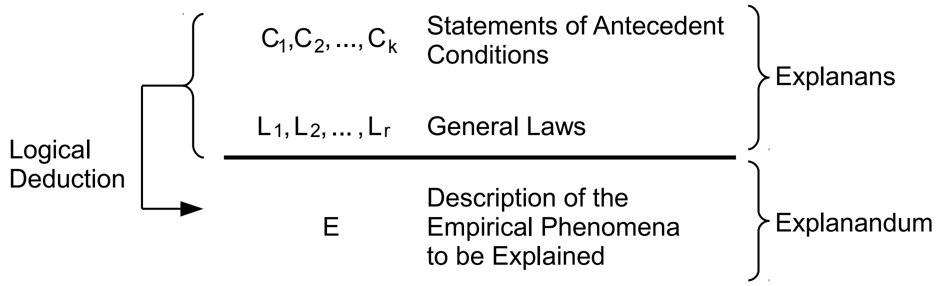


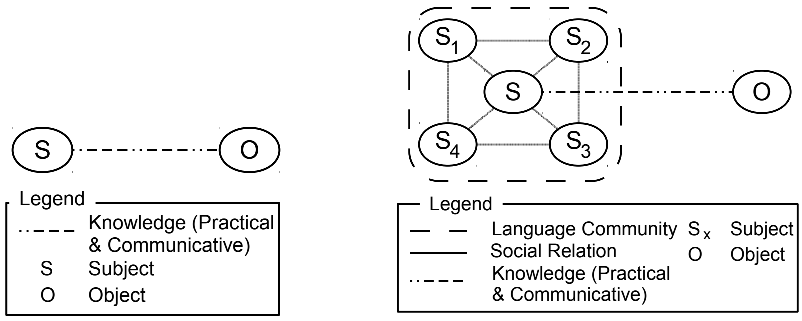
Figure 7.1: Hempel-Oppenheim Schema, source: Hempel and Oppenheim (1948, p. 138)

or theories (general laws) 'imposed upon the world' and existing natural kinds (conditions and phenomena) that can be observed in the mind-independent reality and thereby provide the empirical basis for testing the former's correspondence with reality. The postpositivist understanding of this testing is that of 'falsifiability' (Popper [1935] 2002, chap. 4). Falsificationism is essentially a response to the 'problem of induction' (cf. Hume [1888] 1965, pp. 86-94; Popper [1935] 2002, pp. 3–7), which rendered the concept of 'absolute truth' as assumed in verificationism and essentialism questionable (cf. Sayer 1992, p. 156). The plausibility of the former is based on the following asymmetry: whereas the number of observations captured by a general law is potentially infinite, suggesting that no finite number of successful observations can indicate the absolute truth of the tested general law (the latter's problem), falsification can claim that a single falsifying observation provides a sufficient argument for completely abandoning or at least reducing the scope of the tested 'imposed regularity'. Hence, it is suggested that researchers make 'bold' predictions[99], ideally deductively derived from existing theories, and try to falsify those predictions through empirical tests. Failure of falsification corroborates the theory, which becomes more truth-like. In other words, the absolute conception of truth is replaced by the concept of 'verisimilitude'[100] (see also Popper [1935] 2002, pp. 281-282; 1962, pp. 233–234), the currently dominating version of the correspondence theory of truth in postpositivism. This, however, suggests that scientific inquiry cannot be completely independent of the language community: theoretical propositions are fallible descriptions of reality that are created in the social realm and put forward to be tested against the mind-independent reality (Fischer 1998, p. 133). In sum, the main goal of the research in this perspective is to discover and adequately describe, based on the only authoritative source of knowledge, i.e., empirical observations, the mind-independent reality from behind a one-way mirror (cf. Chua 1986, p. 606; Guba and Lincoln 1994, p. 107). This view of science is schematically depicted figure 7.2a and 7.2b. Whereas the figure on the left represents the abandoned position of theory-independent observations, the figure on the right side recognizes the theory-dependence of observation.

Although this approach has been quite successful in natural science, the 'unity of the scientific method' suggests that social contexts can be investigated along the lines of natural or physical reality, implying that social and physical reality are constituted in a similar way. This

99. In short, this so-called Popper-Criterion can, following from the 'degrees of testability' (Popper [1935] 2002, pp. 95–120), be described as follows: the more a prediction or theory excludes (i.e., the more precise its content), the bolder the prediction or theory, because the greater the chance that the prediction or theory can be refuted (cf. Popper 1962, pp. 256–257).

100. Note that this is different from the probability of stochastic propositions, verisimilitude refers to the probability that the proposition is true (cf. Chmielewicz 1994, pp. 95-96; Popper 1962, pp. 228–237). Correspondingly, stochastic propositions have an amplified probability.



(a) Subject-Object Relation in Positivism (b) Subject-Object Relation in Postpositivism

Figure 7.2: Subject-Object Relation in (Post-)Positivism, source: Sayer (1992, pp. 24–25)

assumption that has been heavily criticized (cf. Berger and Luckmann 1966, p. 70; Guba and Lincoln, 1989, pp. 58–67; 1994, pp. 106–107). Figure 7.2b accounts for this by not making any distinction between natural objects and social subjects, i.e., social reality is objectified or reified (cf. Berger and Luckmann 1966, pp. 106–109) and human beings are reduced to objects exhibiting a particular behavior. The rationale is based on the distinction of social action and behavior—the former understood as behavior plus meaning—proposed by Weber (1922, p. 503). If (post-)positivism reduces valid scientific knowledge to those propositions that are empirically testable, then only the observation of behavior qualifies as scientific. The ontological assumption in regard to social reality and, following from the former, the focus on behavior are the anchor points for the criticism of constructivists discussed in the next section. However, before diving into the details of this stance, the remainder of this section elaborates on the epistemological assumptions of postpostivist research[101], especially their implications in regard to the shortcomings of the conventional conceptualizations of DSRIS and C&E ISR put forward in sections 5.2 and 5.3 respectively.

Falsificationism has been criticized for, among others, the following reasons (cf. Bhaskar 1998b, pp. 136–146; 2008, chap. 9; Bunge 1966, pp. 334–336; Chmielewicz 1994, pp. 159–161; Danermark et al. 2002, pp. 20–21; Duhem [1954] 1998; Feyerabend [1975] 1993, chap. 8–14; Guba and Lincoln, 1989, pp. 64–66; Kuhn 1996, pp. 146–148; Lakatos 1970; Quine 1979; Robson 2002, p. 22; Sayer 1992, p. 17): (i) it becomes self-contradictory by suggesting normative judgments that should actually be excluded, (ii) it presuppose a continuity of underlying facts, (iii) theory-dependent observations, following from the Duhem-Quine thesis, are underdetermined, and (iv) observations are not observations of a neutral observer, but observations of the success or failure of a transformative intervention carried out by the 'observer'. Each of these aspects is briefly discussed in turn.

The first of these criticisms (i) refers to the ability of falsification to function as a technique that demarcates between empirical facts and non-empirical, value-laden propositions. This distinction is a prerequisite for the postulate of the 'freedom from value judgments' (cf. Weber 1922, pp. 146–214), i.e., the demand that propositions are confined to the realm of testable propositions (Chmielewicz 1994, p. 293). This principle is often criticized for being self-contradictory, because it is a value-judgment itself; for example, it is argued (see also Guba and Lincoln, 1989, pp. 64–66):

101. At least since the speech of Hempel the enterprise of positivism, more specifically of its successor the logical positivism or neopositivism is considered to have failed (Hempel 1977). Therefore, the following will focus on postpositivism as a contrasting thesis to constructivism and critical realism.

> “Yet science [. . .] requires rules governing what is proper and improper conduct; without *ethical* principles [. . .] science could not exist. In other words, scientific knowledge presupposes among its very foundations a kind of knowledge which ‘scientism’ has sought to deny, excluded or derogated [. . .] [emphasis in the original]”(Sayer 1992, p. 17).

However, this contradiction can be resolved, distinguishing four levels of value judgments (Chmielewicz 1994, pp. 281–294): ‘meta-scientific value judgments’, value judgments in the context of justification, value judgments in the context of discovery, and value judgments in the subject matter. Whereas the value-freedom postulate is positioned in the meta-scientific level, its content refers to the context of justification. Correspondingly, falsification might still be a useful demarcation criterion and the value-freedom postulate cannot be criticized on *this* account (cf. pp. 211, 296–297). However, the distinction of four levels of value judgments indicates that value judgments in the context of discovery are not excluded by the value-freedom postulate. Therefore, the suggestion to extend the context of discovery in the traditional conceptualization of the build-evaluate loop by criticism (see sections 5.2 and 5.3) is generally compatible with the value-freedom postulate. This, in turn, provides the pivotal element for ‘finishing the project of modernity’ by cracking the wall between the objective and the social world, that is, between cognitive-instrumental and moral-practical rationality (see section 6.1 and footnote 79).

The second aspect (ii) refers to the assumed asymmetry between verification and falsification (see also P. Binns 1978; Rapp 1975): the claim that a single observation can falsify the theory from which the tested proposition was derived has to presuppose either that underlying facts do not change (cf. Chmielewicz 1994, p. 99) or it is prone to the problem of induction (cf. Sayer 1992, pp. 170–174). As the latter was the very problem that lead to its development, the former seems to be more plausible. However, as DSRIS is specifically concerned with change (cf. Iivari 2007, p. 53; 2010, pp. 45, 57; Purao, Rossi, and Sein 2010, p. 179; Sein, Rossi, and Purao 2007, p. 106), it is questionable which function an evaluation of instantiated artifacts based on empirical-quantitative methods, underpinned by postpositivism, has. In fact, it is argued that postpositivism “can neither account for nor serve as a guide for fundamental social change” (Comstock 1982, p. 373). Correspondingly, even if it was argued that the evaluation of the instantiated artifact serves as justification of non-shared assumptions in the artifact, something which has already been discussed in section 5.2, the very act of instantiating the artifact in a practical setting for the evaluation violates one of the fundamental presuppositions of postpositivism. Furthermore, assuming, as postpositivism does, that social reality is governed by social laws (cf. Orlikowski and Baroudi 1991, p. 9; Guba and Lincoln, 1989, p. 85) entails a grain of determinism[102]. This forces postpositivism to see human beings “not [. . .] as active makers of their social reality. The object is not simultaneously the subject. Instead, people are analyzed as entities that may be passively described in objective ways [. . .]” (Chua 1986, p. 606). This neglect of free will, a form of

102. Determinism of social reality, in turn, is closely related to the philosophical discussions of free will and moral responsibility, which is often framed in the compatibilism vs. incompatibilism debate (see McKenna 2009, for a detailed elaboration): whereas the latter assumes that determinism and free will are incompatible, the former assumes that a limited version of ‘free will’ and determinism are compatible. (Post-)Positivism either has to reject, a highly contestable assumption, a notion of free will, treating human beings not different from any other object, or it has to associate itself with the former category. In fact, Hume and Hobbes, two of the leading figures, do not reject a limited version of ‘free will’. For example, Hobbes, although seeing humans merely as ‘machines’ (Hobbes [1651] 1909, p. 1), grants them some limited sort of ‘free will’: “*Free-will* [. . .] consisteth in this, that he finds no stop, in doing what he [or she] has the will, desire, or inclination to doe [emphasis in the original]” (p. 108). Free will in this account refers to pursuing the determined way in an unrestricted way. Nevertheless, human beings are seen as objects (see figures 7.2a and 7.2b).

‘agency robbing’, raised ample criticism:

> “From the perspective of agency, the implications of [post-]positivism are as follows. If facts are given, that is, objective in the culture-neutral sense, then knowledge is a passive function of mirroring them. They are there, inevitably and ineluctably, one is faced with their fatality, and nothing can be done to alter them. It is the same with the laws seemingly grounded on those facts—one is faced with their implacability. Since these laws, like the facts underlying them, are discovered, it follows that they are free of contamination by the private interest of the discoverers and their adherents. The ground is thus prepared for domination sponsored by the state, the party, religious organizations, teachers, or even the local-level planner, all of whom are simply complying with facts and the natural laws of history. People’s preferences and their cultures come to be seen as resistance. Most conventional development work has been of this genre, as were the Bolshevik revolution of 1917 in Russia and the communist revolution of 1949 in China. Agency, the capacity of a people to order their world, has been the common victim” (Bhattacharyya 1995, p. 62).

This, however, raises questions about the underpinning of design science research (DSR) as outlined in section 5.2: if the build process is essentially a creative endeavor based on the intuition and agency of the researcher to change existing contexts, then this tends to be in conflict with the presuppositions that underpin the evaluation phase—at least when using empirical-quantitative evaluation techniques and basing DSR on a (post-)positivist stance as suggested by, for example, Iivari (2007, pp. 53–54).

The third concern (iii), one of the consequences—another one is discussed later—following from the Duhem-Quine thesis (cf. Duhem [1954] 1998; Quine 1979), which is called the ‘holism underdetermination’ (see Stanford 2009, chap. 2), also has serious implications for falsification. The key issue is that it is not possible to perform an empirical test of a prediction derived from a theory in isolation; rather, an empirical test inevitably employs auxiliary hypotheses, which could be blamed for the test’s failure (cf. Bunge 1966, pp. 334–336; Chmielewicz 1994, pp. 159–161). IS, as defined in section 5.1, suggest that information and communication technology (ICT) applications are embedded in a socio-historical context. Correspondingly, the failure of an instantiated artifact to achieve efficiency gains might be attributable to social system aspects such as users resistance, lack of executive support, etc. (e.g., Bostrom and Heinen 1977a, pp. 27–28; Doherty, Ashurst, and Peppard 2012, pp. 11–12; Goldfinch 2007, p. 919), which are, as ceteris paribus clauses, expected to be constant when evaluating ICT applications—an issue closely related to the next criticism.

The fourth concern (iv) is that it is generally assumed that empirical tests are mere ‘observations’. This, however, is seldom true as the insights gained in postpositivism’s role model discipline physics (e.g., see Einstein 1905; Heisenberg 1927, and footnote 94) demonstrate. Instead of being independent observations, empirical tests in natural sciences are transformative interventions in the object of study (Sayer 1992, p. 18, 25). Thus, experiments are better seen as an indicator of the experimenter’s ability to control for various influences (Danermark et al. 2002, pp. 20–21). In other words, experiments in natural science are necessary, because

> “*the pattern of events forthcoming under experimental conditions would not be forthcoming without it*. Thus in an experiment we are a causal agent of the sequence of events, but not of the causal law which the sequence of events, because it has been produced under experimental conditions, enables us to identify [emphasis added]” (Bhaskar 2008, p. 23).

Besides two aspects that are discussed later in this chapter[103], the shift of perspective from passive observations to active control of influences allows to draw the following conclusions (Danermark et al. 2002, p. 53; Guba and Lincoln, 1989, p. 98; Sayer 1992, pp. 130–138): it is not only unreasonable to label experimental results as independent observations, but, in combination with the afore-mentioned various—possibly unknown und unrelated—influences that could make the observation a falsifying or corroborating observation, this questions postpositivism's applicability in social contexts in general, because the ability to control influences in social settings is rather limited (cf. Bhaskar 1978, p. 19; 2008, chap. 2; Chmielewicz 1994, pp. 114–118; Danermark et al. 2002, p. 53, 68; Gorton 2006, pp. 64–58; Sayer 1992, p. 123):

> "Apart from weighty ethical objections to social experiments, social agents — people — unlike natural science objects, are conscious, intentional, reflective and self-changing; we learn by being manipulated, and consciously or subconsciously we change our actions as a reaction to the experimental setting. It is simply not possible to create a social setting where one can isolate certain mechanisms and check that no other mechanisms are involved in course of the events" (Danermark et al. 2002, p. 43).

Although the limitations to social science experiments, including an alternative approach, are discussed more thoroughly in section 7.3, they are the reason why postpositivism has struggled to achieve results in social contexts that are comparable to those of the natural sciences. These 'failures' fueled the development of different underpinnings such as constructivism, which is the subject of the next section.

7.2 Constructivism as 'Antithesis'

Using the 'dialectic movement' as a stylistic device to explicate the present inquiry's underpinning, suggests to posit constructivism as the direct opposite of (post-)positivism. It has to be noted, as indicated above, that the following presentation of constructivism is not intended to create a watertight typology of the diversified stances summarized under the umbrella of constructivism (see Mitev 2005; Sismondo 1993, for an IS-related and a general overview respectively). Rather, the goal of the following is (a) to explicate the other end of the spectrum to situate critical realism more clearly in the range of possible philosophical underpinnings and (b) to substantiate the criticism put forward against the tendency to equalize C&E research, in general and in IS in particular, with 'interpretive research with a critical intent'[104] (see section 5.3).

In regard to (a), the preceding section already stated that the two central aspects of (post-)positivism, which nourished the development of anti-positivism, are the objectification or reification of social reality and, following from the former, the behavioral focus, that is, the neglect of meaning that distinguishes meaningless physical behavior from action (cf. Sayer 1992, p. 121; Weber 1922, p. 503):

> "The difference between the social and natural is that the latter does not constitute itself as 'meaningful': the meanings it has are produced by

103. This is, on the one side, the ontological distinction between events and causal laws (see section 7.3), and on the other side, the ability to control causes or initial conditions in the Hempel-Oppenheim schema depicted in figure 7.1 as a prerequisite to make technological predictions (cf. Bunge 1966, p. 338, 343; [1967] 1998, pp. 157–164; Chua 1986, p. 608, and section 8.1).

104. As indicated in section 5.3, interpretive research is generally underpinned by the ontological and epistemological assumptions of social constructivism (cf. Creswell 2007, pp. 20–21).

men in the course of their practical life, and as a consequence of their endeavours to understand or explain it for themselves. Social life—of which these endeavours are part—on the other hand, is produced by its component actors precisely in terms of their active constitution and reconstitution of frames of meaning whereby they organize their experience" (Giddens 1993, pp. 85–86).

One of these anti-positivist positions is the radical social constructivism (hereafter: constructivism) advocated by Guba and Lincoln (cf. Guba and Lincoln, 1989, 1994, 2005; Lincoln and Guba 2000, 2013). The rationale to focus on this stance as the 'antithesis' is twofold: one the one side, it is a rather extreme position on the spectrum, and on the other side, it is explicitly developed in contrast to (post-)positivism. The latter point, forming the juncture for the following, manifests itself in, inter alia, the following three issues (cf. Guba and Lincoln, 1989, pp. 62–67; 1994, pp. 106–107): (i) the theory-dependence of facts and the underdetermination of theory, (ii) the interactive nature of the knower-known dyad, and (iii) the value-ladenness of facts. An elaboration of these points allows to reconstruct the ontological and epistemological assumptions of social constructivism, i.e., the realization of aim (a).

The first issue (i) refers to fact that pure or independent observations are impossible and, by implication, can only be made from within a language community. Although postpositivists readily acknowledge this, it has serious implications for their research endeavor. One of these consequences was already indicated in the preceding section. There is, however, another problem following from the Duhem-Quine thesis (cf. Duhem [1954] 1998; Quine 1979), i.e., the problem of 'contrastive underdetermination' (cf. Stanford 2009, chap. 3). The key aspect of this form of underdetermination, similar to but reversing the holism underdetermination, is that successful empirical tests corroborate not only one but multiple theories. Guba and Lincoln (1989, p. 64) therefore deny that postpositivism has the ability to establish constantly improving or increasingly 'real' descriptions of reality. To admit and honor these various constructions, they assume a relativist, mind-dependent social reality (cf. Guba and Lincoln, 1989, p. 64; Lincoln and Guba 2013, p. 46). In other words, the single mind-independent social reality of realism is substituted by a non-transcendental (or non-existing[105]) social reality "devised by individuals as they attempt to make sense of their experiences" (Guba and Lincoln, 1989, p. 86). This flip of postpositivism's ontological assumption has fundamental epistemological implications[106] (see also Cecez-Kecmanovic 2005, p. 28; Lincoln and Guba 2013, pp. 47–55):

> "Realities are apprehensible in the form of multiple, intangible mental constructions, socially and experientially based, local and specific in nature (although elements are often shared among many individuals and even across cultures), and dependent for their form and content on the individual person or group holding the constructions" (Guba and Lincoln 1994, pp. 110–111).

105. It is important to note that this discussion refers to social reality, not to physical reality (cf. Lincoln and Guba 2013, p. 46). However, even most constructivists accept that there is 'something' to social reality but insist that it is inaccessible (cf. Mitev 2005, p. 71). Lincoln and Guba, however, state that "[t]here is no compelling reason to believe, a priori, that this surround [the world] has any existence apart from the individuals who encounter it, that is, to believe it to be objectively independent of the sense mechanisms of the individuals who experience it" (Lincoln and Guba 2013, p. 44). This substantiates the above claim that this is a rather extreme position. Nevertheless, it has to be noted that this difference between constructivists actually does not matter, because, as the following illustrates, inaccessibility has the same consequences as non-existence.

106. In the 2005 version of their framework they reaffirm the content of their earlier work (1994/2000), but extend it by an axiological dimension. This newly added, primary focus of their latter discussion is mainly a response to account for the raise of the 'participatory paradigm' (cf. Guba and Lincoln 2005, p. 197).

To fully expand the position of Guba and Lincoln in this respect it is necessary to anticipate an element of the 'interactive nature of the knower-known dyad' [issue (ii)]. This aspect, using the terminology of Guba and Lincoln (1989, p. 67), is that constructions are "*literally*–we [Guba and Lincoln] stress *literally–created* [emphasis in the original]" by individuals themselves or in interactions between them (see also Guba and Lincoln 1994, p. 111; Lincoln and Guba 2013, pp. 47–55). The emphasis of 'created', in combination with their reference to the Duhem-Quine thesis, implies that a construction could have been 'created' differently in other socio-historical constellations, i.e., constructions are not inevitably determined by 'reality'—if the latter even exists. This is the strong reading of the first thesis of constructivism proposed by Hacking, an assumption shared by all, even less extreme, constructivists:

> "X need not have existed, or need not be at all as it is. X, or X as it is at present, is not determined by the nature of things; it is not inevitable" (Hacking 1999, p. 6).

Although it is pointed out that Hacking's (1999) first thesis could not demarcate social constructions and accidental events, and therefore has to be refined to the intentionality of a free agent with an option to create things differently (cf. Kukla 2000, pp. 2–3), this refinement does not change the perspective they take: there is no distinction between ontology and epistemology (Guba and Lincoln, 1989, p. 84; 1994, p. 111)[107]. This strong claim adds a 'semantic constructivism' (cf. Kukla 2000, p. 6) on top of their relativism. In this perspective not only the realist assumption of a mind-independent social 'reality' is rejected, it is further assumed that everything is a matter of consensus and, by implication, an epistemological question:

> "[Constructivists' interpretations] are constructed from the standpoint of the individual actor as opposed to the observer of action; they view social reality as an emergent process — as an extension of human consciousness and subjective experience. Insofar as a wider social environment is accorded ontological status, it is regarded as the creation and extension of the subjective experience of the individuals involved" (Burrell and Morgan 1979, p. 253).

In other words, the ontological assumption of constructivism can be summarized as follows: a mind-independent social reality is not accessible (or does not exist); instead, there are multiple realities, each of which is a mind-dependent, intellectual construction to which the constructing individual has privileged access (see also Chua 1986, p. 615; Guba and Lincoln 1994, p. 111; Orlikowski and Baroudi 1991, p. 14; Robson 2002, pp. 22–23). From this perspective postpositivism is seen as one attempt to reconstruct a social reality, which, however, is unable to

> "deal with each of these [multiple constructions] in *its own right* but [tries] to discover which construction (perspective) comes closest to reality, that is, which is the 'best' construction [emphasis in the original]"(Guba and Lincoln, 1989, p. 58).

This view, by implication, denies that language has a material dimension (Collins 1981, p. 3; Kukla 2000, p. 6), i.e., that linguistic constructs can have a referent (cf. Sayer 1992,

107. Note that this is the reverse of the positive conflation of ontology and epistemology mentioned in the preceding section. Whereas positivism reduces everything to ontology (epistemological monism), postpostivisim with its distinction between reality and our knowledge about it adapts a epistemological dualism, constructivism as presented here, adapting epistemological pluralism reduces everything to epistemology.

pp. 59–60, 221–225; 2000, chap. 2). This is, for example, illustrated by their (Guba and Lincoln 2005, p. 203) explicit reference to Saussure, who distinguishes the signified and the signifier (cf. Saussure 1959, p. 67), whereas Peirce (1932, p. 2228), in contrast, proposes an irreducible triadic relationship between representamen, object, and interpretant. Without going into the details of these semiotic theories, the presently relevant difference is the non-existence of a referent or 'real' objects of social reality in the former account (see also Sayer 1992, chap. 2; 2000, pp. 18, 92–93). Correspondingly, the constructivism of Guba and Lincoln is essentially concerned with language, further illustrated by their emphasis of sense- or meaning-making as vital act of construction (cf. Guba and Lincoln 2005, pp. 197, 202):

> "Sense-making is an effort by human beings, utilizing the constructive character of the mind and *limited only by the imagination*, to deal with confusion by means of a *semiotic organization*—an assemblage of signs and symbols, not only verbal but including many different forms of representation—that attaches meanings to 'realized' elements (elements made real?) selectively abstracted from the otherwise confounded surround [emphasis added]" (Lincoln and Guba 2013, p. 45).

This quote illustrates two important facets of their account: whereas the emphasized part (in-)directly neglects a 'material' social reality, the quote in general grants a central place to the communication medium language. In line with semantic constructivism it is assumed that language describes and *constitutes* social practices (cf. Orlikowski and Baroudi 1991, p. 14), i.e., that social practices are not different from 'language games' (cf. Wittgenstein 1958, §23). This has vital implications for the relationship between the researcher and the subject of research as well as for the conception of truth. Both these epistemological aspects will be discussed in the following.

The former refers to the 'interactive nature of the knower-known dyad' [issue (ii)], which Guba and Lincoln (1989, pp. 66–67) discuss, mixing in some aspects of the 'freedom from value judgments' postulate (cf. Weber 1922, pp. 146–214) and theory-dependency issues (see section 7.1), in terms of the 'absurd subject-object duality' in postpositivist research. Their matter of interest can be, less polemically, restated as follows: the scientific method is inadequate for social sciences (i.e., the rejection of the 'unity of the scientific method'), because people (a) are active agents and not passive objects and (b) attach meaning to their actions (cf. Guba and Lincoln 2005, p. 205; Robson 2002, p. 24, and the preceding section). In other words, postpositivism is criticized, inter alia, for perceiving human beings, for example at length argued by Hobbes ([1651] 1909, chap. 1), as 'deterministic machines' (see also Chua 1986, p. 606; Guba and Lincoln, 1989, p. 94; 1994, p. 113; Orlikowski and Baroudi 1991, p. 12; Robson 2002, p. 23, and section 7.1), which neglects important differences between natural science objects and social science subjects:

> "[Natural (science) objects] are inherently indifferent and uninterested in relation to the world in which they exist, including the doings of the researcher. Natural objects do not give existence itself, and the natural world of which they are part, any meaning or significance; they have not special intentions for their existence, they do not put forward ideas and do not form any concepts competing with those of the researcher. Neither do they react on the formation of knowledge; they are passive and unaltered in relation to the definitions and conceptualizations of the researcher—they are and remain what they are" (Danermark et al. 2002, p. 32).

Instead, constructivists argue that to understand and describe the inevitably intentional actions of human beings researchers have to extract the meaning individuals attributed to their actions from the actor's subjective or 'inner world' (cf. Burrell and Morgan 1979, p. 253; Chua 1986, p. 613; Guba and Lincoln 1994, p. 106; Orlikowski and Baroudi 1991, p. 5), a world to which the individual has privileged access (cf. Habermas [1981] 1987a, pp. 135–141, and footnote 79). As "[m]eaning has to be understood, [i.e.,] it cannot be measured or counted [. . .]" (Sayer 2000, p. 17), constructivism has to employ a hermeneutical method (Sayer 1992, p. 35). A constructivist who tries to acquire knowledge about a constructed reality cannot do this independently of a subject of investigation, the researcher and the researched have to cooperate to reconstruct the researched's construction of reality (Guba and Lincoln, 1989, pp. 88–89; 1994, p. 111; 2005, pp. 201–202; Robson 2002, p. 27). This 'transactional epistemology' (Denzin and Lincoln 2005, p. 184) is schematically depicted in figure 7.3[108]. An important difference between constructivism and postpositivism can be illustrated by comparing figures 7.3 and 7.2b: whereas the latter involves one hermeneutical circle, i.e., researchers interpret objective results within their language community, the former can, although not shown in figure 7.3, involve more than one language community. On the one side, the subjects of research construct social reality, and on the other side, the researcher is reconstructing the construction of the researched. This is what Giddens (1984, pp. 284–285) terms the 'double hermeneutic', i.e., the interpretation and translation between first-order and second-order concepts (see also Danermark et al. 2002, pp. 32–33; Sayer 1992, pp. 35–39).

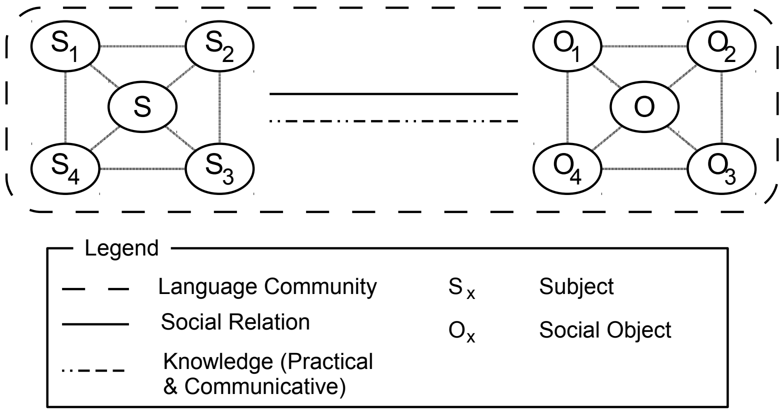


Figure 7.3: Subject-'Object' Relation in Constructivism, source: Sayer (1992, p. 27)

As interpretations are merely a reconstructed explanation of the meaning the subjects of research attribute to their actions, they cannot be presented as being 'true' in the positive sense. In contrast, the 'validity' of constructions, suggested by the underlying consensus theory of truth, is determined by the agreement or disagreement of the researched (cf. Chua 1986, p. 164; Guba and Lincoln 2005, p. 204; Lincoln and Guba 2013, pp. 68–69; Robson 2002, p. 26). Scientifically valid knowledge, in this view, is constituted by those reconstructed interpretations about which consensus emerges (cf. Guba and Lincoln, 1989, pp. 86–87; 1994, pp. 113–114). This process entails the contrasting of different constructions

108. Note that the researcher and the subjects of research not necessarily belong to the same language community, e.g., etnographers tend to study cultures or communities belonging to a different community. However, the 'relexive' form of social science inquiry, i.e., studying social phenomena within the same language community seems to be more common. This is particularly true for an international phenomenon such as IS. As Sayer (2000, p. 18) points out, such a reflexive investigation has the additional advantage that researchers already have (fallible) access to the concepts shared in the language community (see also Bhaskar 1978, pp. 23–24).

in a discourse and, by virtue of the juxtaposition, a refinement or adaptation in response to occurring discrepancies. This, in turn, does not suggest that interpretations get 'truer'; rather, the still fallible constructions become more informed and sophisticated (cf. Guba and Lincoln, 1989, p. 87; Lincoln and Guba 2013, p. 49). In other words, knowledge accumulation happens by contrasting and adapting constructions, a process that results, when constituting scientific progress, in increased understanding (Guba and Lincoln, 1989, p. 107).

Although the following is merely a methodological aspect of constructivism, it allows to explicate the rationale behind the claims of 'challenging social science experiments' issued in the preceding section more clearly: the consensus building process between researchers and researched is actually not confined to scientific inquiries, but occurs in all everyday encounters in the lifeworld. In fact, the lifeworld receives its background status because of the reciprocal interpretation of meaningful action that individuals perform in their ongoing social interactions. In this process the worldviews of individuals are constantly confronted with and informed by the worldviews of others, resulting in more and more sophisticated worldviews (Guba and Lincoln 1994, p. 114). Guba and Lincoln (1994, pp. 110–111) state that through this process meanings can be "shared among many individuals and even across cultures". The presently relevant consequence of this view is that, contrary to postpositivism, it is recognized that individuals can change intrinsically (cf. Danermark et al. 2002, p. 68)—otherwise the adaptation of worldviews would be impossible. This is the reason why constructivists' inquiries are indetermined, flexible, and unfolding (Guba and Lincoln, 1989, pp. 99–100), but also why social science experiments are challenging: the 'objects' are constantly changing (see also section 7.3). This renders the postpositivistic search for 'social laws' pointless (see also Sayer 1992, pp. 100–103). Guba and Lincoln (1989, p. 86) acknowledge that one might find some 'lawlike attributions' in reconstructed interpretations, but these are merely useful beliefs: "If there is no objective [mind-independent] reality then there are no natural laws, and cause-effect attributions are simply that—mental imputations". Instead of searching for cause-effect relationships, constructive research is underpinned by the causality substitute 'mutual simultaneous shaping', which Guba and Lincoln describe as follows:

> "• All elements in a situation are in mutual and continual interaction.
> • Each element is activated in its own way by virtue of the particular configuration of all other elements–potential shapers–that is assumed at that time and in that place.
> • Judgments about which the potential shapers may most plausibly be implicated in explaining and/or managing whatever it is that the investigator wishes to explain or manage is a matter both of circumstances that exist *and* of the investigator's purpose; the investigator asks him- or herself, 'What is most plausible to invoke given that purpose?'
> • The peculiar web or pattern of circumstances that characterizes a given situation may never occur in just that way again, so that explanations and management actions are in a real sense unique and cannot be understood as implying either predictability or control.
> • Explanations are at best 'here-and-now' accounts that represent a 'photographic slices of life' of a dynamic process that, in the next instant, might present a very different aspect [emphasis in the original]" (pp. 97–98).

In sum, an inquiry underpinned by constructivism, i.e., interpretive research (cf. Creswell 2007, pp. 20–21), has a substantially different aim from empirical-quantitative or behavioral inquiries underpinned by postpositivism:

> "Interpretive science does not seek to control empirical phenomena; it has no technical application. Instead, the aim of the interpretive scientist is to enrich people's understanding of the meanings of their actions, thus increasing the possibility of mutual communication and influence" (Chua 1986, p. 615).

Before presenting critical realism as an intermediary stance in the tripartite framing of this chapter, the foregoing discussion should be used to substantiate the claims put forward against C&E ISR in section 5.3, that is, to realize the second aim of this section (b). Within section 5.3 four shortcomings of confining C&E studies to interpretive research with a critical intent, all derived from the ontological and epistemological assumptions of constructivism, were identified as relevant to the present inquiry: it was argued that (i) C&E ISR is limited to ideological criticism, (ii) the inherited 'judgmental relativism' allows to defend all types of ideologies, (iii) the 'call for action' or practical projects is overrestrictive and not free from dangers, and (iv) the neglect of social structures is counterproductive for realizing the goals of critical social theory.

In regard to (i), in contrast to postpositivism, which assumes an objective, that is, mind-independent social reality, constructivism rejects that social reality is accessible or exists and assumes instead that it is a linguistic construction of individuals. Furthermore, these constructions are shared in a language community through the means of discourses in which different worldviews are contrasted and adapted, but the "[*o*]*bjects* of discourse do not exist. The entities discourse refers to are constituted in it and by it [emphasis in the original]" (Hindess and Hirst 1977, p. 20). Correspondingly, and this closely relates to the other issues (ii–iv), social reality, constituted within and not existing beyond discourses, can be changed only within discourses:

> "The most powerful leverage to change an existing construction is obtained by challenging its constructor with difficulties, conflicts, and/or ambiguities that can no longer be reconciled with that construction. Lack of certainty leads to reconstruction" (Lincoln and Guba 2013, p. 74).

Although this indicates that interpretive research goes beyond merely understanding constructions, because the reference to change and discourse indicates that understanding and agreement have to be distinguished (cf. Sayer 1992, pp. 37–38, and the above description of scientific progress), the underlying assumptions raise a difficult question in respect to C&E ISR: if ICT applications, in their nature as physical objects, embody values that influence the social systems in which applications are embedded (see sections 5.3 and 5.1 respectively), how can this be reconciled with the rejection of realist's assumption that a mind-independent social reality exists? Following Hacking (1999, pp. 80–84) and Kukla (2000, pp. 3–4), it can be argued that the existing 'natural kinds' in social reality, i.e., human beings, are constructed insofar as they are aware of the concepts applied to them (cf. Danermark et al. 2002, p. 32) and that these concepts influence how they behave. This, in turn, suggests that they would behave differently if the applied concepts were different. This is the anchor point for social movements of oppressed groups[109], which, inter alia, attempt to change concepts applied to as well as used by the respective groups in order to empower individuals by strengthening their self-consciousness. Nevertheless, there are vital differences between human beings and physical objects such as ICT applications: although it tends to be possible to juxtapose and

109. Two relatively well-known examples are Beauvoir's ([1949] 1956, p. 273) one "is not born, but rather becomes, a women" or Biko's ([1978] 2005, p. 104) 'black is beautiful' that soaks in the 'back consciousness' with "you are okay as you are, begin to look upon yourself as a human being".

change individuals' interpretations of ICT applications in a discourse, this, however, does neither change the ICT application nor the embedded values. As Sayer (2000, p. 11) put it: "there is no reason to believe that the shift from the flat earth theory to a round earth theory was accompanied by a change in the shape of the earth itself". Correspondingly, confining C&E ISR to changes in linguistic constructions—no matter how important this might be—is, due to the material dimension of ICT applications, a serious castration of C&E ISR's scope.

The second shortcoming (ii), the adoption of a relativist ontology, is a response to the consequences following from the Duhem-Quine thesis. In combination with the primacy of language as well as the neglect that linguistic constructs have referents or a material dimension, the door for 'judgmental relativism' (Bhaskar 2011, p. 24) is opened up. Bhaskar (2011, p. 24) defines judgmental relativism as the doctrine that maintains that "all beliefs are equally valid, in the sense that there can be no rational grounds for preferring one to another" (see also Bhaskar 1978, p. 23; Sayer 1992, p. 59). The rationale that the above stance is prone to judgmental relativism is based on the following: if shared constructions are created in discourses, there is a different worldview for each discourse. Guba and Lincoln (1989, pp. 108–109) account for this by referring to the 'local value' of constructions; whereby local refers to the group within which the consensus about the worldview emerged. Correspondingly, there can be, and in fact are, multiple parallel existing worldviews (see chapter 2). However, by rejecting a mind-independent social reality, the linguistic concepts in which the worldview manifests itself cannot refer to anything 'real'. This, in turn, leads to situations in which external criticism against shared constructions can easily be dismissed as 'incommensurable'[110] (see also Habermas [1981] 1987a, pp. 179–196):

> "It is my [Boas] opinion that [. . .] civilization is not something absolute, but that it is relative, and that our ideas and conceptions are true only so far as our civilization goes" (Boas 1887, p. 589).

In other words, interpretations are, in principle, immune to criticism, which can easily be misused (see section 5.3, especially footnote 34):

> "This relativist view presents knowledge as divided into discrete, monolithic and mutually intangible or contradictory systems of thought. It is supposed that each system is immune to criticism from outside, for it will disallow or neutralize them by refusing critics' criteria of what constitutes knowledge. Appeals to evidence as a way of settling disputes will not work because it can be interpreted in ways which are so different as to be incommensurable. Indeed, in an inversion of naïve objectivism, theory is taken to be effectively observation-neutral. Members of different systems will only talk past one another and disagreements will always be based on mutual misunderstanding" (Sayer 1992, p. 72).

From this perspective, the claims that constructivism is 'superior'[111] to postpositivism in respect to C&E purposes and that 'it its widely acknowledged' that postpositivism is an instrument to maintain the status quo[112] or is used—probably better misused—for repressive

110. See Feyerabend ([1975] 1993, pp. 150–154) and Kuhn (1970, sect. 6) for discussions of the incommensurability of scientific theories (see also Hacking 1983, pp. 64–75; Hoyningen-Huene 2002, chap. 3, for details).

111. Sayer (1992, p. 68) reconstructs the argument of constructivists as follows: (1) foundationalism, that is, an absolute foundation of knowledge cannot be found, (2) realism cannot provide it, and (3) realism can be dismissed. He argues that the crucial point is (2), as critical realism would accept (1), but it is not reasonable to dismiss a position with proposing a superior alternative. This is similar to what Danermark et al. (2002, p. 17) labeled "the inward collapse of relativism", i.e., that is self-defeating, because relativists cannot claim truth for their statements and at the same time reject realism.

112. However, the same criticism is also put forward against constructivism. For example, Burrell and Morgan (1979, p. 254) state that "on the study of ways in which social reality is meaningfully constructed and ordered from

efforts (cf. Guba and Lincoln, 1989, p. 65) has to be taken with caution. Whereas Guba and Lincoln just state the latter claim, they derive the 'superior' claim from a critical reflection of the 'freedom from value judgment' postulate:

> "If one of the aims of responsive evaluation is to protect against exploitation while empowering and enfranchising less powerful groups, the constructivist paradigm, which openly acknowledges and seeks out political input, is vastly superior to a paradigm that denies any possibility of political input because of its putatively value-free nature" (pp. 65–66).

They attempt to support this argument by enumerating some value judgments that are inevitable in any research project (see also Lincoln and Guba 2000, p. 169):

> "Values enter an inquiry through such channels as the nature of the problem selected for study or the evaluand to be evaluated, the choice of paradigm for carrying out the inquiry [. . .], the choice of instrumentation and analysis modes, the choice of interpretation to be made and conclusions to be drawn, and the like" (Guba and Lincoln, 1989, p. 65).

As the above discussion indicates most of these value judgments are compatible with the 'freedom from value judgments' postulate, only the latter two tend to relate to the context of justification, which, according to the postulate, should be free from value judgments. Those value judgments, however, follow from the rejection of a mind-independent reality, which leads to the issues of judgmental relativism. In other words, they are the inevitable consequences of an extreme relativism, which, as the discussion in the next section explicates, is not necessary in all cases. Furthermore, it is questionable that postpositivism really 'denies' input in the other levels and that 'seeking out political input' is per se a characteristic of C&E research. Whereas the former tends to depend on the individuals carrying out the research project, the latter neglects important facets of research practice: it is comparatively difficult to get access to contexts (see Spak 2005, pp. 239–240, for a natural resource management case example), to prevent that the research project neglects some stakeholders and is captured by elites (cf. Lund and Saito-Jensen 2013), to get C&E research projects financed (cf. Cecez-Kecmanovic 2005, p. 37), and to ensure that the 'important stakeholders' do not withdraw support if they see their power position challenged. In short, it is a fine line between seeking political input—presupossing that the 'right' political input can be determined—and becoming an instrument of political technology (cf. Marcuse [1964] 1970, pp. 19–20). This, in turn, also raises serious doubts about their 'call for action' [issue (iii)].

The 'call for action' (cf. Guba and Lincoln 2005, pp. 201–202), manifesting itself in the view that inquiries, which do not result in action, are incomplete, is not as unproblematic as it might sound[113]. As already discussed in section 5.3, the present inquiry dissociates itself from this claim for normative and practical reasons. Without reiterating the arguments made before, the most serious aspect is that, in contrast to physical objects, changes to social

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the point of view of the actors directly involved [. . . , constructivists] present a perspective in which individual actors negotiate, regulate and live their lives within the context of the *status quo* [emphasis in the original]".

113. Note that C&E ISR and DSRIS have to be distinguished from action research projects (see Herr and Anderson 2005, pp. 11–23; Spjelkavik 1999, for a general overview and its relation to applied research respectively). The latter can, following Plano Clark and Creswell (2010, p. 333), be defined as "systematic procedures done by practitioners (e.g., teachers, social workers, nurses) to gather quantitative and qualitative data to improve the ways their particular professional setting operates (e.g., a school), their practice (e.g., their teaching), and their impacts on others (e.g., student learning)" (see also Herr and Anderson 2005, pp. 3–5). Correspondingly, C&E ISR and DSRIS, as understood in the present study, are different from action research inquiries, because they are carried out, often in cooperation with 'facilitators' (see section 5.2), by individuals who are part of the social system that is changed. Therefore, the wish for change is an internal process, not an externally imposed—especially not imposed from 'above' as discussed in the following.

subjects are irreversible (Sayer 1992, pp. 29, 136–137). Solely having good intentions tends to be an insufficient foundation for initiating change, especially as the course of the research, as indicated above, is unfolding and emerging (Guba and Lincoln, 1989, pp. 99–100). The high degree of interconnectedness of modern societies (cf. Guba and Lincoln, 1989, p. 97; Sayer 1997, p. 485) always entails the risk of unintended side-effects:

> "with the complex interaction that constitutes society, action ramifies, its consequences are not restricted to the specific area in which they were initially intended to center, they occur in interrelated fields explicitly ignored at the time of action" (Merton 1936, p. 903).

Even if researchers have good intentions they still fail (cf. Danermark et al. 2002, p. 18). The rationale is not, as Guba and Lincoln (2005, p. 201) claim, a belief that this would contaminate the subject of investigation; contrary, it is an issue of legitimacy and fallibility. In reference to Popper's (1967) "*The High Tide of Prophecy: Hegel, Marx, and the Aftermath*" it might also be called the danger of "False Prophets", which should not be read literally. Instead, it is an application of the precautionary principle (see section 5.5), which can be found in several applied sciences such as, for example, pharmacy. New medications have to pass several instances of testing and scrutiny, before they are tested on humans and finally put on the market. It tends highly questionable to demand that researchers go out in the field and initiate an unfolding and unforeseeable change without their proposals being scrutinized by a larger group of experts as well as by those affected. In the end, not all people affected by an imperiled social system have the opportunity to go back to an idyllic ivory tower (cf. Danermark et al. 2002, p. 18; Heusinger, forthcoming).

The final criticism (iv), that is, the neglect of social structures in C&E ISR is essentially a consequence of the rejection of a mind-independent social reality, similar to the discussion in regard to issue (i) and the neglect of values embedded in ICT applications. However, for C&E research to go beyond individual empowerment and realize its emancipatory aims (see section 5.3), the ontological assumption is inadequate, especially in respect to the C&E DSR projects envisioned in the present inquiry. Nevertheless, the reasonable criticism that constructivists put forward against postpositivism, especially the dehumanization of human beings, cannot be dismissed without falling into the 'presupposition failure'-trap. Therefore, the next section presents a philosophical stance that, by mediating between both extreme positions, provides a suitable underpinning for the present inquiry.

7.3 Critical Realism as 'Synthesis'

> "Science, despite its famous emphasis on achieving objectivity by eliminating human error, can make its claim of objectivity only because it relies on the subjective judgments of fallible human beings and social institutions to detect and correct errors made by other fallible humans and institutions."
>
> Stern (2005, p. 976)

Presenting critical realism as third and final actor in the triumvirate of philosophical underpinnings—or more precisely, as a 'synthesis'—suggests to ascribe to it a mediating characteristic. As already indicated above, there are various flavors and a comprehensive discussion is out of scope of the present inquiry. Instead, the critical realism presented in the following is advocated by Bhaskar (1998b, 2008, 2011), which is discussed in ISR by Carlsson (2007, 2009, 2010, 2012) as well as Wynn and Williams (2012). The starting point for Bhaskar's (2008, p. 47) reconstruction is the question "what must the world be like for science to be possible?". In brief, he starts his transcendental quest from the analysis of natural science experiments, the activity that made natural science so successful, in order to carve out those conditions of science—both natural and social—that are fundamental for the scientific enterprise. In the following the results, that is, the coherent set of ontological and epistemological assumptions that form critical realism, of this endeavor are presented in respect to foregoing discussion and the methodical development in the next chapter.

As the name implies, critical realism, despite the powerful arguments of constructivism (see section 7.2), assumes that a mind-independent (social) reality exists. The rationale underpinning this belief, as indicated in the above quote of Stern (2005, p. 976), is the 'fallibility of knowledge' also known as the 'little problem of induction' (see also Danermark et al. 2002, pp. 18–19; Sayer 1992, pp. 66–67, 158):

> "I [Sayer] would argue that it is the evident *fallibility* of our knowledge — the experience of getting things wrong, of having our expectations confounded, and of crashing into things – that justifies us in believing that the world exists regardless of what we happen to think about it. If, by contrast, the world itself was a product or construction of our knowledge, then our knowledge would surely be infallible, for how could we ever be mistaken about anything? [emphasis in the original]" (Sayer 2000, p. 2).

In other words, critical realism generally takes a fallible stance, whereby fallibility is neither the same as irrationality (Chua 1986, p. 606) nor a claim that all knowledge is equally fallible (Sayer 1992, pp. 67–68). Contrary, it recognizes the theory-dependency without leading to relativism (see sections 7.1 and 7.2). This mediating characteristic is based on the following distinction (cf. Bhaskar 1998b, pp. 9–14; 2008, p. xvi; Danermark et al. 2002, pp. 22–24; Outhwaite 1998, p. 282; Sayer 1992, pp. 46–49; 2000, pp. 10-11): on the one side, there is an intransitive domain (i.e., the mind-independent reality containing the elements of investigation), and on the other side, there is a transitive domain (i.e., the domain that comprises scientific theories, which represents the fallible knowledge about the intransitive domain, as well as empirical, observational, and factual statements). This distinguishing feature of critical realism is, in turn, based on the 'ontological gap' (cf. Bhaskar 1978, pp. 3–4; 1998b, pp. 11–12) between science (as social activity), its knowledge in form of theories, and the (intransitive) entities about which science produces theories. In other words and in reference to the discussion in section 7.1, it is argued that causal laws and observable events are ontologically different kinds and that this distinction is ignored by (post-)positivism in its endeavor to establish regularities. This claim, further elaborated in the following, is the pivotal element that pushes critical realism away from postpositivism more towards the center of the spectrum spanned by the two preceding sections.

As indicated above, the genesis of critical realism is based on the transfactual analysis of the conditions that make natural science and its activities possible. The anchor point for this reconstruction are two arguments in regard to experiments as central scientific activity: on the one side, experiments are only rational if there is something that can produce events (hereinafter: mechanism) and if this mechanism exists and works outside of the laboratory as well (cf. Bhaskar 1998b, p. 10; 2008, p. 23), and on the other side, experiments are only necessary because mechanisms are not directly observable; otherwise scientific activities would be exhausted with the gathering of data in a transparent world (Danermark et al. 2002, p. 20). These two arguments culminate in the insight that experiments are activities that create artificial conditions to investigate particular aspects of mechanisms in isolation (Bhaskar 1998b, p. 10; Sayer 1992, pp. 122–123). In other words, experimental activities are performed to infer the 'real being' of a mechanism by drawing conclusions from perceivable events created in artificial conditions. Consequently, experiments not only indicate that mechanisms and events are ontologically different and that mechanisms are not directly observable, but the need to set up experiments in which influences can be controlled shows the before-mentioned theory-ladenness of science (cf. Bhaskar 1978, pp. 21–22). It is only through these objects in the transitive domain, which, inter alia, capture the necessary conditions of the artificial environment in which isolated facets of mechanisms can be observed, and the scientific activity, which causes mechanisms to create observable events, that science is connected to the entities in the intransitive domain (cf. Hacking 1983, pp. 229–232; Sayer 1992, p. 143). In other words, the socially produced transitive dimension relates science to the intransitive domain (Danermark et al. 2002, pp. 23–24); it provides the lenses through which humans perceive and interact with the mind-independent reality. As will be fully explored below, the recognition of the latter activity distinguishes critical realism from postpositivism and constructivism (cf. Bhaskar 1998b, pp. 16–17) and it explains why some natural sciences are more successful than other natural as well as social sciences:

> "The precision and predictive success of some of the natural sciences has not been bought purely by the application of appropriate analytical methods but by the achievement of *physical control* over nature. The latter is not merely a by-product of the former but one of the causes of its success [emphasis in the original]" (Sayer 1992, p. 123).

Nevertheless, the ontological distinction between mechanisms and events in the intransitive domain as well as the need to set up experiments, culminate in the idea of an 'ontological depth' (cf. Bhaskar 2011, p. 40), which distinguishes the three disparate but related ontological domains summarized in table 7.1. It is through the transitive-intransitive distinction and the three domains of reality that the recognition of theory-dependency does not result in ontological relativism. It can be accepted that science as a social activity is subjected to different socio-cultural, political, and economic influences (cf. Feyerabend [1975] 1993, pp. 33–38; Kuhn 1996, pp. 176–187), without neglecting that theories are about something that can be called 'real world' (Danermark et al. 2002, p. 24). This applies to the physical world as well as to social reality.

This, however, does not mean that critical realism, similar to postpositivism, attributes the same ontological status to physical and social reality[114]. Instead, critical realists recognize the importance of communicative interaction in the creation of social reality, but, in contrast to constructivists, reject the implicit notion that it is the only form of transmitting meaning (cf. Danermark et al. 2002, pp. 27–30; Sayer 1992, pp. 17–22). The prime counter-example is a child that acquired certain skills long before it learned a language[115]. Correspondingly, the

114. The ontological assumptions of postpositivists and critical realists are related as follows: in reference to table 7.1 and the before-mentioned basic characteristics of postpositivism (see section 7.1), its 'flat ontology' closely corresponds to the critical realist's domain of the empirical—the domains of the real and actual are rejected or conflated in the empirical domain. This is what Bhaskar calls the 'epistemic fallacy', i.e., "ontological questions can always be rephrased as epistemological ones" (Bhaskar 2008, p. 35). However, exactly those two domains allow critical realists to avoid criticism constructivists put forward to rejected postpositivism, viz. (a) determinism and (b) reductionism. In anticipation of the following discussion, it can be argued that both do not apply to critical realism: the recognition of 'emergent' powers differentiates the powers of human beings from the biological, chemical, and physical powers of their constituents (a) and the appreciation that not all existing causal powers (domain of the real) are also exerted (domain of the actual), that is, the recognition of 'potentiality', leads to a non-deterministic understanding (b).

115. For example, a child knows that the feeding bottle is in the buggy and that pointing to it will make it handed

Table 7.1: The Stratification of the Critical Realist's Ontology, adapted from Bhaskar (1998b, p. 16), Bhaskar (2008, pp. 2–3), Danermark et al. (2002, pp. 20–21), Outhwaite (1998, p. 282), Sayer (2000, pp. 11–12), and Wynn and Williams (2012, p. 790)

Domain of the	Description
Real	the static representation of the intransitive domain, which comprises all existing social and physical objects, defined by their structures, causal powers (i.e., the capacity to behave in a particular way), and liabilities (i.e., the susceptibility to certain kinds of change).
Actual	the dynamic perspective of the intransitive domain, which comprises all, that is, empirically experienceable as well as non-experienceable, events caused by exercised powers.
Empirical	the domain of directly or indirectly experienceable facets of the intransitive domain, which, as a theory-laden lens, is opened up by human sensory capacities and measurement capabilities.[a]

[a] It has to be noted that conceptualizing the domain of the empirical as a sort of 'lens' (i) *does not* imply that it is fixed; rather scientific progress, both technological and knowledge-wise, continuously extends and broadens the lens and (ii) *does* imply that there are unobservable things, which according to (i) might become observable.

context of communicative action has to be distinguished from the, interrelated but yet distinct, context of work, which Sayer (1992, pp. 17–18) roughly defines as any intentional human activity performed *in* the physical world. What the 'in' emphasizes is that human beings align their actions with practices in an already interpreted world—a world existing before and independently of them (cf. Bhaskar 1998b, p. 23). This social reality comprises mechanisms, similar to, but qualitatively different from those of the physical world[116], whose working is captured in the background knowledge of the lifeworld (cf. Danermark et al. 2002, p. 33; Pawson and Tilley 1997, pp. 65–69, and chapter 2). In other words, the lifeworld in which individuals are socialized provides the mind-independent reality for social actions. Within the literature this 'material' dimension is, for example, referred to as 'historical condition':

> "Man makes his own history, but he does not make it out of the whole cloth; he does not make it out of conditions chosen by himself, but out of such as he finds close at hand. The tradition of all past generations weighs like an alp upon the brain of the living" (Marx 1919, p. 9).

Another example is the 'feel for the game' immanent to the well-known 'habitus':

> "It is this dialectic of objectivity and subjectivity that the concept of *habitus* is designed to capture and encapsulate [. . .]. The habitus, being the product of the incorporation of objective necessity, of necessity turned into virtue, produces strategies which are objectively adjusted to the objective situation even though these strategies are neither the outcome of explicit aiming at consciously pursued goals, nor the result of some mechanical determination by external causes. Social action is guided by practical sense, by what we may call a 'feel for the game' [emphasis in the original]" (Bourdieu 1988, p. 782).

Essentially, both quotes capture the same idea: individuals (a) align their actions with independently existing social structures, a culturally transmitted social reality produced by actions of other individuals, as these structures condition the range of possible actions, and

over or it knows that a sandy feeding bottle will be cleaned if given to parents (or friends looking after the kid).

116. As Danermark et al. (2002, p. 34) point out, social mechanism are less stable than natural mechanisms, however, changes require considerable time (Bhaskar 2011, pp. 78–79). This is, for example, indicated in the first two levels of economic institutions distinguished by O. E. Williamson (2000, p. 597): the embedded institutions tend to change only within 10^2 to 10^3 years and the 'rules of the game' (cf. North 1990, pp. 3–5) with 10 to 10^2 years.

(b), by aligning, reproduce these structures through their actions (cf. Archer 1995, pp. 155–161; 1998, pp. 373–376; Bhaskar 1998a, pp. 212–218; 2011, pp. 74–80; Bunge 1997, p. 448; Hustedde and Ganowicz 2013, pp. 172–176; Sayer 1992, pp. 96–97; 2000, p. 18, and section 5.5). This socialization-reproduction cycle is often complemented by further physical arrangements, which function as stabilizers of socially constructed meaning (cf. Clayton 2009, p. 485; Durkheim [1914] 1960, pp. 328–329; Sayer 1992, p. 33). Examples include: wedding bands, bangles[117], or other status symbols, which objectify social roles such as being married, or locked and enclosed spaces, which objectify the meaning of public and private. In short, critical realist accept the role of language in the construction of social reality (cf. Bhaskar 1998b, pp. 50–51), but they also realize that humans align their actions, mediated by concepts, with an inter-subjectively shared meaning, which exist independently of their subjective consciousness, and that these aligned actions reproduce those social structures (cf. Chua 1986, p. 620; Danermark et al. 2002, pp. 33–35; Sayer 1992, pp. 29–35). Therefore, it is possible to say that social reality is socially constructed and at the same time 'real' (cf. Chua 1986, p. 620; Danermark et al. 2002, p. 35).

In other words, critical realism can be viewed as avoiding the constructivist's 'error of voluntarism' as well as the postpositivist's 'error of reification' (cf. Bhaskar 1998b, p. 39) by recognizing the arguments of both stances and at the same time avoiding both extremes. The conceptualization of the relationship between the researcher and the subject(s) of research (see figure 7.4), reflects this as the synthesis of figures 7.2b and 7.3. In fact, figure 7.4 can be framed as an extension of the constructivist's conceptualization that includes 'material objects'—the postpositivist focus—as depicted underneath the language community. Although critical realism is generally a 'realist account', it does not view knowledge as a mirror of the world; rather, knowledge is seen as "a map or recipe or instruction manual, which provides means by which we can do things in the world or *cope* with events [emphasis in the original]" (Sayer 1992, p. 59).

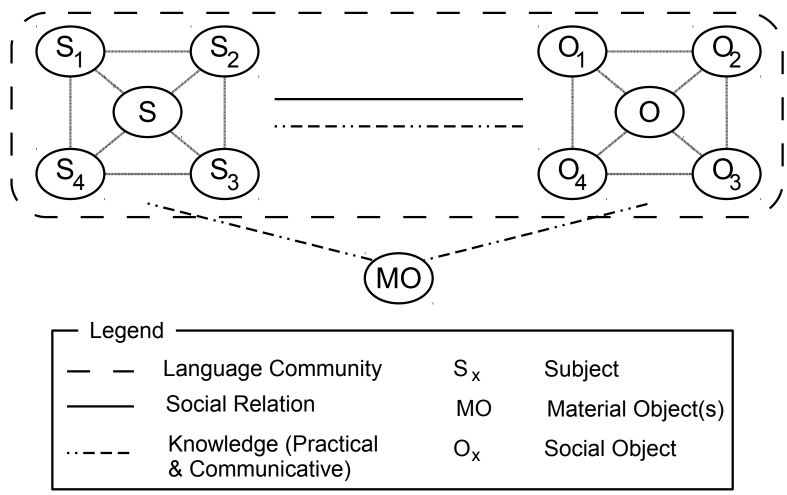

Figure 7.4: Subject-Object Relation in Critical Realism, source: Sayer (1992, p. 28)

However, to analyze the way in which critical realist endeavors, in contrast to attempts based on postpositivism, can avoid the 'social law failure' (cf. Guba and Lincoln, 1989, p.

117. Bangles are armlets worn by, for example, Indian married women. Therefore, its symbolic value is comparable to the Western wedding band.

64; Sayer 1992, pp. 92–103), the mode of knowledge production needs to be examined. In addition to explicating the epistemological assumptions, this discussion also prepares large parts of the background on which the methodical proposal of the next chapter unfolds. As indicated above, the development of critical realism originates from the analysis of experiments, which create artificial conditions to investigate aspects of a mechanism in isolation. In the terminology of Bhaskar (1998b, p. 23) this is referred to as 'closed systems', which are different from 'open systems' (see also Danermark et al. 2002, p. 66–69; Sayer 1992, pp. 121–125). The former can be distinguished from the latter through the 'ability of closure', which manifests itself in the following two conditions that need to be met in order to create closed systems (cf. Bhaskar 2008, chap. 2; Danermark et al. 2002, pp. 66–70; Sayer 1992, pp. 122–123):

External condition for closure: The relation between subjects of research and contexts in which subjects' powers are exercised to produce events must be constant, i.e., contextual forces must be controllable for events to be regular.

Internal condition for closure: The subjects of research must not be prone to qualitative change, i.e., the subjects must not become 'different' subjects by exercising experimental activities, to achieve consistent results.

These two conditions, which are relatively unproblematic in some but, as explicated more thoroughly below, not all natural sciences such as physics, provide hurdles that are impossible to overcome for social sciences: on the one side, humans beings have the ability to learn, which violates the internal condition for closure, and on the other side, social reality is in a state of flux, despite the efforts of various institutions (e.g., juridical system) to establish predictability and control (cf. Danermark et al. 2002, p. 68; Hodgson 2006, pp. 2, 18; North 1990, p. 3; Sayer 1992, p. 123; Searle 2005, p. 11), which violates the external conditions for closure[118]. In reference to the above-mentioned socialization-reproduction cycle the infringement of the external condition can be summarized as follows (cf. Sayer 1992, pp. 96–98; 2000, p. 13):

> "Since social structures require human action for their existence, the actions make up both triggering factors and effects of social structures' generative mechanisms [.... However, p]eople's actions are never determined by a certain structure; they are merely conditioned. For various reasons, people can see, choose or be forced to choose alternative actions" (Danermark et al. 2002, p. 56).

In reference to the two streams of ISR distinguished in section 5.1, these conditions allow to explicate important differences between these avenues: whereas the narrow focus of IS is

118. Although the closure of social systems is therefore impossible, certain disciplines in social science, for example, neo-classical economics are based on assumptions such as rational preferences, utility maximization, and perfect information (Weintraub 2010), which can be interpreted as artificial constraints to control for influences. Introducing such assumptions into neoclassical economics eventually lead to what Albert (1967) termed 'Model Platonism' in economics. The result and the assumptions have be heavily criticized, for example by Leontief (1982, 1983), North (1990, chap. 2–4), Ostrom (1986), Sen (2009, chap. 8), and H. A. Simon (1996, chap. 2). Ironically, all of these researchers received the Nobel Memorial Prize in Economic Sciences for their efforts (1973, 1993, 2009, 1998, and 1978 respectively; source: `http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/`, accessed May 25, 2015). For example, in respect to the analysis of institutions, more specifically rules, which were often studied in a way resembling the closed system approach, Ostrom writes (see also Ostrom 2012, pp. 139–140): There is "strong evidence for the configurational or, nonseparable, attribute of rules. This leads me [Ostrom] to argue against an implicitly held belief of some scholars that what we learn about the operation of one rule in 'isolation' from other rules will hold across all situations in which that rule is used [...]. If rules combine configurationally rather than separably, this dramatically affects the scientific strategy we should take in the study of rules and their effects" (Ostrom 1986, p. 14). In other words, she questions the reasonableness of investigating particular facets in isolation—the central activity of experiments in natural sciences—in social sciences.

able to meet the internal as well as the external condition for closure[119], the broader view, due to the incorporation of social systems and human beings, is unable to do so. Correspondingly, socio-technical endeavors have to employ different strategies[120]. The route critical realists pursue is, similar to the approach H. A. Simon (1962, p. 480) suggests to reduce complexity, divided into two parts[121]: firstly, a structural analysis, comparable to the setting up of an experiment, is carried out; secondly, a causal analysis investigates the dynamic interplay of the structural elements to explain the way in which events are produced. Both these analyses will be dealt with in turn.

The 'structural analysis' is mainly an abstraction of concrete settings (cf. Danermark et al. 2002, pp. 42–59), guided by questions such as "What does the existence of this object (in this form) presuppose? Can it exist on its own as such? If not what else must be present? What is it *about* the object that makes it do such and such? [emphasis in the original]" (Sayer 1992, p. 91). A contrast of this process of abstraction with the afore-mentioned experimental activities allows to define it as (see also Frank 2006, pp. 33–34; Lawson 1998, pp. 144–185)

> "something which is formed when we—albeit in thought—separate or isolate one particular aspect of a concrete object or phenomenon; and what we abstract from is all the other aspects possessed by concrete phenomena. Abstraction is necessary, because the domain of the actual—the events in the world—makes up such a tremendously diversified and heterogeneous dimension of reality"(Danermark et al. 2002, p. 42).

Correspondingly, abstraction isolates certain aspects of the subject of research in thought, instead of isolating them through active manipulation (Danermark et al. 2002, p. 43; Sayer 2000, p. 19). It is, however, important to note that an abstraction is always an abstraction of some concrete[122] setting (concrete $\rightarrow$ abstract) (Sayer 1992, pp. 86–87; 1998, p. 127). This process is, in contrast to the postpositivist notions of 'constant conjunction of events' or generality (see Bhaskar 1998b, pp. 139–141, and section 7.1), guided by the principle of *necessity* (cf. Bhaskar 2008, pp. 201–204; Harré and Madden 1998, pp. 104–116; Sayer 1992, pp. 160–162). In other words, abstraction is not an arbitrary process; rather, abstraction determines all the necessary and constitutive, i.e., characteristic, properties of the subject of investigation and does not divide what is necessarily related[123] (cf. Danermark et al. 2002, p. 45, 59; Sayer 1992, pp. 87, 92–98, 138–140; 2000, p. 27). The result of this process has to be understood as "an 'extract' from reality, an extract consisting of the 'fundamental part', the 'essence' or the 'core' of a phenomenon, which is as real a phenomenon as any other" (Danermark et al. 2002, p. 48). This form of essentialism proposed by critical realism has to be distinguished from what in reference to Sayer (1992, pp. 162–165) can be called a 'misaligned essentialism', i.e., the assumption that everything is necessarily related (see also

119. ICT applications are comparable to the technical devices Sayer (1992, p. 129) and Danermark et al. (2002, p. 43–44) put forward to illustrate the observability of mechanisms.

120. Within the literature there are two strategies mentioned for artificially closing complex systems: (i) it can be assumed that the characteristics of the system under investigation are time-invariant and therefore constitute regularities (cf. Sayer 1992, pp. 124–125), or (ii) theoretical efforts can be employed to circumvent or reduce the complexity (cf. Stame 2004, p. 71). Whereas (i), at least in the case of DSRIS, leads to a presupposition failure, because of the explicitly stated aim of change, (ii) is a feasible option as explored in the remainder.

121. Gorton (2006, p. 43) argues that Popper's ([1935] 2002) account of the hypo-deductive model is merely "an artifact of Popper's early philosophy". He further examines Popper's 'situational analysis/logic' (cf. Popper 1967a), which tends to be compatible with what is outlined in the following (see Gorton 2006, chap. 1, 6). However, this examination is out of scope of the present inquiry.

122. For a detailed discussion of the concrete-abstract distinction in critical realism, which differs slightly from a layman's understanding see Sayer (1992, chap. 3).

123. Sayer (1992, pp. 61–62) points out that including contingently related relations in the definition of concepts, e.g., gender or race, often leads to the naturalization of discriminating social structures (see also section 10.3).

Sayer 2000, chap. 4). The form of essentialism underpinning critical realism is a vital prerequisite of science, because rejecting some form of essence implies that causal relations cannot be distinguished from accidental sequences and that 'physical impossibility' and 'spurious correlation' are unintelligible (cf. Sayer 1992, p. 168). In other words, scientists would be unable to justify why they do not collect just any data and hypothesize about order in the data set (cf. Chmielewicz 1994, pp. 142–143). This, however, does not exclude that necessary relations can be of different qualities and cannot change over time (cf. Sayer 2000, p. 95). This is captured by the afore-mentioned contingent relationship between the objects of the transitive and the intransitive domain (i.e., fallibility of knowledge), which neither affects the relation between senses and properties nor the conventions or rules to combine concepts for meaningful discourse—although the latter might be revisable, the former is relatively stable (Sayer 1992, pp. 69, 162). This stability is an aspect that is neglected by constructivism[124] and its underpinning consensus theory of truth: not all concepts can successfully inform or are useful in practice. This is what Sayer (1992, pp. 68–70) refers to as 'practical adequacy', which must not be mistaken with 'instrumentalism'[125]. To be practically adequate knowledge must 'carve out' the structuredness of reality, manifesting itself in necessary instead of contingent[126] relations (cf. Hacking 1999, pp. 80–84)—the second move in the understanding of events (abstract $\rightarrow$ concrete). In critical realism, the structuredness of social reality is expressed in relations, because it is argued that social objects are inevitably relational objects (cf. Bhaskar 1998b, pp. 44–45; Outhwaite 1998, pp. 287–288), i.e., they are what they are because of relations they have to other objects (cf. Chua 1986, pp. 619–620; Sayer 1992, p. 90). The different types of social relations which are distinguished are depicted in figure 7.5 (see also Bhaskar 1998b, pp. 46–47; Danermark et al. 2002, pp. 45–47; Sayer 1992, pp. 88–90; 1998, pp. 127–128; 2000, pp. 16–17).

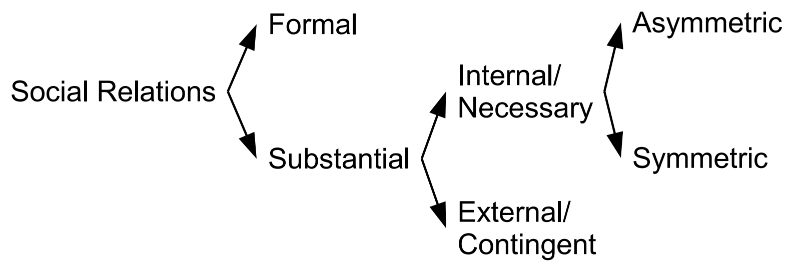

Figure 7.5: Types of Social Relations, source: Danermark et al. (2002, p. 46)

Whereas formal relations are merely shared characteristics such as gender, age, etc., substantial relations are considered to be real relations. Within the set of substantial relations, those which are internal and necessary can be distinguished from those that are contingent

124. Sayer (1992, p. 75) states that the relativism that underpins constructivism is based on a misconception with the ordering-framework of theory: it assumes (i) that there are no constraints on words and referents as well as (ii) an observation-neutral theory.

125. 'Instrumentalism' states that knowledge should be judged (only) in respect to its usefulness, similar to the perspective that can be attributed to DSRIS (see section 5.2). Sayer (1992, p. 70) heavily criticizes this view and states that "useful knowledge is only useful because it's true!". He acknowledges that the argument goes in circles, but the main point is that usefulness is not accidental but property of the 'essence' of the object of knowledge. Whereas instrumentalism is only concerned with the result, i.e., it accepts that results are achieved for the wrong reasons, practical adequacy goes beyond the outcome-focus: it demands (i) practical adequacy of the inputs to trans-contextual working hypotheses and theories, (ii) an explanation of what happens instead of focusing only on the result, and (iii) robustness of theory and explanation.

126. The term 'contingent' has, in comparison to everyday use, a slightly different meaning, which will be more thoroughly explored in the following (see also p. 89).

and external. This distinction, however, is not fixed but depends, at least partially, on the inquiry's focus and the selected unit of analysis (cf. Danermark et al. 2002, p. 46; Outhwaite 1998, pp. 291–292; Sayer 1992, p. 91). Nevertheless, the necessary-contingent distinction as well as the subdivision of necessary relations into symmetrically and asymmetrically can be defined as follows:

> "A relation R_{AB} may be defined as *internal* if and only if A would not be what it *essentially* is unless B is related to it in the why that it is. R_{AB} is *symmetrically internal* if the same also applies to B [emphasis in the original]" (Bhaskar 1998b, p. 46).

Based on these distinctions the structure of a subject of investigation can be specified as a "set of internally related objects or practices" (Sayer 1992, p. 92), which is sometimes also referred to as 'totality' (see also Chua 1986, p. 619):

> "A particular element exists only in the context of the totality of relationships of which it is part, and the element and the whole are bound by an essential rather than a contingent interdependence. This dialectic relationship between elements and the totality is understood to be shaped by historical and contextual [contingent] conditions" (Orlikowski and Baroudi 1991, p. 19).

However, within the following the term 'totality' will not be used, because it might misleadingly be interpreted as a sort of 'holism' (cf. Bunge 1997, pp. 440–441; 2004, p. 191), which differs, based on the distinction between necessary and contingent relations, from the structure as understood in the present study: the set of internally related elements comprised in a selected unit of analysis. Nevertheless, this carved out part of reality provides the basis for the second analysis of experiment substitute. However, before turning to the causal analysis, an important corollary that critical realists draw from the foregoing discussion has to be added—the theory of 'emergence'.

The key aspect of this theory is that the conjunction[127] of two or more objects, forming new objects on a higher stratum, gives rise to powers and liabilities that are irreducible to the powers and liabilities of their constituents (cf. Bhaskar 2011, pp. 19–20; Bunge 1997, p. 415; 2004, p. 188; Danermark et al. 2002, pp. 59–62; Johnson 2008, p. 523; Pawson and Tilley 1997, pp. 64–65; Sayer 1992, p. 119; 2000, p. 12)[128]. The prime physical example is the emergent power of water not to be inflammable, although its constituents hydrogen and oxygen are both are inflammable. A more Ph.D.-related example, reusing Mumford's quote—despite solely focusing on instrumental rationality, presented in section 5.1—is the power of socio-technical systems that is irreducible to social and technical systems' powers:

> "The human being cannot operate at a high level of efficiency without the machine and the machine cannot operate at all without the human being. Such a system is unlikely to function effectively if this mutual dependency goes unrecognised and only the machine part of the system is consciously designed" (Mumford 1983, p. 13).

The recognition of different strata indicates that the selection of an unit of analysis and its investigation allows, or more precisely requires, to take the working of lower strata for

127. In reference to the above made distinction between external and contingent as well as internal and necessary relations, a conjunction that modifies powers and liabilities of objects is concerned with internal/necessary relations. However, it has to be noted that contingently related objects are vital for the realization of particular events (cf. Sayer 1992, pp. 118–121).

128. See also the discussion of DeMarco and Lister (1999, chap. 18) about software developing *teams* that are more than just a group of software developers.

granted, i.e., it is assumed that constituents work in a specific way (cf. Danermark et al. 2002, pp. 62–66; Sayer 1992, pp. 119–121). One the one side, this illustrates that in open systems different mechanisms work simultaneously (i.e., that of lower strata), and that this concurrency might overwrite or amplify the production of certain events (see also Danermark et al. 2002, pp. 62–63), which questions the ability of an evaluation in practical settings to justify the reasoning employed when building an artifact (see section 5.2). On the other side, this explains why some natural sciences are more successful than other natural sciences and social sciences in general: the recognition that some powers are emergent, that is, irreducible to powers of lower strata, suggests that it is possible to isolate the working of a particular stratum from that of higher strata (i.e., artificial conditions), but the reverse is not a viable option (cf. Collier 1998, pp. 260–261; Danermark et al. 2002, p. 67; Sayer 1992, pp. 119–121). Correspondingly, the higher the stratum on which the object of investigation is located, the greater the complexity, i.e., the number of influences that need—in principle—to be controlled. However, as indicated above, this active intervention as the central aspect of experiments is not possible on the social strata. Nevertheless, the second analysis exhibits a way for social sciences to circumvent this problem.

The ‘causal analysis’ is the dynamic counterpart of the structural analysis that aims to explain “why what happens actually does happen” (Danermark et al. 2002, p. 52), because this kind of knowledge allows—in the best case—to control or, in less favorable situations, to better adjust to respective phenomena (cf. Bunge 1966, pp. 341–342; [1967] 1998, pp. 156–157; 1997, p. 414; 2004, p. 206):

> “If we know what underlies a certain course of events we can also—this is the assumption—intervene and direct future courses of events and make them correspond better with our intentions and purposes in various ways. Alternatively, if we find that we cannot influence the course of events, we can still, by predicting it, better adjust accordingly” (Danermark et al. 2002, p. 52).

As mentioned above, the abilities of social sciences to produce this kind of insight, especially in the postpositivist sense manifesting itself in the Hempel-Oppenheim schema (see section 7.1), have traditionally been very limited. This suggests that the goal of this analysis and, by implication, the meaning of terms such as ‘prediction’ are interpreted differently by critical realists (see also Bhaskar 1998b, p. 11):

> “Realist philosophies of science [. . .] abandon a number of positivist assumptions about scientific theorising. The most important of these [. . . is] probably [. . .] the covering-law model of explanation, which [. . . is] replaced [. . .] by the idea of explanation as the attempt to represent the generative mechanisms which bring about the *explanandum*. A corollary of the latter principle is that explanation is not identified with prediction, the latter being possible, strictly speaking, only where the system is closed by natural or experimental means. For practical purposes in the social sciences we can forget about closures, so that any predictions we make will be necessarily tentative and will not provide decisive tests of our theories [emphasis in the original]” (Outhwaite 1998, p. 292).

Based on the foregoing discussion of the ontological assumptions of critical realism and the distinction between closed and open systems, this quote explicates two presently relevant epistemological consequences (see section 7.1): (i) the postpositivist assumption of an asymmetric relationship between explanation and prediction is abandoned and (ii) the notion of causal relationship is changed. Whereas predictions are considered to be tentative due to the variety of contextual influences in open social systems, the critical realists' understanding of causal statements becomes, under the influence of the afore-mentioned necessity, the following: "what an object is and the things it can do by virtue of its nature" (Danermark et al. 2002, p. 55). The central entities of this perspective, summarized in table 7.2, are the following four: the above defined structures; powers emerging from structures; mechanisms that produce events; and tendencies, which express that a certain object tends to behave or act in a certain way. In other words, tendencies are the substitute for postpositivists' causal laws (cf. Bhaskar 1998b, p. 11; 2008, p. 212; 2011, p. 68).

Table 7.2: Entities of a Causal Analysis, based on: Astbury and Leeuw (2010, pp. 367–371), Bhaskar (2008, pp. 3–9, 221–230), Bunge (1997, 2004), Danermark et al. (2002, pp. 55–59), Sayer (1992, pp. 92–117), Sayer (2000, p. 14), and Wynn and Williams (2012, pp. 790–792)

Element	Description
Structure	A structure is a set of necessarily, symmetrically or asymmetrically, related objects, which, in turn, constitute the internals of an object on a higher stratum. In other words, the unit of analysis as object of research is a specific organization of objects and their relations on a lower stratum.
Power	Powers, including liabilities, are stratum-specific or emergent properties of objects that possess these powers because of their structure, i.e., because they are specific natural kinds, which suggests that powers change if structures change. Ascribing a particular power to an object is to assert that, given appropriate contextual conditions[129], it will exercise the power and produce or realize a specific observable or unobservable event.
Mechanism	Mechanisms are the (often) unobservable, various parallel and intertwined, multi-level, object-specific processes or sequences of states, manifesting themselves in a string of events produced by exercised powers, that explain the interplay of the research object's internals' powers and that of contingently related contextual conditions.
Tendency[130]	Tendencies, as substitute for cause-effect relationships or causal laws[131], express that a certain object *tends* to behave or act in a certain way, that is, it sets the concept of power in motion. A tendency, in comparison to a power, is a property of a natural kind that it possess because it is a special type of that natural kind; it is predisposed or oriented toward this particular power by virtue of its nature.

The following, due to the complexity of the object of research, incomplete and simplified, one might even add fictional, illustration aims to fill these rather abstract terms with some 'real world' meaning: modern societies have, in general, a tendency to produce a certain degree of unemployment, primarily to keep inflation at an acceptable level, as, for example, captured in the 'unemployment equilibrium' of Keynes' seminal work *The General Theory of Employment, Interest and Money:*

> "the outstanding features of our actual experience; — namely, that we oscillate, avoiding the gravest extremes of fluctuation in employment and in prices in both directions, round an intermediate position appre-

129. Conditions refer to the existence of other structured objects, having their own powers and liabilities, existing in the spatiotemporal proximity (cf. Sayer 1992, pp. 107, 140).

130. This is what Bhaskar described as tendency$_2$, tendency$_1$ is equalized with powers as he states that only tendency$_2$ "is something more than a power" (Bhaskar 2008, pp. 221–222).

131. Danermark et al. (2002, p. 57) state that from this point of view "[s]cientific laws are [...] neither empirical statements (that is to say statements about experiences), nor statements of events; they are statements about independently existing and transfactual active objects' mechanisms or ways of working" (see also Bhaskar 1998b, p. 11; 2008, p. 212). An example of tendencies as dispositions of a natural kind given by Bhaskar (2008, p. 222) is the following: "[a]ll men [...] possess the power to steal; kleptomaniacs possess the tendency to do so" (see also Pawson and Tilley 1997, pp. 71–72).

ciably below full employment and appreciably above the minimum employment a decline below which would endanger life" (Keynes [1936] 2008, p. 229).

This tendency is based on the power of societies to achieve 'full employment', i.e., the 'ideal unemployment' rate as trade-off with an acceptable rate of inflation. This power is, in turn, based on the structure of that society, that is, on the relation of objects on lower levels (e.g., economic system, political system, etc.) and their respective powers (e.g., demand of labor, implementing policies, etc.). Exercising these lower-level powers, however, depends on contingently related contextual influences (e.g., state of technology, demand of products, international trade, etc.); see also figure 7.6. An event realized by the object of research (i.e., society) might be a rising unemployment rate, which can be explained, for example, by the dissemination of innovative 'labor-saving devices' such as ICT applications (see section 5.3). In other words, the latter is one of the possible mechanisms that can be used to explain why economic actors do not exercise their power to demand labor, which, in turn, is the 'cause' that produces the event of unemployment rates above the 'ideal' level. It might now even be argued that this is inherent to capitalist societies due to the required process of 'creative destruction' (cf. Schumpeter [1943] 2003, pp. 81–86), which might, if this was true, explain the tendency of capitalist societies to have an 'unideal' rate of unemployment. Unfolding and substantiating or falsifying this theoretical construction is, due to the illustrative purpose, unrewarding and not necessary.

This, admittedly, constructed example of how the entities summarized in table 7.2 can be applied to the causal analysis of 'real world' events, in addition to its illustrative purpose, (a) indicates what adjusting to uncontrollable events means (i.e., implementing policies) and (b) exhibits that the relation between objects and powers is necessary as well as that the interplay of powers and mechanisms, generating events, is contingent (cf. Danermark et al. 2002, p. 55; Sayer 1992, p. 105, and figure 7.6). In other words, the surrounding conditions 'decide' which powers are exerted and thereby also determine the events generated, which makes the object of research what it is and what it is not (e.g., an egalitarian society with 'full employment' or not).

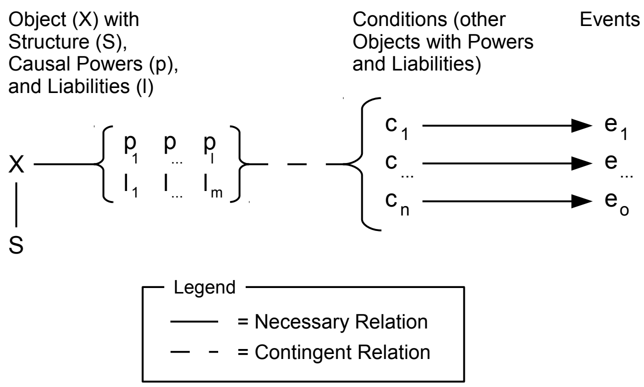

Figure 7.6: Conceptualization of Natural Necessity, adapted from: Archer (1995, p. 160)

More importantly, however, is that, in combination with the afore-mentioned distinction of the domains of the real and actual, not all powers are exerted (i.e., 'full employment', demanding labor). In other words, objects of research possess powers that are not exercised, yet they exist (cf. Danermark et al. 2002, p. 55; Sayer 2000, p. 12). By implication, and this tends to be the most distinctive feature of critical realism in comparison to postpositivism as well as to constructivism, this provides the ground for assuming that factually existing states have 'potentiality':

> "It is the belief that every state of existence, be it an individual or a society, possesses historically constituted potentialities that are unfulfilled. Everything is because of what it is and what it is not (its potentiality)" (Chua 1986, p. 619).

In sum, the three philosophical stances, or more precisely their methodological implications, presented in the three preceding sections of this chapter can be contrasted as follows (cf. Sayer 1992, p. 134; Wynn and Williams 2012, p. 793): whereas postpositivism focuses on predicting events, constructivism is concerned with understanding the socio-cultural meaning of events. Critical realism fits in these interrelated endeavors by concentrating on carving out the mechanisms that generate events. In other words, research based on critical realism aims to "transcend the contradiction between the way people behave in practice and the way they understand themselves to be acting" (Meredith et al. 1989, p. 307). However, this is only one way in which critical realism can inform research. As will be elaborated more fully in the next chapter, the present inquiry focuses on the potentiality of given states, that is, on the possibility to design feasible alternatives to factually existing social systems by identifying not exercised powers as well as constellations in which these powers are or can be exercised. The core idea, mentioned in section 5.3, is the synthesis of 'draft meanings' (Wellmer 1969, p. 41), that is, the exploration of progressive contexts to gather insights that can fruitfully inform practical discourses in which changes to social systems are debated.

Chapter 8

The Research Design

"'Utopia' refers to an imaginary and desirable state of affairs, especially if it be elaborated in detail and expounded in narrative form. Sometimes the term 'utopian' is used dismissively with respect to some proposal that the speaker believes to be impracticable. However, if someone imagines a highly desirable future social order, distinctly different from the one we live in, it is unsound to assume that his order must be unfeasible. Just four or five lifespans ago, it would have been almost universally considered the ravings of a lunatic to propose that women have legal equality with men and that governments be elected by near-universal adult suffrage. The indignant incredulity with which most people would have greeted such fantastic proposals could have been, and in few cases were, rationalized into plausible arguments. The utopians are sometimes right; the skeptics are sometimes wrong. It is illegitimate to dismiss some scheme merely because it is utopian (where 'utopian' means desirable and unlike the present state of affairs). Alternatively, if 'utopian' be defined as to imply 'unfeasible', then the claim that some scheme is utopian requires supporting arguments about feasibility."

Steele (1992, p. 352)

Based on the preparatory work carried out in chapter 5 and the analysis of the ontological and epistemological assumptions underpinning the present inquiry, the discussion now can turn to the study's research design, that is, the approach that translates the foregoing examinations into a research project. In conventional dissertations such an elaboration is usually confined to the selection and justification of existing approaches, which entails a research method, denoting the general procedure for carrying out a research project, and research strategies, which specify techniques to collect and analyze data from the 'real world' (cf. Chmielewicz 1994, pp. 36–41; Chua 1986, p. 604; Comstock 1982, p. 370; Sayer 1992, pp. 2–3). However, as pointed out in part I, the present inquiry deviates slightly from the traditional procedure by developing instead of selecting a method. Correspondingly, the following elaboration is, in contrast to standard research reports, richer in substance and the project carried out in the next part is, although being a self-contained research endeavor, mainly an argument supporting the developed method's feasibility. Nevertheless, the following sections fade out this divergence and proceed in usual terms.

As schematically depicted in figure 8.1, the present inquiry is, as extensively discussed in section 5.3, theoretical in nature, to avoid "fall[ing] between stools" such as studys that try to be theoretical and practical at the same time (Sayer 1992, p. 134), and mainly concerned with the design of social and technical systems as explicated in sections 5.1 and 5.2. This suggests that the inquiry's research design can be broken down in two sub-endeavors: the design of a social system and the construction of a corresponding technical system, supporting the processes of the social system.

Correspondingly, there are also two interrelated research methods—one for each sub-

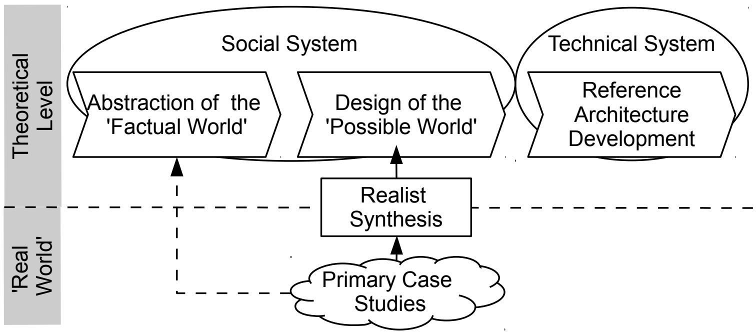

Figure 8.1: The Inquiry's Research Design

endeavor. Firstly, a method for the design of technical systems (section 8.3), which, as suggested by the standard practice of dissertations, comprises the selection and justification of an existing approach from the disciplinary knowledge base. Secondly, the methodical support for the design of the social system, more precisely for the design of 'possible worlds' (see section 8.1). The latter constitutes, as indicated by the research objectives (see section 6.2), the central focus of this chapter, because it answers the first research question stated in section 6.1:

> *Which steps are required to design desirable, feasible, and constructive alternatives to factually existing information systems (IS) that can inspire and inform participants of practical discourses about potential options for the changes debated in these discourses?*

The method presented, or more precisely developed, in section 8.1 is a more detailed and substantially reworked version of the approach sketched by Heusinger (2013a, forthcoming). The key focus of this method is the construction of desirable and feasible alternatives to existing social systems that function as domain model for the elicitation of requirements demanded by traditional technical system design approaches, such as the one presented in section 8.3. As already indicated in section 5.3 and the introductory quote of this chapter, proposals for social systems often are, if solely carried out on a theoretical level that is not coupled with the 'real world', dismissed as being 'utopian'. The present inquiry circumvents this potential counterclaim, as pointed out in the last section of the preceding chapter, by gathering credible evidence for the realizability of the 'possible world' in form of 'draft meanings' (Wellmer 1969, p. 41). An appropriate research strategy for extracting such draft meanings or organizational options (cf. Mumford 1983, p. 92, and section 5.2) is the 'realist synthesis' proposed by Pawson (2006) (section 8.2). Although this research strategy does not directly collect data from the 'real world' but 'merely' from primary case studies (see figure 8.1), this technique provides evidence that is, in reference to the discussion in section 5.2, as credible and fallible as the evidence gathered by an evaluation of the instantiated artifact in a practical setting. Nevertheless, this research strategy has the additional advantage of being able to consolidate insights of the (disciplinary) body of knowledge, instead of solely extending it by idiosyncratic proposals (see section 5.2)—only because the number of studies increases does not mean that we also accumulate more knowledge. The intent, however, is not to supplant existing research strategies in the disciplinary knowledge base, but, as will be discussed more thoroughly in chapter 9, to supplement them with a—needed—synthesizing procedure. In other words, the present inquiry does not directly extract data from the 'real world', but draws on the wealth of literature as foundation for the design of 'possible worlds'.

8.1 The Design of 'Possible Worlds'

"When certain theoretical perspectives become too institutionalized into a discipline, in essence becoming a de facto orthodoxy, they hinder progressive debates by inadvertently playing a gate-keeping function within our professional societies and journals."

Brennan et al. (2013, p. 2)

As indicated before, the traditional notions of 'relevance' and 'rigor' captured in the various methods derived from the 'build-evaluate loop' (see section 5.2) exhibit the features mentioned in the above quote: they keep out C&E DSR projects. To ignite a debate the present section advances the 'unorthodox' design of 'possible worlds', which is, similar to the suggestions for interpretive C&E research (cf. Alvesson and Deetz 2000; Wynn and Williams 2012, and section 5.3), divided into three steps: firstly, the 'factual world', a representative abstraction of the structure of a selected unit of analysis, is 'carved out' (see section 7.3); secondly, the idea of a 'possible world' as well as its underpinning value position are sketched and utilized to criticize the 'factual world', resulting in a number of required 'context shifts' (cf. Heusinger 2013a, p. 342; Pawson and Tilley 1997, pp. 72–78; Tilley 2000, p. 6) and intervention entry points; finally, the possibility of a transition from the 'factual world' to the 'possible world' needs to be assessed to distinguish 'possible worlds' from 'utopias' in the narrow sense. This latter step, based on the 'realist synthesis' discussed more thoroughly in section 8.2, is carried out for each of the identified intervention entry points to (i) gather justificatory evidence for the possibility of the transition and to (ii) extract 'draft meanings' (Wellmer 1969, p. 41) or 'organizational options' (Mumford 1983, p. 92), representing the variety of concrete contexts in the domain the reference architecture should support.

This curtailed description suggests that the design of 'possible worlds' shares common features with the socio-technical system design approaches briefly touched in section 5.2. Nevertheless, there are substantial differences (cf. Heusinger, forthcoming): whereas the latter aim to devise a full-fledged system as well as 'transient structures' for a particular context, the design of 'possible worlds' is mainly concerned with envisioning a hypothetical but still feasible alternative to existing contexts in a domain and justifying that this alternative can possibly exist. Correspondingly, the differences lie within the 'transient structures' (cf. Bots 2007, p. 384), specifying the concrete interventions required to realize the envisioned system, the involved level of abstraction (see section 7.3), and the explicit normative stance. However, a more specific differentiation as well as an elaboration of the potential relationship (see section 9) have to be preceded by a discussion of the design of 'possible worlds'. This later facet is the focus this section, which is, as indicated above, divided into three steps.

Step 1: Abstraction of the 'Factual World'

The relationship between the envisioned 'possible world' and the existing real world exhibits similarities to incommensurable theories (see footnote 110), which are different models of the world and, due to a shift of terminology, use different languages to explicate their conceptualization (Hoyningen-Huene 2002, pp. 65–66). Therefore, comprehending the 'possible world' requires a shift of thinking, which according to Sen (2009, p. 122) is a dual task (see also Habermas [1981] 1987b, pp. 29–31): using a conformist language to communicate clearly, while simultaneously expressing non-conformist ideas. In other words, "[n]ew concepts can only be developed from preexisting ones. We generally try to explain the unfamiliar by reference to the familiar" (Sayer 1992, p. 63). This is an essential part of the semiotic theory of Saussure (1959), which was briefly touched in section 7.2. However, Sayer (1992, p. 85) points out that the non-conformist use of language is inevitably restricted, because to "abandon too much is to destroy our ability to think and to find ourselves struggling to do what used to be straightforward". This suggests that the 'possible world' should not be too distant from the real world, an aspect accounted for by basing the design of 'possible worlds' on progressive aspects of the real world.

The dialectic relationship between the 'possible world' and the real world is also reflected in the distinction of the insight and the transformation element in the principles of interpretive C&E research (see Myers and Klein 2011, pp. 23–24, and section 5.3). Correspondingly, it seems to be most fruitful to start the design of a 'possible world', the non-conformist idea, by creating a conformist abstraction of the real world segment of concern (hereinafter: 'factual world') along the 'structural analysis' outlined in section 7.3. The pre-existing, historically constituted conditions within it not only determine interventions' efficacy (cf. Marcuse [1964] 1970, pp. 10–12; Pawson 2006, p. 24), they also provide the basis for a critical assessment (cf. Myers and Klein 2011, p. 23; Tilley 2000, pp. 5–6). Abstraction, as noted before, must not be mistaken as unrealistic or far from reality, a common mix-up exemplified by the afore-mentioned 'incompleteness criticism' (see section 5.5):

> "We all know that the only mental tool by means of which a very finite piece of reasoning can cover a myriad of cases is called 'abstraction'; as a result the effective exploitation of his powers of abstraction must be regarded as one of the most vital activities of a competent programmer. In this connection it might be worthwhile to point out that the purpose of abstracting is *not* to be vague, but to create a new semantic level in which one can be absolutely precise [emphasis in the original]" (Dijkstra 1972, p. 864).

In other words, it is a goal-oriented process that captures the necessarily related elements and processes of a subject of investigation (see section 7.3 and, for more detailed discussions, Brown, Slater, and Spencer 2002; Danermark et al. 2002, sect. 3; Frank 2006, p. 34; Sayer 1992, sect. 3–4; 2000, sect. 5). It excludes contingently related elements, attributes, and relations to be applicable in multiple contexts, i.e., a domain (see section 5.4). This implies, when applied to a concrete context, the second move (abstract $\rightarrow$ concrete) discussed in section 7.3, the abstraction needs to be enriched by information gathered in the real world:

> "The move from abstract to concrete must therefore combine theoretical claims with empirical research aimed at discovering 1 which kinds of objects are present [...]; 2 what are the contingent forms they take [...]; and 3 under what conditions do they exist in this instance [...]. Because of *the need to incorporate empirical knowledge of contingencies at each stage*, the move from abstract to concrete cannot be deductive, for the conclusions are not wholly derivable from or 'contained' within the meaning of the premises [emphasis added]" (Sayer 1992, p. 142).

This relationship, similar to the one Ostrom (2011, pp. 7–9) outlined for the relation between frameworks, theories, and models (see also Ostrom 2007, pp. 25–26; 2010a, p. 646; 2010b, p. 411), indicates that there has to be a close interaction between abstract and concrete or theorizing and empirical research, especially in social sciences where the transformation of social structures takes place, due to continual change and learning, in different paces (Sayer 1992, p. 145).

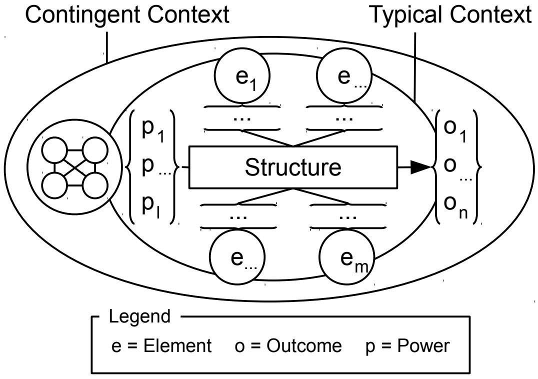

Figure 8.2: Abstraction of the Unit of Analysis, adapted from: Archer (1995, p. 160) and Sayer (1992, pp. 109, 117)

Within traditional DSR projects the unit of analysis is usually given by the organizational context for which the technical system is designed. Theoretical approaches such as the present inquiry, in contrast, are more flexible in respect to boundaries (see section 5.1). Therefore, the first activity is to explicate the research endeavor's unit of analysis. It has to be noted that this choice is, at least tactically, guided by an implicit idea of the 'possible world', because the research context needs to be congruent with the purpose and goal of the inquiry. After the object of research has been delimited, the next task, guided by the schema depicted in figure 8.2, is to explicate the general structure of the unit of analysis. The involved activities are equivalent to those of the 'structural analysis' (see section 7.3), which, in turn, is captured in the second principle[132] Wynn and Williams (2012, p. 796) propose for carrying out realist case study research: decompose the unit of analysis into relevant elements and identify the necessary relations between those elements. Together, as indicated in the center of figure 8.2, elements and relations between them constitute the context's structure.

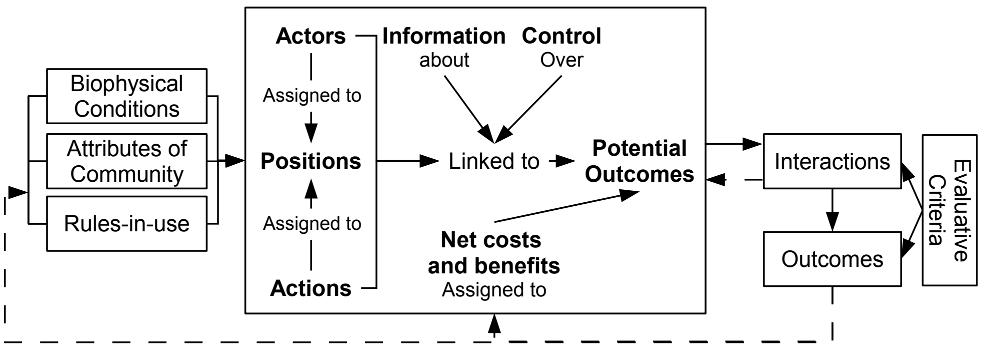

Figure 8.3: Specification of Social Systems, adapted from: Ostrom (2011, p. 10)

Although the foregoing discussion outlines the general procedure, the level of abstraction is too high to fruitfully inform the design of 'possible worlds'. Therefore, the description is refined using the institutional analysis and development (IAD) framework (cf. Ostrom 1986, 1990, 2009, 2010a, 2010b, 2011), which captures the structural variables present to some

132. The first principle (i.e., 'Explication of Events') is, due to the different orientation, unnecessary for the present inquiry as it aims to provide a causal explanation of a particular event (Wynn and Williams 2012, pp. 796–798) as described in the 'causal analysis' in section 7.3. However, the present inquiry, as elaborated more fully in the following, is primarily concerned with creating a representative abstraction of a domain as a basis for the design of 'possible worlds', in which the explanation of mechanisms generating an event are of secondary relevance.

extent in all social systems (cf. Ostrom 2011, p. 9)[133]. In the terminology of this framework the above described abstraction of the 'factual world' is called an 'action situation', i.e., structural elements constituting a process of interest (cf. Ostrom 2007, p. 28; 2011, p. 11). As can be seen in figure 8.3 the action situation, itself embedded in a larger context, is described by the following seven entities (cf. North 1990, p. 46; Ostrom 1986, pp. 5, 17; 2007, pp. 29–30; 2010a, pp. 647–648; 2010b, pp. 415–416; 2010c, p. 810; 2011, p. 11; Ostrom and Cox 2010, p. 455): (i) the actors involved in the process of interest; (ii) the different positions or social roles in the action situation, which are occupied by actors; (iii) the set of actions assigned to certain positions; (iv) the potential outcomes resulting from the combined effect of joint actions; (v) the information each actor can issue to select a particular action; (vi) the degree of control actors can exercise over their choices; and (vii) the net costs and benefits of actions and outcomes. These seven entities and the corresponding set of rules for each of these entities summarized in table 8.1[134] are the core to describe the internals of an action situation, social system, or a typical context (see figure 8.2). As indicated before, the action situation is embedded in a larger context, comprising contingently related elements captured in three categories of variables (i.e., the biophysical conditions, the community attributes, and the rules-in-use). These three categories can be unpacked to investigate a particular situation in respect to a certain focus (see also Ostrom 2010a, pp. 646–647; 2010b, p. 414): the biophysical conditions allow to analyze the interactions within socio-ecological systems (e.g., Ostrom and Cox 2010, pp. 456–459; Ostrom 2007, pp. 39–43; 2011, pp. 21–23), the community attributes allow to study the effectiveness of certain governance arrangements in different contexts (e.g., Ostrom 2002, pp. 1333–1335; 2007, p. 43), and the rules-in-use or 'working rules' (cf. Commons 1924, pp. 14–142) allow to investigate the influence of socio-historical aspects on action situations (e.g., Ostrom and Cox 2010, p. 455; Ostrom 2007, pp. 35–39; 2011, pp. 17–21). The rationale behind using the IAD framework as refinement or specification of social systems is that it has attracted considerable attention in several social sciences fields and was subjected to numerous empirical tests in various contexts (see footnote 134): whereas the latter indicates the framework's credibility as appropriate framing of social systems, the former suggests that it is an adequate anchor point for interdisciplinary cooperation, which is inevitable and necessary in the design of socio-technical systems (cf. Baxter and Sommerville 2011, p. 9).

Table 8.1: The Rules of an Action Situation, source: Ostrom (1986, p. 19)

Positions or Position Rules
A set of rules "that specify a set of positions and how many participants hold each position"[135].
Actors or Boundary Rules[136]
A set of rules "that specify how participants are chosen to hold these positions and how participants leave these positions".
Outcomes or Scope Rules
A set of rules "that specify the set of outcomes that may be affected and the external inducements and/or costs assigned to a position".
Actions or Choice Rules (Authority Rules)

Continued on Next Page

133. For a comparison of the IAD framework and the Local Public Economies framework see Oakerson and Parks (2011, p. 154–155). Although both are generally compatible, the latter has an explicated multi-level focus, mainly concerned with contrasting self-managed systems with other approaches (see section 10.3).

134. For detailed discussions of these rules and references to empirical studies investigating these rules see Cox, Arnold, and Tomás (2010), Ostrom (1990, p. 90), Ostrom (2010a, pp. 651–653), and Ostrom (2010b, pp. 420–423).

135. This simplification is compatible with Ostrom (2010c, p. 810–811).

136. Ostrom (2007, p. 38) uses the term 'entry and exit rules' instead.

Table 8.1 – Continued from Previous Page

	A set of rules "that specify the set of actions assigned to a position at a particular node".
Control or Aggregation Rules	
	A set of rules "that specify the decision function to be used at a particular node to map actions into intermediate or final outcomes".
Information or Information Rules	
	A set of rules that "authorize channels of communication among participants in positions and specify the language and form in which communication will take place".
Net Costs and Benefits or Payoff Rules	
	A set of rules that "prescribe how benefits and costs are to be distributed to participants in positions".

A 'factual world' refined in the described way exhibits similarities to the conceptual frameworks guiding empirical-quantitative inquiries (cf. Ostrom 2011, p. 11) and to the structural context descriptions used in explanatory case study research (cf. Wynn and Williams 2012). Correspondingly, the 'factual world' can be used to examine concrete settings in a domain to identify predominantly occurring tendencies and relate them to ascertained powers as described in the 'causal analysis' in section 7.3. This would eventually transform the 'factual world' into a "model [. . .] of a mechanism, which *if* it were to exist and act in the postulated way would account for the phenomena in question [. . .] [emphasis in the original]" (Bhaskar 2011, p. 19). In other words, the 'factual world' can be refined to a model providing explanations of "why what happens actually does happen" (Danermark et al. 2002, p. 44) in certain contexts. Such models might be utilized, for example, in C&E research to reveal why certain tendencies are reproduced and considered to be legitimate (cf. Comstock 1982, p. 383). However, the present study is less concerned with explaining the genesis of certain events, but it aims to design a 'possible world'. In the terminology of the IAD framework this could be understood as a 'reformed factual world' (Ostrom 2011, p. 11), emerging if the rules or social structures of the object of research are changed (cf. Ostrom 1986, p. 6; 2007, pp. 37–39; 2011, p. 19–21). Sketching out this 'reformed' alternative—the 'possible world'—is the main task of the next step.

Step 2: Critical Analysis of the 'Factual World'

Artifacts, such as a 'possible world', can be seen as blueprints for the construction of means that achieve given ends (cf. Walls, Widmeyer, and El Sawy 1992, p. 40, and section 5.2). However, there are no means or ends in themselves; both are only significant in a certain sphere, which is set through delineating normative value judgments (Chmielewicz 1994, pp. 214–217). In C&E research the realm encompasses the removal of manifested injustices (Robson 2002, p. 28), which are identified by scrutinizing the believed-to-be-legitimate circumstances for preconceptions and biases (Sen 2009, pp. 128–130); in the current terminology, by criticizing the 'factual world'. As already argued in section 5.3, criticism is an adequate reason for initiating change (cf. Chmielewicz 1994, pp. 307–307; Frank 2006, p. 55; Popper 1978, p. 163; Zelewski 2007, pp. 104–105): "if the starting point of all change is perfect and good, then change can only be a movement that leads away from the perfect and good" (Popper 1967b, p. 30); if, however, the starting point is criticizable, then a movement might lead to better outcomes. Unfortunately, C&E (ISR) studies often do not go beyond pure criticism (Myers and Klein 2011, p. 29), which is referred to as 'destructive negativism' (see also Baxter and Sommerville 2011, p. 9; H. A. Simon 1992, p. 366):

> "In order that fundamental criticism does not degenerate into a destructive negativism, it must be tempered by an explicit value position and by the attempt to identify viable improvements to the status quo, be it at the micro or macro level [...]. This is not a license for critical theorists to impose their own preferred values, but an injunction to consider the merits of alternative ethical positions [...]" (Myers and Klein 2011, p. 33).

In a similar vein, Habermas ([1981] 1987b, p. 65) points out that criticism of an existing order is more powerful if it originates from an, at least hypothetically, possible alternative (see also Sayer 1997, p. 48; Steele 1992, p. 374). In the present case this is the 'possible world', which serves as contrasting background or instrument, thereby becoming a normative concept (cf. Avgerou 2005, p. 106), to identify the shortcomings of the 'factual world'. Correspondingly, the first task of the critical analysis is to make explicit the guiding idea of a 'possible world' by briefly sketching its key points in a form adequate for performing the critical assessment. Confining the 'possible world' to a rough sketch follows from the 'underdesign principle' (Fischer and Herrmann 2011, pp. 9, 15–17), which states that only those structural elements and processes of a socio-technical systems should be specified that are indispensable. In this way the 'possible world' provides an outlook for changes to social systems, but still leaves open the opportunity to adapt certain aspects to local needs and circumstances. However, in anticipation of the discussion of the third step, it is pointed out that this variability is achieved through abstraction by inclusion (see section 5.4), that is, the initial draft will be iteratively revised and refined based on the draft meanings or organizational options identified in the existing body of knowledge. Before going into the details of the next task of this step, that is, of the critical assessment, a brief clarification of the relationships between the real world, the 'factual world', and the 'possible world' will serve to explicate additional vital characteristics of 'possible worlds' as well as to avoid potential misunderstandings in the following.

As indicated by 'contingent context' and 'typical context' in figure 8.2, there is no one-to-one correspondence between the 'factual world' and abstractions of factually existing contexts in the 'real world' (hereinafter: context abstraction). The 'factual world' is merely a representative cross-section of contexts in a domain, which might differ from context abstractions in two ways (see figure 8.4): (i) the 'factual world' comprises entities not present in the context abstraction or (ii) the context abstraction already exhibits certain progressive aspects of the 'possible world', which are not present in the 'factual world'. These differences are consequences of the structural analysis guided by the principle of necessity (see section 7.3), because a critical realist's abstract domain, or more precisely the theory created in it, comprises only necessarily related objects, relations between objects, and powers of objects. However, it was pointed out in section 7.3 that the notion of necessary and contingent is influenced by the study's purpose, which in combination with the ineptitude of abstractions to account for the co-existence of contingently related objects (cf. Sayer 1992, pp. 143–144), might raise two objections: (i) the 'factual world' is not as representative as suggested and (ii) the exclusion of ramifications makes the development teleological.

Objection (i) refers to the shortened sequence of context shifts required to transform a particular setting into the 'possible world'. A context shift, in anticipation of the elaboration in the next step, is used to capture the change or reform of the structural composition of a particular context caused by an intervention (e.g., by changing responsibilities or communication rules). Although the intervention changes merely a particular context, the pre-post compar-

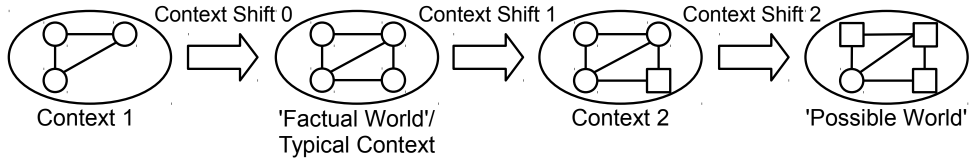

Figure 8.4: Sequence of Context Shifts

ison of the very same context allows to interpret an intervention's result as the creation of a new context. Based on this clarification the schematic illustration in figure 8.4 can be read as follows: the structural composition of context 1 is changed by three interventions, eventually transforming the social system's structure into the one devised for the 'possible world'. However, if the starting point of the design of a 'possible world' is the 'factual world', then the context shift 0 is not included in the sequence of interventions considered in the design of the 'possible world'. In contrast, transforming the structural organization of context 2 into the 'possible world' does not require context shift 1. Whereas the latter does not constitute a problem for the design of 'possible worlds' (i.e., it is still included), the former reduces its geographical applicability (cf. Chmielewicz 1994, p. 83), which, as discussed more fully in chapter 14, is the anchor point for further refinement and extension in additional research cycles or projects[137].

The exclusion of ramifications (ii), that is, of different interventions causing similar context shifts (e.g., context shift 1*), inevitably makes the underpinning development conception teleological. This a direct consequence of the 'open system' perspective extensively discussed in section 7.3: the variety of contingently related influences in the real world, manifested in the contingently related objects that the theory has abstracted from, might render the intervention, which generates context shift 1, impractical in a certain context although the latter's context abstraction resembles the 'factual world'. However, this neither affects the ability of 'possible worlds' to inspire participants of a practical discourse in which changes to social systems are debated (see section 5.1) nor does it render the 'possible world' utopian, because the progressive aspect's realizability, discussed more fully below, has already been demonstrated. It merely indicates that interventions have to be devised specifically for idiosyncratic contexts and their peculiarities as will be discussed more fully in chapter 9.

Both these objections culminate in the same insight: the design of 'possible worlds' is a 'theorizing' effort that produces fallible 'interim results', which "summarize progress, give direction, and serve as placemarkers" (Weick 1995, p. 389). They are theorizing efforts on the *level* of 'middle range' theories (cf. Merton [1949] 2011, p. 448)[138], which lie between (a) the level of single propositions and working hypotheses, which are used to justify 'possible worlds', and (b) the level of 'unified theories' (e.g., the one of Habermas [1981] 1987a, [1981] 1987b, see also the discussion in part I). However, they are not derived from one such general or unified theory but may be compatible with more than one of these theories (Merton [1949] 2011, pp. 449–451). In other words, middle range theories can be interpreted as an interface between theory and scientific data (Pawson and Tilley 1997, p. 124). In

137. Such research endeavors can refine 'possible worlds' by, for example, suggesting different development paths, which can be utilized for the analysis of trade-offs or making socio-technical systems 'mutable' (cf. Gregor and Jones 2007, p. 322). As such considerations are out of scope of the present inquiry, they are options for future research.
138. For an illuminating discussion of middle range theories from a critical realist perspective see the seminal work of Pawson and Tilley (1997, pp. 123–127).

reference to the discussions in chapters 1 and 2 as well as in anticipation of the exemplary application of the method for the design of 'possible worlds' in chapter 10, the 'possible world' designed as an illustration of the method's feasibility is generally consistent with the theory of Habermas ([1962] 1991, [1981] 1997, [2008] 2009), but it is not excluded that it is also compatible with other unified theories as it is not logically derived from or bounded to that theory. However, 'possible worlds' differ from middle range theories as explicated by Merton ([1949] 2011, p. 450) in that they are not "a set of assumptions from which empirical generalizations [. . . can] be derived", which, as implicit in the classic notion of theory[139], are based on experienced or observed, i.e., existing, phenomena, but they represent desirable future states. In the terminology of critical realism (see section 7.3), they are, by virtue of their normative character, theories that explain how—yet to be created—mechanisms in not yet existing contexts produce desirable outcomes (cf. Pawson and Tilley 1997, pp. 84–85). In other words, 'possible worlds' are the goals, aims, or objectives—not to be mistaken with functional achievements or instrumental goals—that interventions (cf. Linder and B. G. Peters 1984, pp. 250–257), policies (cf. Schneider and Ingram 1988, p. 70; 1997, pp. 82–84), or programs (cf. Weiss 1995, pp. 73–74; 1998, pp. 51–55) try to realize. Programs, as the most common term[140], are themselves underpinned by program theories (see also Pawson 2003b, pp. 472–473):

> "Policy makers try to engineer episodes of social change, and the success (or otherwise) of these initiatives depends upon the extent to which the program theory has been able to predict and control this interpretative spiral of ideas and social conditions. Just as a theory of physical change precedes the natural science experiment, the careful enunciation of program theory is the prerequisite to sound evaluation. We [Pawson and Tilley] demonstrate that one can use broadly the same formal and general conceptual matrix with which to express those program theories, namely: *outcome = mechanism + context*. In other words, programs work (have successful 'outcomes') only in so far as they introduce the appropriate ideas and opportunities ('mechanisms') to groups in the appropriate social and cultural conditions ('contexts') [emphasis in the original]" (Pawson and Tilley 1997, pp. 56–57).

In a similar vein, Weiss (1998, p. 57) defines program theories[141] as "the *mechanisms* that mediate between the delivery (and receipt) of the program and the emergence of the outcomes of interest [emphasis in the original]" (see also Astbury and Leeuw 2010, p. 366;

139. Although there is no clear definition of what a theory actually is (Maanen, Sørensen, and Mitchell 2007, pp. 1147–1148), there tends to be some consensus on important characteristics of theories in the classical sense. This includes: theories comprise variables and their relationships, have a domain of application, and are based on or built after observed or experienced aspects of reality (cf. Lynham 2002, p. 222; Wacker 1998, pp. 363–364; Weick 1989, p. 519); for excellent discussions of theory building in different disciplines see Dubin (1978), Lynham (2002), and Wacker (1998). However, 'possible worlds' are, as mentioned in section 5.1, not yet realized and, by implication, cannot be based on phenomena observed in the real world.

140. Although all these terms, i.e., policy, program, project, plan, intervention, and etc., refer, at least if they are defined and not used, as they often are, interchangeably, to entities on different spatiotemporal scales that vary in scope and range of activities (see, for example, DFID 2001b, for an extensive discussion), the following uses them interchangeably. The underpinning rationale is twofold: one the one side, all these terms share a common core as explicated in the next step of the design of 'possible worlds', and on the other side, the differences unfold only in regard to the strata of the selected unity of analysis. As the design of 'possible worlds' is not bound to a specific stratum (see section 5.1), a differentiation tends to be unrewarding in this general discussion.

141. Program theories are intertwined with implementation theories, which, in contrast to program theories, do "not deal with the processes that mediate between program services and achievement of program goals but focus [. . .] on the delivery of program services" (Weiss 1998, p. 58). In other words, implementation theories are, in the terminology introduced in section 7.3, the translation of abstract program theories into concrete implementation strategies, i.e., the second move (abstract → concrete). Therefore, program theories are the abstract set of ideas, in the form of necessary conditions, transferable between different contexts (Pawson and Tilley 1997, p. 120).

Weiss 1997, p. 46). Furthermore, such programs are, as schematically depicted in figure 8.4, usually sequenced to achieve desired outcomes (cf. Pawson 2003b, pp. 472–473). This allows to frame the above discussion as follows: program theories are abstractions of programs or interventions[142], which initiate the context shifts that eventually lead to the 'possible world' as normative goal. Although, as fully explored below, 'possible worlds' are achieved by and designed based on such program theories, they nevertheless specify the goal these social programs aim to achieve. Therefore, 'possible worlds' have, following from the Gestalt-switching[143] nature of means and ends in the hierarchy of means and ends (i.e., means become ends of lower levels)[144], a dual character: on the one side, they are means to identify and remove manifested injustices, and on the other side, they are goals for which programs are devised. This latter facet can be illustrated with, for example, the policy design approach Linder and B. G. Peters develop in reference to H. A. Simon (1978a) and his seminal works. They argue that an approach to policy design has to consider three entities "to deal with the complex world in which policy is [. . .] fashioned" (Linder and B. G. Peters 1984, p. 254). This includes: the characteristics of problems, of goals[145], and of instruments (cf. Linder and B. G. Peters 1984, pp. 254–257; Linder and G. Peters 1987, p. 468). In regard to the above discussion, programs belong to the instrument category, which comprises the means that achieve ends (i.e., 'possible worlds') to address problems. Whereas programs are dealt with in the third and final step of the method, the characteristics of problems, at least insofar as they concern the design of 'possible worlds', are subject to the next task in the presently discussed second step.

The aim of this second task is to identify how interventions or programs can transform the structure of the 'factual world' into the one devised for the 'possible world'. The pivotal elements to realize this aim are, as hypothesized by the 'possible world', the existing but not exerted powers of the (social) objects in the abstraction of the selected unit of analysis—the 'factual world'. They indicate the "immanent possibilities for action" (Comstock 1982, p. 374) (hereinafter: intervention entry points). Correspondingly, this task involves two intertwined activities: firstly, the comparison of the 'factual world' to the alternative organization manifested in the sketched 'possible world' as this suggests which powers, if they exist, need to be enabled to transform the 'factual world' into the 'possible world'; and secondly, the justification that enabling these powers is indeed desirable and not a departure from the 'perfect and good'. Whereas the first activity provides the hypotheses that guide or frame the search for draft meanings or organizational options in the next step, the second activity explicates the underlying value position (cf. Frank 2006, p. 41; Myers and Klein 2011, p. 33), which is ideally supported by arguments that 'cannot be reasonably rejected' (Scanlon 1982, 1998), to

142. Within section 5.2 an ISR-specific version of an approach falling into this category was discussed under the umbrella of IS as transient structures.

143. Kuhn (1996, pp. 111–114) uses the Gestalt-switch to illustrate the shift of perspective that is involved in the transition from one 'disciplinary matrix' to another.

144. Within chapter 5 two examples of entities exhibiting such a dual character were already discussed: on the one side, ICT applications are seen as ends in the narrow view of IS whereas the broader view of IS conceptualizes them as means (see section 5.1), and on the other side, human beings can also be seen as means and ends as discussed in section 5.5. However, in the second example it was also explicated that if human beings are solely seen as input factor to economic production (i.e., human beings as means), then this is "a strange inversion of objects and instruments" (Anand and Sen 2000, p. 2039), because not the perspective but the order of levels is changed.

145. Additionally, they further state that goals have, despite their relevance (cf. Dryzek and Ripley 1988, p. 711), received comparatively little attention or were confined to concerns of efficiency, that is, to instrumental rationality (see Linder and B. G. Peters 1984, p. 256; Linder and G. Peters 1987, p. 468; Vining and Weimer 2006, p. 417, and the Impact Assessment discussion in section 5.5). However, without "more explicit attention to goals and the design process the decision-maker might not be made aware of that weakness in the range of alternatives considered" (Linder and B. G. Peters 1984, p. 256). 'Possible worlds', although not directed towards policy-makers, fulfill a similar function: they provide alternatives not only to factual existing but also to other proposed solutions.

ensure what Popper (1978, p. 167) calls 'control through critique': it unveils the normative foundation of 'possible worlds' to stimulate discussion instead of implicating or camouflaging values. This, in turn, indicates why Myers and Klein (2011, p. 26) suggest to inform C&E research by critical social theory; the explication of such arguments is subject of moral and ethical discourses[146], which find their scientific manifestation in the contributions of critical social theory. The second activity, in addition to satisfying the basic principles of good scientific practice by revealing fundamental assumptions, also provides a set of 'negative criteria' inherent to the value position. These are those normative aspects that must not be violated in the synthesis of draft meanings or organizational options, because this would result in contradictions between the goal the 'possible world' pretends to be and the organizational structure it embodies. In respect to the above mentioned ramifications, these criteria narrow down the solution space of 'possible worlds' without indicating a single solution as the most desirable.

In sum, the second step involves three tasks: (i) sketch the idea of the 'possible world', i.e., of a hypothetically existing alternative, to outline the initial starting point for the design of a more desirable social system; (ii) explicate the value position underpinning the 'possible world' to provide a rationale for its desirability and to narrow down the solution space; and (iii) criticize the 'factual world' from the perspective of the sketched alternative to identify intervention entry points. The last activity is what makes the research relevant: it is not relevant because it deals with problems articulated by 'important stakeholders'; instead, it is relevant because there are reasonable, normative arguments to characterize the 'factual world' as unjust. Having the opportunity to contribute to the removal of an identified injustice entails a certain responsibility or imperfect obligation to do exactly this (cf. Heusinger 2013b, pp. 27–28; Robeyns 2008, p. 91; Sen 2008, pp. 334–335; 2009, chap. 17).

Step 3: Possibility Assessment & Synthesizing Design

Up to this point, the idea of the 'possible world' is just a hypothetical alternative, which might or might not be realizable. Such suggestions are often accused of being utopian, even from within the C&E research community (see section 5.3). Yet, this 'utopian counterclaim' (cf. Heusinger 2013a, p. 441; forthcoming) is based on the confusion of two different types of utopianisms (cf. Steele 1992, p. 352): on the one side, utopias are treated as per definition infeasible, indicating that any rational assessment is unrewarding, and on the other hand, there is a conception that leaves open whether a utopia is realizable or not. The aversion of utopias can be traced back to a rejection of Marxism. However, as Steele (1992, p. 355) points out in his criticism of the historical materialism, the reoccurring claim of 'Marxists' that capi-

146. Moral and ethical discourses are the two key discourses of Habermas' discourse ethics (cf. Habermas [1983] 1990, [1991] 1994, 1992): (i) moral discourses are concerned with testing norms for their moral validity using the universalization principle (U), which states that a norm "is valid when the foreseeable consequences and side effects of its general observance for the interests and value-orientations of *each individual* could be *jointly* accepted by *all* concerned without coercion [emphasis in the original]" (Habermas 1998, p. 42); (ii) ethical discourses, guided by the 'ethical point of view' (pp. 25–28), are concerned with values and can be divided in (a) ethical-existential discourse (i.e., clinical questions of self-understanding in regard to individuals' life projects) and (b) ethical-political discourses (i.e., the self-clarification of collective identities) (cf. Habermas [1991] 1994, pp. 4–12, 16; [1992] 1996, pp. 96–97; 1998, pp. 215–216, 244). These ethical discourses are procedures that complement moral discourses, if the latter is insufficient to resolve failures in communicative action; Habermas nevertheless insists that universal moral discourses have a priority over ethical discourses (Habermas [1991] 1994, pp. 12–13, 48–56; 1998, pp. 37–38). In addition to moral and ethical discourses, the discourse ethics comprises two further discourses that are more relevant to Habermas' latter works on political theory (cf. Habermas 1986, [1992] 1996, 1998, 1992). This includes: (iii) pragmatic discourses, which are concerned with rational choices of means to given ends and compromises (Habermas [1991] 1994, pp. 8–11, 16) and (iv) discourses of application that determine which of numerous, morally valid norms is more appropriate for a particular context and how, 'in the light of all relevant features of the situation', it should be applied (cf. Habermas [1991] 1994, pp. 13–14, 37–38, 128–130; [1992] 1996, p. 109; 1998, pp. 45–46).

talism is dead or is in a crisis “could have been kept within bounds if the Marxists had been more utopian and therefore more scientific”. Nevertheless, as the ‘infeasibility’ meaning of utopias tends to prevail in the literature (e.g., Popper 1967b, pp. 138–148), the present inquiry adopts the term ‘possible world’ to refer to the possibly realizable meaning. The key, as pointed out by Heusinger (2013a; forthcoming, p. 344), to differentiate between both is the distinction of existing, possibly existing, and fictional issues (cf. Chmielewicz 1994, p. 45). The two presently relevant subclasses of issues are propositions covering facts (i.e., existing issues) and working hypotheses (i.e., possibly existing issues). Correspondingly, the shift of perspective is empirical: from the facts of the ‘factual world’ to the working hypotheses of the ‘possible world’. The crucial point is that the latter is based on possibly existing instead of fictional issues. This distinguishes a ‘possible world’ from a utopia. The change has to be realizable the ‘possible world’ to be possible (Frank 2009, p. 169). Therefore, Heusinger (2013a; forthcoming, p. 344), based on Chmielewicz (1994, p. 241), suggests that ‘context shifts’ need to be assessed in terms of their logical, theoretical, technological (cf. Henderson 1901, pp. 471–473)[147], economical, and normative possibility. Whereas normative possibility, the guiding principle of the design process, is already ensured through the preceding step, the remaining four assessments form a hierarchy (cf. Ostrom 1986, p. 19) as schematically depicted in figure 8.5. That is, each assessment presupposes an affirmative answer to the respective preceding assessment (e.g., economic possibility presupposes technologies, which determine the involved costs; technologies can be developed only if a change is theoretical possible; the theoretical possibility presupposes logical possibility).

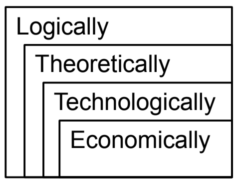

Figure 8.5: The Possibility Hierarchy, adapted from: Heusinger (forthcoming)

The following two lines of reasoning, complemented by a brief introductory description of the respective assessment, demonstrate that the justification of ‘possible worlds’ has to be confined—for practical and normative reasons—to the assessment of their theoretical possibility. However, this neither compromises their ability to inform practical discourses about options for social change nor is this justificatory evidence less credible than the one gained through the evaluation of an instantiation of an artifact in a practical setting (see sections 5.2 and 5.3). It merely indicates that ‘possible worlds’ are, as any other scientific contribution, generally fallible.

Firstly, the assessment of *logical possibility*, the central focus of D. K. Lewis (1986), would essentially require a ‘proof’ that the formalized versions of the ‘possible world’ and the ‘factual world’ do not contradict each other. Such an assessment not only presupposes a mature disciplinary terminology, but, assumed such a vocabulary was given, would provide an argument that (i) does not indicate that the ‘possible world’ is indeed realizable in the real world and (ii), following from the former, tends to be an anemic argument in regard to the central aim of C&E research, that is, to enlighten actors and inform ‘political’ action (Comstock 1982, p. 386).

147. The term ‘technology’ is used in a much broader sense than the term itself might suggest. It includes, besides pure technological aspects, social technologies such as norms, rules, etc. to organize social systems.

Secondly, the technological and the economic possibility assessment both do their bit to answer the question of "How and at which cost can a 'possible world' be implemented?". More specifically: the *technological possibility* is concerned with means or interventions required to realize desirable ends in certain contexts. However, as indicated in footnote 147, technology is, following Henderson (1901, pp. 471–473), understood is a sense going beyond the pure technological notion the term might carry for the audiences specified in section 3.1 and includes social technologies (e.g., rules, norms, etc.) that are the primary means to channel human behavior and organize social systems (cf. Bots 2007, p. 390–392; Bots and Daalen 2012, p. 2; North 1990, pp. 73–104; Ostrom 1986, p. 6; 2007, pp. 37–39; 2011, p. 19–21; O. E. Williamson 2000, pp. 595–600). In turn, suitable technologies can be assessed for their *economic possibility* by specifying or estimating their costs as well as their benefits and comparing the results with the resources available. The costs considered within such an evaluation include "the various inputs, both direct and indirect, required to set up and run [. . .] an intervention" (Robson 2004, p. 136), that is, in addition to the life cycle costs of an intervention the resources required for 'transient structures' (cf. Bots 2007, p. 384) are part of the assessment as well. The definition of benefits by contrast is fuzzier because it depends on the employed approach (cf. Bouyssou et al. 2001, pp. 73–79; Cellini and Kee 2010, pp. 493–495; Robson 2004, p. 137): whereas a cost-benefit analysis tries to measure everything in monetary terms[148], a cost-effectiveness analysis uses whatever units appear to be most sensible. In respect to the design of 'possible worlds', both assessments require a concrete context that defines which technologies are suitable and at which cost they can be implemented in that very context. In contrast to practical socio-technical system design and DSR, both of which are carried out in the real world, such a concrete context is not given in the present inquiry for reasons outlined before, especially in sections 5.3 and 5.2. Correspondingly, these two higher levels of the possibility hierarchy are excluded from C&E DSR projects for practical reasons. However, the main rationale for confining the design of 'possible worlds' to a theoretical endeavor is a normative consideration (see Carlsson and Berkes 2005, p. 74; Mathews 2013, p. 150; Habermas [1971] 1973, pp. 28–32; [1981] 1987b, p. 51; Lasswell 1968, pp. 181–183, and section 5.3): C&E research is seen as a research endeavor that provides insights for practical discourse in which affected people debate about changes in social systems and have the final authority. In other words, C&E research should inform about possible options, but the people affected are responsible for the concrete configuration of change as well as for its initiation and realization, which might or might not be supported by research 'facilitators' (see section 5.2). Similar arguments to be cautious with the benevolent paternalism emanating from the scientific ivory tower can be found in other (applied) disciplines as well (see also sections 5.5, 5.3, and 5.2):

> "We *researchers-evaluators-developers-consultants engage in serious business. We deal with people's lives*–not only the lives of young people, but of teachers and other adults. *We deliberately try to change them, and seldom exactly as they would change themselves.* We interfere with their lives, convinced we are helping them, toward something better. We are opposed to coercion, yet inattentive to the moral complexity of enticement. In the process of change how much should we give people opportunity to approve, to participate in controlling, the changes we would make in their lives? [emphasis added]" (Stake 1989, pp. 89–90).

Therefore, the core activity of this third step is to assess the *theoretical possibility* of the

148. See the criticism of this approach above, in part I, and in sections 5.3 as well as 5.5.

‘possible world’ sketched in the preceding step. More precisely: it has to be justified that the identified intervention entry points can be exploited by an intervention, which attunes the structure of the ‘factual world’ to the one envisioned for the ‘possible world’. The more formal expression of such interventions is, using the terminology introduced in section 7.3, expressed in a so-called technological proposition (cf. Aken 2005, pp. 388–389; Bunge 1966, pp. 341–342; Chmielewicz 1994, p. 9; Carlsson 2007, p. 80; Habermas [1981] 1987b, pp. 75–78; Niiniluoto 1993, pp. 11–13): “If you are in the ‘factual world’ and want to remove limitation (L) by exploiting entry point (E), intervention (I) *might* result in structure (S) in which mechanism (M) produces the more desirable outcome (O)”. This is, as indicated above, a shift of contexts (from context 1 to context 2) (cf. Pawson and Tilley 1997, pp. 72–78; Tilley 2000, p. 6), from the ‘factual world’ closer to the ‘possible world’ (see figure 8.6).

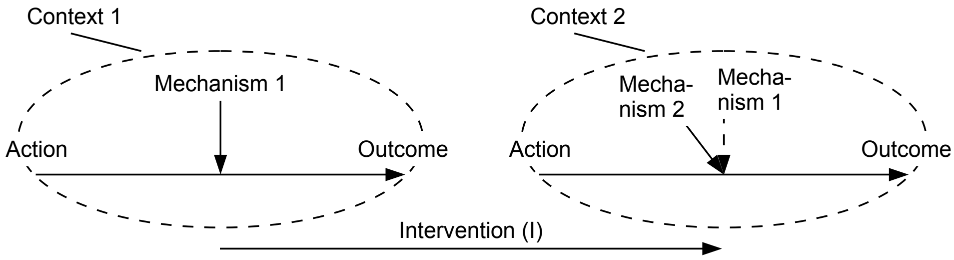

Figure 8.6: Context Shifts, adapted from: Pawson and Tilley (1997, p. 76)

As indicated in the discussion of the preceding step and as depicted in figure 8.4, the transition from the ‘factual world’ to the ‘possible world’ is often too complex to be realized by a single intervention but requires a chain of interventions that together form an intervention on a higher stratum. This sequencing introduces a recursive element: an intervention requires a certain context, which, if not yet existing, needs to be created using a different intervention. In other words, the intervention leading to the ‘possible world’ is essentially a sequence of multiple lower level interventions (see figure 8.4), which can be created by either (a) transforming theoretical propositions, whose causes are manipulable (Bunge 1966, p. 342), or (b) using “trail-and-error procedures and experimental tests” (Niiniluoto 1993, p. 13). A third strategy, the one employed in the present inquiry (see section 8.2), is to synthesize the insights gained in applied research using the ‘realist synthesis’ (Pawson 2006)[149]. However, all three approaches can justify an intervention only partially, a consequence following from the uniqueness of contexts and the open system perspective (see section 7.3). Nevertheless, the realist synthesis has advantages over the other two approaches, because it allows to extract the results of different interventions. These extracted draft meanings or organizational options span the space of theoretically possible and, from the perspective of the underpinning value position, acceptable variations in the structure of the ‘possible world’. Correspondingly, the ‘possible world’ is grounded through the already demonstrated possibility of the interventions reported in those studies from which draft meanings or organizational options were extracted [an advantage over (a)] and a greater applicability through the consideration of variations across contexts [an advantage over (b)]. This implies that ‘possible worlds’ are not clear predictions; however, “[a]lthough we obviously cannot predict the future we can make some judgements about what is or is not feasible and desirable” (Sayer 1997, p. 478). This has also been realized much earlier by, for example, Mill ([1843] 1882, pp. 586–589), who,

149. For ISR studies that employ the realist synthesis see Carlsson (2012) and Dobson, Myles, and Jackson (2007).

in the "Science of the Human Nature", argues that predictions of social sciences are not as exact as those of natural sciences, but that they are still valuable guides. Furthermore, seeing 'possible worlds' as fallible interim results leaves open the option to refine and redesign them in response to the growth of experience and the need to compromise (cf. Popper 1967a, p. 132). However, this flexibility comes at the expense of scope. In anticipation of the discussion in section 9, the abstract character of 'possible worlds', despite being compatible with the C&E demand to enable affected people to adapt 'possible worlds' to their local needs and circumstances, prevents 'possible worlds' to function as domain model for the design of concrete software architectures. Building these artifacts is based on the elicitation of requirements from a concrete context (see section 5.4), which differs from a 'possible world' by the inclusion of contingently related entities. Unfortunately, this information, determining the specificity of concrete architectures, is exactly what the 'possible world' abstracts from. In other words, the 'possible world' can only be utilized for building context-independent, domain-specific technical systems, that is, for reference architectures (cf. Bass, Clements, and Kazman 2003, p. 26; Angelov, Grefen, and Greefhorst 2012, see section 5.4).

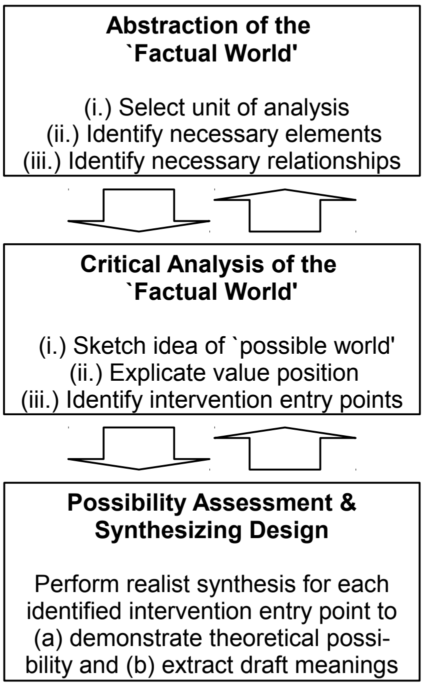

Figure 8.7: Method for the Design of 'Possible Worlds'

Before diving into the details of the realist synthesis as research strategy underpinning the third step of the design of 'possible worlds', a brief remark in regard to the summary of the foregoing discussion in figure 8.7 is inserted. As can be seen in this figure, the described steps are interdependent. This follows from the fact that performing a realist synthesis can and doubtlessly does provide new insights that allow to refine the sketch of the 'possible world' and the carved out structure of the unity of analysis (cf. Pawson and Tilley 1997, p. 126). Furthermore, the continually changing nature of social reality implies that this incremental refinement probably never ends and that theoretical constructs have to evolve accordingly. Therefore, a single research cycle, indicated by a saturating realist synthesis, can only provide interim results—manifested in relatively stable but spatiotemporally bounded structures.

8.2 The 'Realist Synthesis'

"Human beings, who are almost unique in having the ability to learn from the experience of others, are also remarkable for their apparent disinclination to do so."

Douglas Adams

The 'realist synthesis' proposed by Pawson (2006) is a research strategy for the collection and analysis of data from the existing body of knowledge. In this view, it is a method in the narrow sense that provides guidance on how to 'learn' from the experience of others. Its focus is on the creation of the above-mentioned program theories to inform policy makers about where, why, and how a program works or fails (Pawson et al. 2005, p. 21). However, as indicated in the preceding section the realist synthesis is also considered to be an appropriate research strategy for the design of 'possible worlds' (cf. Heusinger, forthcoming): it allows to gather justificatory evidence to distinguish 'possible worlds' from utopias as well as to synthesize draft meanings and organizational options to refine the sketched 'possible world' so that it provides an adequate basis for the development of a technical system aligned with the 'possible world'. Therefore, the central aim of this section is to adapt the general procedure[150] suggested for the realist synthesis to the peculiarities of the design of 'possible worlds' as presented in the preceding section. Such a modification is unproblematic, because the realist synthesis is not an over-prescriptive procedure, mechanically leading to a specific result; rather, it is a general approach varying with inquiries' foci and purposes (cf. Pawson et al. 2004, pp. 25–26; 2005, pp. 25; Pawson 2006, pp. 94–96). Correspondingly, the following will braid the adaptation with an examination of the general technique as outlined in figure 8.8 (cf. Contrandriopoulos and Brousselle 2012, pp. 67–68; Pawson 2002b, 2003b; 2006, chap. 4; Pawson et al. 2004, 2005; Pawson and Manzano-Santaella 2012; Pawson and Tilley 1997; Tilley 2000). In addition to this focal point of the present section, the coming discussion will—en passant—also cater for the needs of the illustrative application of the method for the design of 'possible worlds' in part IV by incorporating some concrete advice for carrying out a realist synthesis. However, these suggestions are not specific to the exemplary case but represent general recommendations made in the literature.

As depicted in the first row of figure 8.8, the general procedure comprises six tasks (i.e., identify the review question, search for primary studies, appraise quality, extract data, synthesize data, and disseminate findings), which can be further broken down into specific steps. The following discusses each of these six general tasks and the comprised activities in respect to the third step of the design of 'possible worlds', that is, the 'Possibility Assessment & Synthesizing Design'.

The first task in a realist synthesis can be broken down into three steps: (i) map key program theories, (ii) prioritize identified theories, and (iii) formalize the review model. The mapping of key program theories aims, similar to the formulation of review questions, to specify the focus of the following activities. Such program theories are, as discussed in the second step of the design of 'possible worlds', underpinned by the conceptualization depicted in figure 8.2: they are "the *mechanisms* that mediate between the delivery (and receipt) of the program and the emergence of the outcomes of interest [emphasis in the original]" (Weiss

150. Although the realist synthesis' procedure resembles the one underpinning the 'standard review strategies' (cf. Dixon-Woods et al. 2004, pp. 11–27; Gough, Oliver, and Thomas 2012; Rudnicka and Owen 2012), there are substantial differences as the following discussion will explicate (see also Pawson et al. 2004, pp. 40–41; Pawson 2006, pp. 38–72, 78–79).

Tasks

1 **Identifying the review question**	2 **Searching for primary studies**	3 **Quality appraisal**	4 **Extracting data**	5 **Synthesizing the data**	6 **Disseminating the findings**
Map key programme theories	Background familiarization search				
Prioritize key theories for investigation	Search for sources of programme theory		Annotation, note-taking on candidate theories	Prime focus of synthesis selected and formalized	Negotiation with decision-makers on analytic and policy focus
Formalize model of subset of hypotheses to be tested	Search for empirical studies to test model	Assessment of relevance of primary inquiry to inform model	Collation of materials from selected primary studies		
		Assessment of rigour of primary data to test theory	Detailed reportage of evidence from each case study	Absorbing primary material into developing synthesis	
	Search for further empirical studies consequent on revisions to model	Further assessment of rigour as each study enters the synthesis	Differential reportage of evidence from each case study	Juxtaposing, adjudicating, reconciling, consolidating, and situating further evidence	Consultation on which emerging lines of inquiry should be followed
				Revised model of the complex and inter-related elements of programme theory	Summary theory to initiate process of 'thinking through' future implementation decisions

Time

Figure 8.8: Procedure of the 'Realist Synthesis', source: Pawson (2006, p. 103)

1998, p. 57). Table 8.2 gives an overview of generally possible questions that cover important aspects in regard to the examination of program theories. These general review questions can be utilized as starting points for an initial background search that allows to refine the questions in respect to the subject of interest (cf. Pawson 2006, pp. 80–81, and the first step of the second task depicted in figure 8.8). This indicates in which way the third step of the design of 'possible worlds' influences the creation of an abstraction of the factual world as illustrated in figures 8.1 and 8.7. Nevertheless, the vital aspect of this activity in the realist synthesis is to clarify the meaning of terms and to identify concepts (Rycroft-Malone et al. 2012, p. 3), because they are the pivotal element to bridge 'real world' experiences and transferable, theoretical knowledge:

> "The explanatory terms [...] operate at a middle level of abstraction. *They are concrete enough to be identified in particular primary studies and yet abstract enough that material on them can be uncovered across a medley of case studies*. This intermediacy allows the reviewer to test and develop the theories under review and is the key to producing transferable policy lessons [emphasis added]" (Pawson 2006, p. 82).

However, as a single review study cannot answer all of these questions (cf. Pawson 2006, pp. 81, 94; Pawson et al. 2005, pp. 27–28; Rycroft-Malone et al. 2012, p. 5), the second step in the first task is to select one review question and thereby focus the synthesis on a particularly important explanatory theme (cf. Pawson et al. 2004, p. 15; 2005, p. 25). In the final step this question is used to create a 'theoretically based evaluative framework' (Pawson

Table 8.2: Explanatory Compendium for Complex Programs, source: Pawson (2006, p. 80)

Categories	Key questions
Program Theories[a]	
	How is the program supposed to work?
Reasoning and Reactions of Stakeholders	
	Are there differences in the understanding of the program theory?
Integrity of the Implementation Chain	
	Is the program theory applied consistently and cumulatively?
Negotiation and Feedback in Implementation	
	Does the program theory tend to bend in actual usage?
Contextual Influences	
	Does the program theory fare better with particular individuals, interpersonal relations, institutions, and infrastructures?
History of the Program and Relationships with other Policies	
	Does the policy apparatus surrounding the theory advance impede it?
Multiple, Unintended, Long-Term Effects	
	Is the theory self-affirming or self-defeating or self-neutralizing?

[a] For a detailed and thorough analysis of the differentiation of program theories in the realist synthesis and related types of theories in the policy analysis and evaluation domain [e.g., the frequently quoted 'Program Theories' and 'Implementation Theories' distinguished by Weiss (1998, pp. 57–58, chap. 3)], see Blamey and Mackenzie (2007) and Stame (2004, pp. 61–63).

et al. 2005, p. 24) or 'data extraction form' (Rycroft-Malone et al. 2012, p. 4), which provides the template for extracting evidence from primary studies in the succeeding steps. In other words, the general approach for theory building based on a realist synthesis is to first (see also section 8.1)

> "articulate underlying programme theories and then to interrogate the existing evidence to find out whether and where these theories are pertinent and productive. Primary research is examined for its contribution to the developing theory. The overall intention is to create an abstract model of how and why programmes work, which then can be used to provide advice on the implementation and targeting of any novel incarnation of the intervention" (Pawson 2006, p. 74).

In this way the realist synthesis allows to "unpack the mechanism of how complex programmes work (or why they fail) in particular contexts and settings" (Pawson et al. 2005, p. 21). However, the design of 'possible worlds' differs slightly from this procedure: the review question is already given by the critical assessment (see section 8.1), and the goal is not to derive a 'full-fledged' model of why, how, and where interventions work or fail, but merely to identify, from the perspective of the value position underpinning the 'possible world', suitable interventions that address those problems for which the 'factual world' is criticized. This latter qualification indicates that not the program theory as an abstraction of the intervention is the central focus of the design of 'possible worlds'; rather, of interest are (i) the general possibility of an intervention and (ii) its progressive results, i.e., the draft meanings or organizational options resulting from an intervention's realization. Therefore, in respect to the design of 'possible worlds' the first task solely involves the definition of a data extraction form that comprises the entities relevant to (i) and (ii): the former, providing preliminary evidence that it is indeed possible to address the criticized problems in the 'factual world', is given by a scrutinized study that describes a successful intervention, the latter, substantiating that this very intervention leads to outcomes consistent with the 'possible world', refers to the extraction of the information about the context's structure before and after the intervention.

Table 8.3: Data Extraction Form, based on: Rycroft-Malone et al. (2012)

Full Reference of Study:	
Intervention:	
	Which steps were involved in the intervention?
Original Context:	
	In which contextual structure was the intervention introduced?
Resulting Context:	
	How has the contextual structure changed in response to the intervention?
Side-Effects:	
	Which side-effects of the intervention were identified?

Although not pivotal, the synthesis carried out in the third step of the design of 'possible worlds' should, in addition to the reported structural components, also try to carve out the working of interventions and possible side-effects. Both are useful arguments in practical discourses that are informed by 'possible worlds'. Therefore, the general template guiding the realist synthesis carried out to extract data from the existing body of knowledge for the design of 'possible worlds' is the one presented in table 8.3.

The goal of the second task is to locate primary studies that provide evidence for the speculative program theory created in the first task (Pawson 2006, p. 83). This involves the following four steps (see figure 8.8): (i) perform a background search, (ii) search for program theories, (iii) search for empirical evidence to test the model, and (iv) fine-tune the synthesis. Whereas the first two of these steps occur parallel to the activities involved in the first task (p. 83), the third step resembles a traditional literature review—differing only in its purposive nature (Pawson 2006, p. 85; Pawson et al. 2004, p. 20; Rycroft-Malone et al. 2012, p. 5). Before diving into the more detailed discussion of this step, the final step (iv), accounting for the unfolding awareness resulting from carrying out (i) to (iii), iteratively refines the search for primary studies (Pawson 2006, p. 85). In other words, carrying out the former three activities broadens the understanding of the program theory under investigation. This manifests itself in the identification of formerly unknown facets, which are, consequently, subjected to the above described procedure. This, in turn, leads back to the elaboration of (iii). As can be seen in figure 8.9, accounting for the incremental refinement of (iv) by the two dotted lines, the traditional literature review involves the following six activities (cf. Hagen-Zanker and Mallett 2013; Plano Clark and Creswell 2010, pp. 121–127): (a) define a review question, (b) select keywords, (c) create a search protocol, (d) perform a search and retrieve documents, (e) filter documents, and (f) synthesize evidence. As the first activity has already been discussed above and the last two activities resemble tasks three and four of the realist synthesis (see figure 8.8), the following elaboration is confined to the three remaining activities of a traditional literature review [(b)–(d)].

The first of those activities (b) comprises the identification of concise keywords, determined by breaking down the review question (Plano Clark and Creswell 2010, p. 122), and the retrieval of relevant synonyms[151]. Altinay and Paraskevas (2008, p. 47) suggest to further extend the set of keywords by including the British as well as the American spelling of each term. This could, in principal, be realized using wildcards[152]. However, test queries performed on the two most prominent databases for scientific research[153] (cf. Abrizah et al.

151. The Ph.D. retrieves synonyms from `http://thesaurus.com/`, accessed May 25, 2015.
152. Most databases offer '*' to replace zero to m characters and '?' as substitute for exactly one character. Sometimes '$', standing for zero or one character, is offered as additional wildcard (e.g., Web of Knowledge).
153. Google scholar, available at `http://scholar.google.de/`, accessed May 25, 2015, is the third large

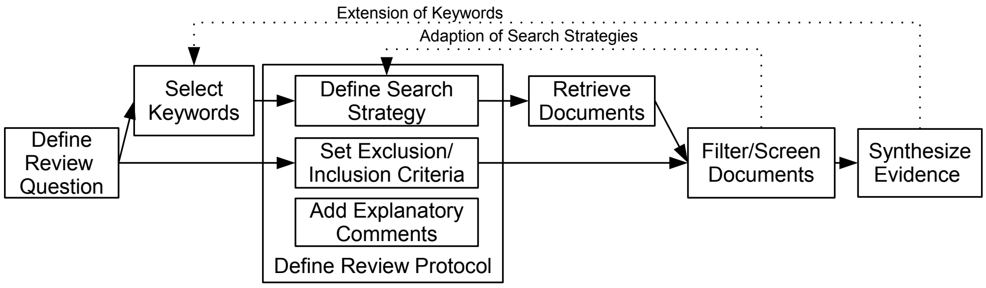

Figure 8.9: Literature Review Process, adapted from: Hagen-Zanker and Mallett (2013, p. 6) and Plano Clark and Creswell (2010, pp. 121–127)

2013, pp. 722; Bar-Ilan 2010, p. 495; Salisbury 2009), that is, the Web of Knowledge[154] and Scopus[155], indicate that searching[156] for 'organization' and 'organisation' results in the same set of documents[157]. In contrast, search queries using wildcards created an unexpected behavior of the Web of Knowledge search engine: querying for 'organi?ation' (n = 142,188), 'organi*ation' (n = 142,315), and 'organi$ation' (n = 142,189) did not, as it was expected, result in at least the same number of hits that were returned for the non-wildcard queries ('organization' and 'organisation' respectively; both: n = 183,826)[158]. In response to this behavior the present inquiry adopts the following conventions based on the insights gained through the performed tests: (i) only the American spelling of keywords in their singular form is used, because the result set includes documents with the British spelling as well as plural forms of both spellings (e.g., querying for 'city' and 'cities' results in the same number of hits) and (ii) similar keywords are truncated and combined with wildcards as this simplifies the query strings without resulting in an unexpected behavior (e.g., the keyword 'commun*' was used to retrieve documents containing 'communal' as well as 'community' and both these terms were present in the set of retrived documents).

The third activity of a traditional literature review (c) refers to the creation of a review protocol. This includes: (i) the definition of search strategies, (ii) the specification of exclusion and inclusion criteria, and (iii) an explanation of the rationale underpinning the two former blocks. In the present inquiry the *search strategy* is defined as a triple comprising the two above-mentioned databases, query constraints, and search strings. *Query constraints* refer to restrictions in regard to literature types and the publication time span. In respect to the former the realist synthesis (e.g., Pawson et al. 2004, p. 21; 2005, p. 29) suggests to extend the traditional scope of literature reviews and include 'grey literature', because these contributions provide additional insights for the development of full-fledged program theories. However, the present inquiry has a narrower focus; therefore, it does not make use of this literature type. Instead, it focuses on peer-reviewed journal articles, because they provide a good trade-off between timing and quality standards (cf. MLA 2009, p. 34; Plano Clark and Creswell 2010, pp. 119–120, and figure 8.10). The *time span*, that is, the year of an article's publication, is

database, containing even a larger set of documents. However, the quality of indexed entries is not controlled (Aguillo 2012, p. 343) and it is still not very 'user friendly' (Bar-Ilan 2010, p. 495). Therefore, the present inquiry does not make use of Google scholar during the synthesis.

154. Available at: `http://www.webofknowledge.com/`, accessed May 25, 2015.

155. Available at: `http://www.scopus.com/`, accessed May 25, 2015.

156. All of the following searches were conducted on October 7, 2013, and restricted to English peer-reviewed articles published between 2004 and 2013.

157. Both, the Web of Knowledge (n = 183,826) and Scopus (n = 305,133) delivered the same number of hits for both queries.

158. This strange behavior could be reproduced using further test terms such as 'neighbor' and respective variations.

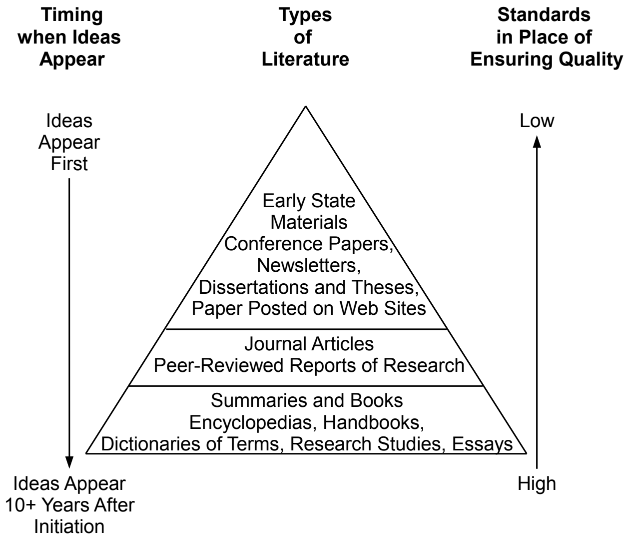

Figure 8.10: Timing and Quality of Different Literature Types, source: Plano Clark and Creswell (2010, p. 119)

confined to the period of 2004-2013, because ten years are considered to be a threshold for up-to-date articles in social sciences (Turabian 2007, p. 34). Finally, the *search strings* are created in the following three steps (cf. Altinay and Paraskevas 2008, p. 47): firstly, keywords are reduced to their basic form and connected with the above-mentioned wildcards; secondly, the resulting strings are grouped into categories using the `OR`-operator; and thirdly, relevant categories are combined using the `AND`-operator. The definition of *exclusion and inclusion criteria*, the second central activity within the third step, uses the review question to derive 'objective' factors for excluding irrelevant documents. Explicating these criteria increases the review's transparency by ensuring that documents are filtered in a consistent and replicable manner (cf. Altinay and Paraskevas 2008, pp. 48–49; Hagen-Zanker and Mallett 2013, p. 8; Rycroft-Malone et al. 2012, p. 6). In contrast to query constraints, these criteria do not apply to the complete study but are content-related criteria derived from the review question.

The next step (d) involves two activities: whereas the first uses the above-mentioned search string to retrieve documents from the selected databases, the second filters out those documents that are relevant to the review by scrutinizing each document's title, abstract, and index terms in respect to the defined exclusion/inclusion criteria (cf. Hagen-Zanker and Mallett 2013, p. 12; Rycroft-Malone et al. 2012, p. 6; Turabian 2007, p. 33). This initial screening not only results in a set of relevant documents, but it might also trigger the refinement of the review protocol as indicated by the dotted lines in figure 8.9 (cf. Creswell 2009, p. 32; Pawson 2006, p. 85; Pawson et al. 2005, pp. 28–29). Pawson (2006, p. 86) suggests that such a refinement stops, if "sufficient evidence has been assembled to satisfy the theoretical need or to answer the [review] question" (see also Pawson et al. 2004, pp. 20–21; 2005, p. 28). To decide if a point of saturation is reached, collected studies need to be assessed for their 'rigor' parallel to the initial screening (step two and three in the third task as depicted in figure 8.8). It has to be noted that the understanding of 'rigor' as used in the realist synthesis differs considerably from the conventional notion as manifested in the hierarchy of evidence[159] . Similar to the above argument, within the realist synthesis rigor is not an

159. The hierarchy of evidence is a core component of the evidence-based movement that, originating from medicine, has gained considerable attention in many disciplines such as policy design/making, social welfare, edu-

attribute applying to the complete article or, more precisely, to the employed method, but it is a feature of the inferences drawn within the inquiry. It is a characteristic of the 'fragments of evidence' (Pawson 2006, p. 89) in the reviewed study: each of these fragments might have "sufficient weight to make a [...] credible contribution to the test of a particular intervention theory" (Pawson et al. 2005, p. 30). In fact, studies regarded as extremely rigorous often exclude information, for example, contextual peculiarities, which are important for the generation of trans-contextual knowledge (cf. Hagen-Zanker and Mallett 2013, p. 5; Heusinger 2013a, pp. 340–341; Pawson et al. 2004, p. 22; 2005, p. 29). In other words, studies are not excluded solely based on their methodical approach, but their content is assessed for its usefulness in respect to the review's purpose. This has vital consequences for the next tasks of the realist synthesis, which, by implication, exhibit considerable differences to the activities carried out in the traditional literature review. However, as a comparison of both approaches is unrewarding in respect to the goal of this section, the remainder concentrates on the three final steps of the realist synthesis as shown in figure 8.8.

The data extraction as the fourth task in the realist synthesis is broken down into three steps (cf. Pawson et al. 2004, pp. 23–24; 2005, pp. 30–31; Pawson 2006, pp. 91–92): annotation, collation, and reportage. The first of these steps refers to the annotation or highlighting of relevant fragments of evidence in each study which passed the filtering process using, for example, the SQ3R method[160] (F. P. Robinson 1970). Based on the deeper understanding that unfolds during this activity, i.e., the thorough examination of the existing body of knowledge, the identified fragments can be, as suggested by the next step, collated across dispersed articles as well as disciplines:

> "The reviewer experiences a shift from divergent to convergent thinking as ideas begin to take shape and theories underpinning the intervention gain clarity. Accounts of systematic review which insist on its reproducibility and thus mechanical nature are being economical with the truth in not recognizing this ineffable point of transformation and defining feature of good scientific inquiry" (Pawson 2006, p. 93).

Finally, the collated fragments are reported using the afore-mentioned data extraction template (see table 8.3), instead of categorizing reviewed studies into related themes, for example, using literature maps as suggested by the traditional literature review (e.g., Creswell 2009, pp. 30, 33-34; Plano Clark and Creswell 2010, pp. 128–129). This is a direct consequence of considering not whole articles but each study's fragments of evidence as the review's unit of analysis (cf. Pawson et al. 2004, p. 21).

In the second to the last step of the realist synthesis, the collated and reported fragments of evidence are synthesized. That is, fragments are used for the focus-specific refinement of the initially proposed program theory (cf. Pawson 2006, pp. 93–94; Pawson et al. 2005, p. 31, see table 8.4 for a non-exhaustive overview of typical foci). In other words, the central

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cation, among others (see Hansen and Rieper 2009, pp. 143–154; Pawson 2006, pp. 1–16, for an overview). The hierarchy of evidence is created along the 'quality' of the evidence that different methods can deliver. Although there are numerous versions of the hierarchy, they all have, depending on the methods considered, a ranking similar to the following descending order (cf. Glasby and Beresford 2006, p. 271; Harbour and Miller 2001, p. 335; Pawson 2006, p. 49): systematic reviews and meta-analyses of randomized controlled trials (RCT), RCTs, non-randomized interventions, observational studies, non-experimental studies, and expert opinion. However, such hierarchical orderings have been heavily criticized (cf. Campbell 1969; Glasby and Beresford 2006, pp. 275–282; Pawson 2003a; 2006, pp. 49–51; Pawson et al. 2005, pp. 29–30, for extensive discussion).

160. SQ3R stands for Survey, Question, Read, Recite, and Review. In respect to the present case only the first three steps tend to be relevant. However, the data extraction is an iterative processes and each document is consulted more than once. Therefore, the two further steps are, at least, implicitly involved. Correspondingly, the SQ3R method as outlined F. P. Robinson (1970) is a useful complementary guidance for the extraction of data.

Table 8.4: Typical Foci of a Realist Synthesis, summarized from Pawson et al. (2004, p. 25–26), Pawson et al. (2005, p. 25), and Pawson (2006, pp. 94–96)

Synthesis to	The goal of a review with this purpose is to
question program theory integrity	explicate the weak points and stumbling blocks or blockages in the implementation chain of interventions.
adjudicate between rival program theories	elaborate on the reasoning underpinning different types of interventions aiming to achieve similar goals to identify which permutation of mechanisms is most successful.
consider the same theory in comparative settings	understand the influence of contextual influences on the intervention, i.e., try to identify patterns of winners and losers of an intervention.
compare official expectations with actual practice	contrast the regulatory or legislative expectation of an intervention with the effects of the intervention in concrete settings

activities in this task, also called the creation of ‘chains of inference’ (Rycroft-Malone et al. 2012, p. 7), are the extension and refinement of the speculative model’s structure based on the data extracted from the existing body of knowledge (Pawson 2006, p. 96). To ensure that these chains of inference are created in a systematic and transparent manner, Pawson (2006, p. 99) demands that each inferential shift is justified in relation to the original material or collated fragment, which caused the respective qualification. The focus in respect to the design of ‘possible worlds’ can be, analog to the non-exhaustive list of foci stated in table 8.4, specified as follows: (a) justify the possibility of all hypothesized context shifts to distinguish the ‘possible world’ from a utopian proposal and (b) extract draft meanings and organizational options from those interventions that, consistent with the value position underpinning the ‘possible world’, address problems for which the ‘factual world’ is criticized to refine the sketched ‘possible world’ and to provide the basis for the development of a technical system aligned with the ‘possible world’.

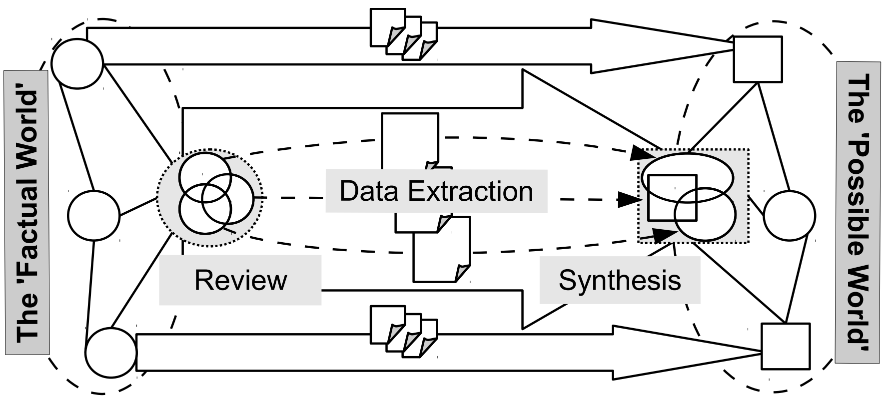

Figure 8.11: The Realist Synthesis and the Design of ‘Possible Worlds’

Based on this explication of the review’s purpose, the interplay of the afore-mentioned tasks of the realist synthesis and the activities suggested by the method for design of ‘possible worlds’ can be described as follows: within the first two steps of the design of ‘possible worlds’ the structure of the ‘factual world’ as well as the sketch of the ‘possible world’ are explicated (dotted ellipses in figure 8.11). Furthermore, the critical assessment, as third activity in the method’s second step, provides the review question by specifying the type of intervention(s) required to transform the structure of the 'factual world' into the more desirable structure of the 'possible world' (solid arrows in figure 8.11), that is, the broad idea of the structural transformation required to enable the exercise of formerly inhibited powers. Therefore, instead of refining a program theory to identify stumbling blocks, variations, contextual success factors, or differences in expectation and realization as suggested by the typical foci summarized in table 8.4, the realist synthesis is used to extract two types of insights from the reviewed set of studies (documents in figure 8.11): on the one side, the review scrutinizes the set of filtered documents to identity those inquiries that report about successful and, defined in respect to resemblance of the required transformation, suitable interventions as they are the empirical evidence, which justifies that the hypothesized context shifts are realizable (a). On the other side, the studies are examined for fragments of evidence that provide information about the progressive aspects of the 'possible world' (b) as this allows to carve out the mechanism(s) operating in the 'possible world'. The variety of draft meanings and organizational options from which this can be inferred simultaneously reflects the diversity of contexts within the domain to which the reference architecture, as complement to the 'possible world', needs to adapt. As indicated in table 8.3, this requires to extract the following data from the reviewed studies: (i) the origin of the intervention (solid elements in the dotted element in the 'factual world' in figure 8.11); (ii) a description of the intervention itself (dotted arrows in the solid arrows in figure 8.11); and (iii) the resulting context (solid elements in the dotted element of the 'possible world' in figure 8.11). Side-effects, as the fourth element in the data extraction template, are not depicted in figure 8.11, but they can be imagined as properties of program theories that indicate which trade-offs are inherent to the respective intervention's realization. Before diving into the details of the method for the design of the technical system that accompanies the designed 'possible world', the remainder of this section examines the realist synthesis' closing task.

Although there is no final closure in a theory building effort based on a realist synthesis, the last step in the general procedure refers to the dissemination of the created program theory. As depicted in figure 8.8 this involves the negotiation with and consultation of stakeholders as well as the creation of policy recommendations. Whereas the former two activities are melted into the iterative, repetitive, and unfolding process described above (cf. Pawson et al. 2004, p. 28; Pawson 2006, p. 102), also manifested in the two-dimensional organization of the procedure, the creation of policy recommendations can be described as follows (see also Pawson 2006, p. 100):

> "Accordingly, what the 'recommendations' describe are the main series of decision points through which an initiative has proceeded, and the findings are put to use in alerting the policy community to the caveats and considerations that should inform those decisions" (Pawson et al. 2004, p. 27)."

As Pawson (2006, p. 101) emphasizes, compatible with the view to consider all knowledge as fallible (see section 7.3) and to apprehend 'possible worlds' as theorizing products (see section 8.1), the created program theory, underpinning created policy recommendations, is not an irrevocable theory, but merely 'some more knowledge'—an interim theory that is open to further refinement in subsequent research cycles.

8.3 The Design of Reference Architectures

"A large software system often looks to its maintainers as a giant house of cards in which pulling out any one element might cause the whole edifice to collapse."

B. Meyer (1997, p. 6)

Within this section the perspective of the inquiry's research design shifts from the social facets of socio-technical systems to the technical side (see figure 8.1). ICT applications, as indicated by B. Meyer's analogy, need to be planned carefully and systematically to avoid the risk of a 'collapsing building'. The goal of the following discussion is to elaborate on one such method for the systematic design of technical systems. In respect to the target audiences specified in section 3.1, it is assumed that the readers have a certain level of background knowledge in regard to the construction of technical systems and their 'blueprints', which suggests that the degree of detail can be lower than in the preceding sections. On the other side, as revealed by the present inquiry's objectives (see section 6.2), the development of technical systems, or more precisely their 'blueprints', as originary ISR endeavors is merely an additional exercise that illustrates how a 'possible world' can be used for the design of a reference architecture—the natural complement of a 'possible world' (see section 5.3). Therefore, although the following provides, based on the discussion in section 5.4, the methodical underpinning that allows to develop a reference architecture utilizing the artifact created with the method developed in section 8.1, the present section's goal is not to present a comprehensive and full-fledged reference architecture development approach, which is currently not existing in the disciplinary body of knowledge (see section 5.4), but, leaning towards the pragmatic side of scientific research, to advance a preliminary vehicle that, although tentative, is sufficient to demonstrate how the construction of 'possible worlds' extends the build-evaluate loop's context of discovery (see section 5.2).

In respect to this goal, two of the insights gained in section 5.4 are presently important: (i) although there is no clear and precise definition of the term 'reference architecture', it can be interpreted as a more abstract software architecture, and (ii) the reference architecture development framework proposed by Angelov, Grefen, and Greefhorst (2012) makes 'only'—no matter how important and useful—recommendations in respect to the granularity and the type of structural perspectives that characterize a congruent reference architecture. The latter aspect already leads to the conclusion that the proposed framework needs to be extended in respect to the construction of reference architectures (see section 5.4). According to (i), this can be achieved by appropriating software architecture development approaches. Correspondingly, the present section's goal can therefore be specified as attuning—in a pragmatic manner—a method for the design of software architectures to the peculiarities of (a) reference architectures and (b) 'possible worlds'.

The software engineering literature is full of suggestions of approaches that are concerned with the construction of technical systems (see Boehm and Turner 2004, appx. A; Fowler 2004b, pp. 19–26; Pressman 2010, chap. 2–3; Esposito and Saltarello 2009, pp. 26–29; Leffingwell 2011, chap. 1, for overviews). The variety of these proposals forms a continuum that ranges from agile to disciplined (cf. Barlow et al. 2011, pp. 32–34; Boehm and Turner 2004, pp. 22–25; Edberg, Ivanova, and Kuechler 2012, pp. 284–286). Even though the selection of one approach depends, inter alia, on aspects such as the criticality or risk of the endeavor, the size of the project as well as the team, the dynamism of requirements, etc. (cf. Barlow et al. 2011, pp. 32–34; Boehm and Turner 2004, pp. 54–57; Cockburn

2000; McConnell 2004, pp. 32–42), a key criterion influencing the methodical choice is the frequency with which requirements change: in circumstances in which the frequency is high, agile or adaptive methods are preferable over disciplined approaches; the latter, in contrast, are more suitable in large and critical projects with relatively stable requirements (cf. Barlow et al. 2011, pp. 32–34; Boehm and Turner 2004, p. 55; Bass, Clements, and Kazman 2013, 275–281, 287). Beside these rather 'objective' features, subjective criteria such as experience and expertise are also decisive aspects (cf. Boehm and Turner 2004, p. 25; DeMarco 2009, p. 96). However, as implied by the continuum, hybrid stances attempt to bring together both camps by incorporating elements and procedures from each side (cf. Barlow et al. 2011, pp. 34–38; Cao, Mohan, and Ramesh 2009, pp. 339–341; Edberg, Ivanova, and Kuechler 2012, pp. 287–288; Waardenburg and Vliet 2013, pp. 2169–2170).

Although the present inquiry opts for one such hybrid position, the approach taken leans more towards the agile side of the continuum[161]. This adaptive orientation, on the other side, might raise an objection in regard to the inherent tension between the prescriptive nature of reference architectures as blueprints for software architectures systems (see section 5.4) and agile principles such as the "working software over comprehensive documentation" as stated in the 'Manifesto for Agile Software Development'[162] (see, for example, Rozanski and Woods 2005, pp. 88–89). However, as Bass, Clements, and Kazman argue (see also Abrahamsson, Babar, and Kruchten 2010; Booch 2010, p. 96; Leffingwell 2011, chap. 20; Madison 2010):

> "In fact, the question for a software project is not 'Should I do Agile or architecture?', but rather questions such as 'How much architecture should I do upfront versus how much should I defer until the project's requirements have solidified somewhat?', 'When and how should I refactor?', and 'How much of the architecture should I formally document and when?'. We [Bass, Clements, and Kazman] believe that there are good answers to all of these questions, and that Agile and architecture are not just well suited to live together but in fact critical companions for many software projects" (Bass, Clements, and Kazman 2013, p. 275).

Correspondingly, as this objection does not get in the way of appropriating agile techniques for the venture pursued in this section, the discussion now can turn to the approach that is adapted to realize the goals specified above. The procedure underpinning the following endeavor is the one suggested by Microsoft's 'Patterns & Practice' team (Meier et al. 2008, 2009). It is not only a method proposed by the largest 'Software & Programming' company[163], which gives it a certain degree of credibility, but it is also one of the few techniques specifically concerned with the development of software architectures. Furthermore, the author has some practical experience, which, as indicated above, is one factor in the selection process. However, other criteria such as team and project size, the maturity of requirements, etc., all suggest that this is in fact a suitable selection.

As shown in figure 8.12, the process starts with the identification of the 'architecture objectives', which refers to the foundational decisions in the development of an architecture—or

161. See Rozanski and Woods (2005, pp. 56–60 and chap. 7) for an approach that leans more towards the disciplined side of the continuum. More extensive and elaborated discussions of the interplay between agile development and architectural design can be found in Abrahamsson, Babar, and Kruchten (2010), Bass, Clements, and Kazman (2013, chap. 17), Booch (2010), Leffingwell (2011, chap. 20), and Madison (2010).

162. The full set of principles of the Manifesto for Agile Software Development is available at: `http://www.agilemanifesto.org`, accessed May 25, 2015.

163. Microsoft is ranked as the largest 'Software & Programming' company in 'Forbe's Global 2000' ranking, the list of the 2,000 largest enterprises worldwide (see Forbes 2013).

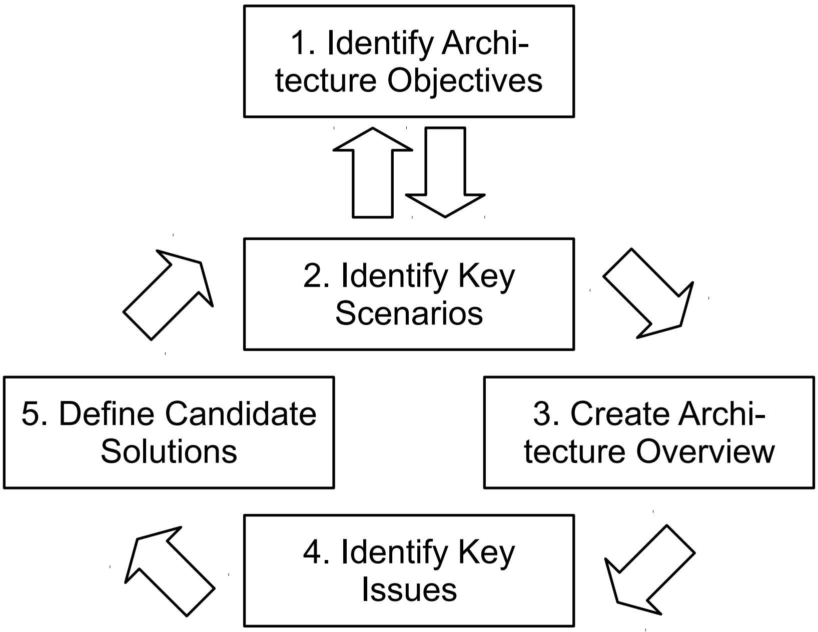

Figure 8.12: Architecture Design Cycle, adapted from: Meier et al. (2009, p. 38)

as Brooks (1987, p. 17) puts it: "The hardest single part of building a system is deciding what to build". However, such a decision is made in respect to requirements spanning the problem space in which a solution is constructed. This implies that the approach requires certain inputs, such as use cases and usage scenarios, that provide the material for its first activity (cf. Meier et al. 2009, p. 37). Unfortunately, neither the architectural design cycle depicted in figure 8.12 nor the method for the design of 'possible worlds' presented in section 8.1 provide any guidance on how to create such a requirements model. Therefore, an intermediary step, i.e., the 'create/refine requirements model', is added as a bridging activity. Consequently, the following examination starts with this additional prerequisite before it turns to those activities that are comprised in the architectural design cycle.

Create/Refine Requirements Model

Within this first, additional step the designed 'possible world' is transformed into a 'requirements model', which is defined as a representation of the three key features of a technical system (cf. Pressman 2010, pp. 107–109; Wiegers and Beatty 2013, pp. 7–10): its user class-specific usage scenarios (i.e., user requirements), the functions the system delivers (i.e., functional requirements), and its specific characteristics and properties (i.e., non-functional requirements). By gathering this information about a future technical system, the requirements model provides the foundation or material for all subsequent design steps. The creation of a requirements model proceeds along the steps summarized in table 8.5[164] (see also Wiegers and Beatty 2013, pp. 15–17, chap. 7), each of which will be discussed in turn.

164. The discussion of Pressman (2010, chap. 5–7) also includes a seventh step, i.e., the management of requirements. However, following Wiegers and Beatty (2013, pp. 17–18), this step is considered different from the creation or development of requirements, which are the central concern of this first step in the method for the design of (reference) architectures. Although it is recognized that tracking and evaluating newly emerging requirements throughout the process as well as reviewing requirements for correctness, completeness, and consistency in response to changes are important activities in a software project, the focus of this section is not to develop a comprehensive and full-fledged reference architecture design method as described above.

Table 8.5: Creation of a Requirements Model, adapted from: Pressman (2010, chap. 5–7)

Activity	Description
1. Inception	Identify stakeholders and write, based on some initial discussions, a short 'product request' that entails a brief description of the problem space as well as the desired solution.
2. Elicitation	Create the following lists from multiple viewpoints: (i) a list of objects, which are either part of, interact with, or produced by the solution, (ii) a list of services, which manipulate objects or interact with them, (iii) a list of constraints existing in the context, and (iv) a list that defines performance criteria.
3. Elaboration	Refine gathered information through the creation of use cases, which describe how the users interact with the system, and extract analysis classes, their properties, provided services, and their relationships from these descriptions.
4. Negotiation	Identify conflicting requirements and reconcile conflicts through prioritization and negotiation.
5. Specification	Create a final specification of internally consistent requirements from multiple points of view, i.e., a set of models (e.g., scenario-based models, data models, class-oriented models, flow-oriented models, and behavioral models) that together constitute the 'requirements model'.
6. Validation	Review specification to remove errors, ambiguities, inconsistencies, omissions, and nonconformities.

The first activity listed in table 8.5, that is, the inception phase, involves a discussion with stakeholders to create a product request, which is also referred to as the elicitation of 'business concerns' (IEEE 2004, p. 2_5)[165] or 'business requirements' (Wiegers and Beatty 2013, p. 8). As there are no stakeholders with whom such business requirements could be discussed, this activity tends to be in conflict with confining the design of 'possible worlds' to the theoretical level (see sections 5.2 and 5.3 as well as figure 8.1) as well as the aim of designing a reference architecture that has no specific stakeholders (Angelov, Trienekens, and Grefen 2008, 229–230). However, this 'direct user involvement' (Steward and Williams 2005, p. 210), if possible at all, is just one of the techniques involved in the process of creating a requirements model. Steward and Williams (2005, p. 210) point out that requirements are also gathered using indirect evidence about the user (e.g., extrapolating user characteristics from organizational documents or comparable technical systems)[166] and the scripting of users (e.g., the development of visions about the user) (see also Woolgar 1991, pp. 67–69). This can be interpreted as the construction of 'hypotheses about the user' (Bastelaer and Lobet-Maris 1999, p. 2), which is manifested in terms like 'user classes' (Wiegers and Beatty 2013, pp. 105–107), 'stakeholder classes' (Rozanski and Woods 2005, pp. 111–115), or 'user roles' (Cohn 2004, pp. 31–33). In other words, not only theoretical but also practical design efforts

> "must confront the inevitable metaphorical leap in creating a representation of 'the user' in a context of incomplete information about current users and their requirements (let alone users who do not yet exist)" (Steward and Williams 2005, p. 216).

In practical endeavors such problems are circumvented by involving 'user representatives' (Cockburn 2001, p. 15) or 'on-site users' (cf. Cohn 2004, pp. 39–40), which, in the agile terminology, are also called 'product owners' (cf. Leffingwell 2011, pp. 201–225; Schwaber 2004, chap. 5), into the daily development cycles. Although, this option is not directly avail-

165. The page number 2_5 refers to the fifth page of the second chapter.

166. This can also be achieved by involving 'proxy stakeholders' (Rozanski and Woods 2005, pp. 117–118), which "should meet the same criteria as their real counterparts" (see also the 'user proxies' in Cohn 2004, chap. 5).

able for theoretical efforts, it was indicated in section 6.1, that C&E DSR projects unfold, for practical and normative reasons, in contexts in which the researcher is simultaneously a participant. Correspondingly, it can be argued that in theoretical efforts, analog to constructivists' argument that researchers have already access to the language community (see section 7.2), at least one 'product owner' is involved in the design process, who, through her or his interactions in the lifeworld, has, at least to a certain degree, knowledge about other users that can be exploited to make hypotheses about 'the user' of the technical system. This view is compatible with seeing 'possible worlds' and the accompanying technical systems as inputs to practical discourses (see section 5.3) and recognizing that both are abstract interim results that are open to further refinement. Furthermore, developing a reference architecture based on a 'possible world' can also leverage, in addition to the explicated draft meanings and organizational options, the existing body of knowledge, analog to the procedure described in the preceding section, to extrapolate user characteristics and their requirements from comparable technical systems. Hence, although the option of direct user involvement is not available, the design process can still use a subset of those techniques practical efforts employ to construct users and their requirements. This allows to consider multiple viewpoints and not just the one of the researcher, as demanded by the succeeding phase in the requirements model construction process (see table 8.5).

The core of this elicitation activity in the conceptualization outlined above is to extract information for the following four lists from different perspectives: (i) a list of the entities or objects that interact with, are part of, or produced by the technical system for which the architecture is developed, (ii) a list of services that users can interact with or that manipulate the technical system's objects, (iii) a list of contextual constraints, and (iv) a list of non-functional performance criteria. Within the present inquiry these lists are created based on 'user stories' (cf. Ambler 2002, p. 357; Beck and Andres 2005, p. 14; Beck and Fowler 2001, chap. 11; Cohn 2004, pp. 4–5; Leffingwell 2011, pp. 56–75, 99–117; Rubin 2013, p. 84), which are defined as short, usually one sentence long, customer-developer agreements or reminders, written in the domain's language, that express that a certain requirement needs to be considered in the following steps[167]. These relatively high level and short descriptions are the agile substitute for the more 'sophisticated', traditional requirement elicitation techniques (Leffingwell 2011, p. 37). This, however, does not imply that the agile approach needs less information, but that this information is added when it is required: "It's not that you don't need all of those details. You just don't need them all upfront. When you need to build the stories, then you need more details" (Beck and Fowler 2001, pp. 46–47)[168].

Within the next phase a number of those user stories are elaborated into or aggregated to, what Jacobson et al. (1992, pp. 128–132, 151–169) termed an 'use case model' (cf. Cohn 2004, pp. 137, 143; Fowler and Scott 2000, p. 41; Leffingwell 2011, pp. 367–368)[169]. Such use cases, defined as descriptions of a system's behavior in response to a set of goal-driven interactions of an actor (or role) from the perspective of users (cf. Cockburn 2001, pp. 1–3; Fowler and Scott 2000, p. 40; Meier et al. 2009, p. 41; Pressman 2010, pp. 133–134; Wiegers

167. Ambler (2002, p. 357), Beck and Fowler (2001, p. 46), Leffingwell (2011, p. 101), and Rubin (2013, p. 83) suggest index cards as representational technique for user stories. These are simple, preferably physical, cards that depict, in their simplest form, the story's title, the story itself, and the priority assigned by the product owner.

168. Generally, within agile projects all user stories are stored in a (product) backlog, which serves as reservoir of requirements that are realized in iterations or sprints. Within these sprints the selected user stories are then refined in a timely manner. For a more extensive discussion of iterations and backlogs in agile approaches see Leffingwell (2011, chap. 9) and Rubin (2013, chap. 6).

169. Although this is the approach taken in the present inquiry, it is sometimes suggested to derive user stories from use cases that capture the initial requirements (e.g., Ambler 2002, pp. 200–201).

and Beatty 2013, pp. 144–146)[170], are highly effective tools for the scenario-based evaluation of the software architecture[171] (cf. Bass, Clements, and Kazman 2003, p. 14; Clements, Kazman, and Klein 2002, pp. 52–55; Rozanski and Woods 2005, p. 199). More importantly, these domain language descriptions function as raw data that, using the grammatical parsing described by Abbott (1983) and the selection criteria proposed by Coad and Yourdon (1991, p. 66)[172], can be mapped onto software modules, their properties and services, and their relationships. In short, use cases can be utilized for the creation of architectural descriptions. This not only indicates that the elaboration phase partly overlaps with the elicitation phase, but also that this phase is directly connected to the specification phase (fifth activity in table 8.5), in which the set of models constituting the requirements model are created and, by implication, that the negotiation phase (fourth activity in table 8.5), in which conflicts between and priorities[173] of requirements are negotiated (Wiegers and Beatty 2013, p. 386), parallels those activities. Furthermore, the fifth activity, i.e., the creation of the requirements model, overlaps with the tasks carried out in the architectural design process:

> "It is important to note that all elements of the requirements model will be directly traceable to parts of the design model. A clear division of analysis and design tasks between these two important modeling activities is not always possible. Some design invariably occurs as part of analysis, and some analysis will be conducted during design" (Pressman 2010, p. 151).

In other words, the architectural design is braided with the elaboration, negotiation, specification, and validation activities carried out within the requirements model's development[174], and on the other side, developing and refining the requirements model also influences the architectural design cycle as the increasing understanding of the problem domain, manifested in newly identified requirements, might trigger a refactoring of the architecture (cf. Bass, Clements, and Kazman 2013, p. 285; Rozanski and Woods 2005, p. 76). Correspondingly, the distinction between creating a requirements model and designing a (reference) architecture is not clear cut and sequential but merely analytical. This suggests that a small but relatively stable requirements model, which might be, using the terminology of Cockburn

170. Similar to the design patterns described in section 5.4, the process of creating and analyzing use cases can be supported through 'analysis patterns' (Fowler 1997). These patterns provide reusable knowledge for the analysis of application domains that goes beyond what the analysis of use cases can provide (cf. Fowler 1997, p. 1; Geyer-Schulz and Hahsler 2001, p. 2). Although these analysis patterns might fruitfully inform the design of 'possible worlds' and corresponding technical systems, almost all explicated patterns are concerned with the economic system. See also the patterns on Fowler's website: `http://martinfowler.com/articles.html#id314249`, accessed May 25, 2015.

171. For a discussion of the differences between the evaluation of software architectures and reference architectures see Angelov, Trienekens, and Grefen (2008, pp. 230–238) and chapter 9.

172. Coad and Yourdon (1991, pp. 66–72) suggest that a noun identified with the grammatical parsing can or should be included in a model as class if it meets the following eight criteria: (a) the technical system needs to know and remember something about the real world entity represented by the class (i.e., remembrance), (b) the class requires services for manipulation of its attributes (i.e., behavior), (c) the class has multiple attributes otherwise it might be more suitable to include it as an attribute of another class (i.e., multiple attributes), (d) there is a set of attributes that apply to all instantiations of the class (i.e., always-applicable attributes), (e) there is a set of services that are applicable to all instantiations of the class (i.e., always-applicable services), (f) the class is an essential part of the problem space (i.e., domain-based requirements), and (g) the class should not include attributes or services that can be derived from other attributes or services as such decisions are part of the design (i.e., no derived results). The final characteristic, that is, 'is generally instantiated more than once' as manifested in the 'more than one object', might not be applicable in all situations as demonstrated by the Singleton pattern (cf. Gamma et al. 1995, pp. 127–134).

173. For an overview of techniques that can be employed for prioritizing requirements see Achimugu et al. (forthcoming), Leffingwell (2011, p. 261–271), and Wiegers and Beatty (2013, pp. 317–327).

174. This is, for example, indicated in the 'requirements modeling for WebApps' case study, which Pressman (2010, pp. 205–213) uses as illustration of the activities summarized in table 8.5. Not only is the selection of the mobile application archetype, discussed below, an architectural decision, but there is also a considerable overlap between activities comprised in the specification phase and the ones involved in the architectural design cycle.

(2005, pp. 49–50), called a 'walking skeleton requirements model', is sufficient as initial input to the architectural design cycle within which the model is incrementally refined parallel to the architectural design. This is perfectly compatible with the 'travel light' principle (cf. Ambler 2002, p. 29) suggested for agile approaches (see also Wiegers and Beatty 2013, p. 244) and therefore for the stance taken in the present inquiry.

Identify Architecture Objectives

The design of an architecture, equally applying to the construction of reference architectures, is not an mechanical process; rather, it is a thoughtful reflection of possible conflicts between requirements and their resolution through adequate compromises (cf. Rozanski and Woods 2005, p. 121; Vliet 2000, p. 293). This is the reason for perceiving the first step of the architectural design cycle as conceptually separate from but simultaneously interdependent with the remaining activities (see figure 8.12): whereas the specification of architecture objectives, such as the selection of an 'architectural genre' (Pressman 2010, sect. 9.2)[175] restricts the possibilities in the remaining steps, the system's evolutionary specification, especially if embedded in a changing environment, might trigger revisions of these decisions (Shekaran et al. 1994, p. 244). Such revisions can be captured in the 'architecture decision description templates' proposed by Tyree and Akerman (2005, pp. 20–21), which, inter alia, convey the rationale for selecting particular options to avoid the need to answer already discussed questions (see also Pressman 2010, p. 247). Although the present inquiry acknowledges the importance of keeping this information in practical architecture development processes in the 'real world', the exemplary nature of this section's methodical proposal as well as the suggestion to preserve readers' motivation by excluding trail-and-error paths (cf. Chmielewicz 1994, p. 38; Stone and Jasny 2013, p. 57; Couzin-Frankel 2013, p. 68), part IV will only present the final result. In other words, if the description of outcomes resulting from the method's application appear to be free of discards and revisions, this sequential account does not reflect the real processing; rather, it is merely a consequence of translating the evolutionary and incremental nature of the carried out activities into a linear series.

The first step of the architectural design cycle involves the following three activities (Meier et al. 2008, pp. 76–77; 2009, pp. 39–40): (i) the definition of the goal guiding the architectural design, (ii) the explication of needs and experiences of the architecture's relevant stakeholders, and (iii) the identification of organizational and technological constraints present in the application context. Whereas the first two of these tasks refer to the construction of a shared problem understanding that provides guidance in reaching acceptable compromises and determines the effort required for each phase of the design process (cf. Bass, Clements, and Kazman 2003, pp. 12–13; Meier et al. 2009, p. 40; Rozanski and Woods 2005, p. 78), the third activity involves an analysis of the requirements model and relevant facets of the context's environment to explicate constraints such as standards and policies that shape the context for which or within which the architecture is developed (cf. Rozanski and Woods 2005, pp. 105–106). In regard to the foregoing discussion, these aspects are covered (a) by the context and goal dimensions in the 'reference architecture' framework (Angelov, Grefen, and Greefhorst 2012) described in section 5.4 [(i) and (ii)] and (b) by the translation of the designed 'possible world' into a requirements model as explicated above [(iii)]. However, in

175. Pressman (2010, p. 247), defining architectural genres as a "specific category within the overall software domain", gives, inter alia, commercial systems or content authoring systems as examples.

regard to (b) it has to be noted that the abstract nature of 'possible worlds' does not allow to identify constrains of a particular context but only those that are present in multiple contexts covered by the domain (see section 5.4).

Identify Key Scenarios

Within this second step, or the first step of the actual development cycle, the key scenarios guiding the architecture development are identified; whereby a scenario is defined as "a crisp, concise description of a situation that the system is likely to face in its production environment, along with a definition of the response required of the system" (Rozanski and Woods 2005, p. 121). As indicated above, the present inquiry's requirements model captures these scenarios in use cases created out of user stories and stores them in a product backlog. The latter is, based on the product backlog of Scrum[176], understood as the prioritized or ordered, continuously extended list of all use cases that need to be considered in the architectural development (see also Leffingwell 2011, chap. 9; Rubin 2013, chap. 6, and footnote 168). Within each iteration of the architectural development cycle scenarios are taken from this product backlog as input for a new iteration in which the (reference) architecture is refined. However, instead of ordering scenarios according to the priorities of product owners (cf. Rubin 2013, pp. 18–19), the architecture development cycle orders scenarios according to their architectural significance, which is determined by the following criteria (cf. Meier et al. 2008, p. 78; 2009, p. 41): a scenario is considered to be a key scenario if (i) it deals with an unknown or risky area, i.e., an issue in technological development, (ii) it is 'business critical' or has a high impact, i.e., it involves a wide range of system functionality, (iii) it deals with the intersection of quality attributes, discussed more thoroughly below, and functional requirements, and/or (iv) it requires a compromise between different quality attributes. Although all use cases are prioritized based on these criteria, neither is the initial ordering fixed, i.e., priorities can change, nor is the backlog itself closed, i.e., it can be extended; rather, changes can and probably do occur in response to the unfolding understanding of the problem space (cf. Ambler 2002, p. 203). This incrementally or evolutionary refinement is one of the key characteristics of agile methods; however, when developing (reference) architectures changing priorities or newly identified requirements can have significant impacts: in the worst case they might require a complete revision of foregoing iterations' decisions and compromises. Therefore, re-interpreting the 'multiple models' principle proposed by Ambler (2002, pp. 32–33) from having multiple modeling techniques to creating multiple models, the present inquiry creates, at least till a stable model is reached, multiple architectural designs in parallel. However, as indicated above, the discarded models are neither preserved nor presented in the illustrative application[177].

Create/Refine Architecture Overview

Whereas the first two discussed steps of the architectural design cycle are merely preparatory in nature, this phase involves actual design decisions. Within the first iteration a coarse-

176. Scrum is an agile approach for the development of products that was first described by Takeuchi and Nonaka (1986).

177. In anticipation of the discussion in chapter 14, it might be argued that it is useful to keep these models and relate them to each other as this indicates the technical system's mutability (cf. Gregor and Jones 2007, p. 322), which can be captured as an architecture's variability (cf. Bass, Clements, and Kazman 2013, p. 356). However, such considerations are out of scope in the present inquiry.

grained architectural model is created by carrying out the following activities (cf. Meier et al. 2008, p. 79; 2009, pp. 42–43): (i) choose an application archetype, (ii) identify deployment constraints and Quality-of-Service attributes, (iii) select architectural patters, and (iv) specify relevant technologies for the architecture's realization. In respect to the present concern of designing a reference architecture, steps two and four are too specific or detailed: whereas the information for the former is only partially specified in the designed 'possible world', the latter can be excluded completely, because reference architectures are, by virtue of their abstract nature, technology agnostic (see section 5.4). This leaves the first three steps for further elaboration.

The selection of an application archetype (i) is, on the one hand, largely determined by the variety of usage scenarios that the technical system, if realized, should satisfy (Meier et al. 2009, p. 265), but on the other hand, it also narrows down the spectrum of realizable usage scenarios as indicated by the brief descriptions of frequently used application archetypes summarized in table 8.6.

Table 8.6: Application Archetypes, source: Meier et al. (2008, chap. 14–19) and Meier et al. (2009, chap. 20–25)

Mobile Applications	are, due to screen, input, and navigation restrictions, often relatively simple applications, deployed as rich or thin clients, that support offline and (occasionally[178]) connected scenarios
Rich Client Applications	are platform specific standalone applications, realizing disconnected or (occasionally) connected scenarios, that run on the client system and can provide relatively high levels of user experience
Rich Internet Applications	have nearly the same set of features as rich client applications, but they are typically deployed over a network, run in a browser environment, and often require a particular run-time environment on the client side
Service Applications	are applications that typically do not have a user interface, but provide their functionality to completely unrelated or loosely coupled applications that can access these services via extensible markup language (XML)-based messages transported over a network
Web Applications	are applications that run on a web server and are accessed via browsers. In comparison to rich client or rich internet applications, web applications typically do not provide equally high levels of user experience

The next step (ii) explicates the contingently related, that is, the only within a concrete deployment context existing, infrastructural and organizational requirements and limitations (e.g., mandated suppliers, security policies) so that these restrictions can be taken into account when making architectural decisions (cf. Bass, Clements, and Kazman 2013, pp. 41–42; Meier et al. 2009, pp. 42–43; Rozanski and Woods 2005, pp. 105–106). However, as indicated above, this information is not directly available if basing the design process on 'possible worlds' and, in addition, is often even deliberately ignored to realize the domain-focus of reference architectures (see section 5.4). Nevertheless, the synthesized draft meanings or organizational options, in combination with further empirical insights extracted from the existing body of knowledge, allow to hypothesize about relatively common contingently related entities. Yet, to maintain the reference character this supplementary information should

178. This tends to have changed considerably in the past few years.

be used only to identify anchor points at which contextual variations branch out, that is, to realize abstraction by inclusion as discussed in section 5.4.

Table 8.7: Architectural Patterns, adapted from: Bass, Clements, and Kazman (2013, pp. 204–238), Garlan and Shaw (1994, chap. 3), and Meier et al. (2009, chap. 3)

Client-Server Architecture
Segregates the application into two applications: the client making request to the server, which processes requests and delivers responses.
Component-Based Architecture
Decomposition of the application into cohesive and coherent modules with well-defined communication interfaces; typically, a higher-level of abstraction, which excludes issues such as shared states.
Layered Architecture[179]
Separates the functionality according to the principle of 'separation of concerns' into different layers, which typically draw on the functionality of lower-level layers to provide their functionality to higher-level layers ('inverted pyramid of reuse').
Objected-Oriented Architecture
Refers to the decomposition of a system in reusable and self-sufficient objects, each responsible for maintaining an predefined invariant of its internal, hidden from other objects, representation, which communicates with other objects via (local) function calls.
Service-oriented architecture (SOA)
Similar to the component-based architecture, however, each of the interoperable modules exposes its functionality using published, discoverable contracts and pre-defined messages for communication, instead of platform-specific communication functionalities (layered architectural style), which are typically transmitted over a network instead of local calls (component-based architectural style).
Peer-to-Peer Architecture
Divides the application into several cooperating applications running on distinct nodes (i.e., the peers) that offer their services to other peers and request services from those peers over the network

Within the first iteration of an architectural design cycle, the next task (iii) is to select appropriate architectural patterns, which, as described in section 5.4, prescribe how different coarse-grained modules within an archetype should interact to realize desired quality attributes, discussed more thoroughly in the next step, and/or satisfy other development constraints. Table 8.7 lists and describes the most frequently used architectural patterns[180], which, in almost all cases, need to be combined to achieve specified architectural objectives (cf. Garlan and Shaw 1994, pp. 15–16; Meier et al. 2009, p. 21). The first iteration's selection is ideally not changed within further cycles; rather, the chosen architectural patterns are, in reference to Wirth (1971), 'stepwise refined' by using lower level patterns to add details (see section 5.4). In other words, the first iteration provides a coarse-grained architectural suggestion (Vliet 2000, p. 205) that is incrementally refined in succeeding iterations. Whereas a traditional architectural design cycle carries out this refinement until it reaches a level that is close to programming languages, i.e., the granularity of design patterns such as the ones described by Gamma et al. (1995), the level of detail in case of a reference architecture is specified by the reference architecture framework, more precisely by the 'design sub-dimensions' manifestations that are recommended for a congruent reference architecture

179. The N-Tier Architecture is a frequently mentioned refinement of the layered architecture, where each layer is located on a different tier, i.e., physical infrastructure component, typically using the platform-specific communication functions. The 3-Tier architecture, separating a presentation, business, and database tier, is the most common instantiation of the N-Tier architectural pattern (see also Fowler 1997, chap. 12).

180. For more detailed discussions and further architectural patterns see Bass, Clements, and Kazman (2013, pp. 204–238), Buschmann, Henney, and Schmidt (2007a), Clements et al. (2011, chap. 4), Garlan and Shaw (1994), Meier et al. (2009, chap. 4), as well as Rozanski and Woods (2005, pp. 145–151).

type (cf. Angelov, Grefen, and Greefhorst 2012, p. 412).

However, independent of the iteration, the results of design activities need to be documented in a form that can be iteratively refined and provides an adequate basis for communication (cf. Meier et al. 2009, p. 44). As indicated in section 5.4, such an architectural description needs to take multiple perspectives into account:

> "An architecture is a complicated artifact, best expressed by focusing on particular perspectives depending on the message to be communicated. These perspectives are called views, and you must choose the views to document, must choose the notation to document these views, and must choose a set of views that is both minimal and adequate. This may involve combining various views that have a large overlap. You must document not only the structure of the architecture but also the behavior" (Bass, Clements, and Kazman 2013, p. 359).

As indicated in section 5.4, a minimal description of an architecture includes, besides the mentioned static and dynamic views, also an allocation or deployment view. Although this is a suitable requirement for software architectures, the abstract nature of reference architectures makes this context-specific view often superfluous. The selection of views, however, is in itself insufficient, a notation to represent these views needs to be picked out as well. Even though there are various proposals of dedicated architectural description and/or design languages (e.g., Di Ruscio et al. 2010; Feiler, Gluch, and Hudak 2006; Stafford and Wolf 2001), the Unified Modeling Language (UML) (cf. OMG 2011a, 2011b; Rumbaugh, Jacobson, and Booch 2004) also provides viable representation techniques (cf. Clements et al. 2011, p. 431; Rozanski and Woods 2005, p. 165). In respect to the illustrative nature of the application in part IV, the UML is not only sufficiently powerful, but, in contrast to the other approaches, makes the inquiry accessible to a larger audience, because the UML is comparatively well-known. As shown in table 8.8, many of the reference architecture design elements (see table 5.4 in section 5.4) can be represented using the UML. For those entities that are not covered complementary documentation notations were taken from the quoted literature.

Table 8.8: Reference Architecture Design Elements and their Representations

Design element	Representation	References
Components & Connectors	UML Component Diagram[181]	Fowler and Scott (2000, pp. 141–143), OMG (2011b, pp. 145–166), as well as Rumbaugh, Jacobson, and Booch (2004, pp. 253–258)
Interfaces	UML Class Diagram	Fowler and Scott (2000, chap. 4, 6), OMG (2011b, pp. 21–144), as well as Rumbaugh, Jacobson, and Booch (2004, p. 217)
	Textual Description	Clements et al. (2011, pp. 261–285) as well as Rumbaugh, Jacobson, and Booch (2004, pp. 413–418)
Algorithms & Protocols	UML Activity Diagrams	Clements et al. (2011, p. 450), Fowler and Scott (2000, chap. 9), OMG (2011b, pp. 303–434), as well as Rumbaugh, Jacobson, and Booch (2004, pp. 149–157)

Continued on Next Page

181. Rumbaugh, Jacobson, and Booch (2004, p. 258) state that "there is no sharp line between component diagrams and general class diagrams", whereas the earlier version of the UML Reference Manual treated component diagrams more as a separate diagram (see Rumbaugh, Jacobson, and Booch 1999, p. 222).

Table 8.8 – Continued from Previous Page

	UML Sequence Diagrams	Clements et al. (2011, pp. 450–452), Fowler and Scott (2000, pp. 68–72), OMG (2011b, pp. 473–534), as well as Rumbaugh, Jacobson, and Booch (2004, pp. 585–589)
Policies/ Guidelines	UML Use Case Diagrams	Cohn (2004, pp. 137, 143), Fowler and Scott (2000, p. 41), Jacobson et al. (1992, pp. 128–132, 151–169), Leffingwell (2011, pp. 367–368), OMG (2011b, pp. 597–615), as well as Rumbaugh, Jacobson, and Booch (2004, pp. 668–675)
	Use Case Descriptions	Cockburn (2001, pp. 119–120)

Identify Key Issues

The next step in an iteration is to identify key issues, which are intimately related to non-functional requirements or quality attributes (Meier et al. 2008, p. 87; 2009, p. 45), also known as crosscutting concerns[182] (cf. Meier et al. 2009, p. 205; Pressman 2010, p. 228; Rozanski and Woods 2005, pp. 5–6), inherent to or embedded in the architectural suggestion of the preceding step. In other words, whereas the former step was primarily concerned with functional requirements, the present step reworks or refines the created architectural overview in regard to non-functional requirements, i.e., quality attributes and crosscutting concerns (Meier et al. 2009, p. 46). Therefore, the central activity carried out in this step is an ‘architectural refactoring’, which resembles what Fowler (1999, p. xvi) describes as code refactoring: “Refactoring is the process of changing a software system in such a way that it does not alter the external behavior of the code yet improves its internal structure”.

Table 8.9: Software System Quality Attributes, adapted from: ISO (2011) and McConnell (2004, pp. 463–464)

Quality Criterion	The degree to which the technical system
Functional Suitability	provides a complete set of appropriate functions that deliver correct and precise outputs
Performance Efficiency	uses only those resources that were specified in the requirements
Compatibility	can exchange data with other systems[183] and to which it can co-exist with other systems on the same infrastructure
Usability	allows users to achieve their goals, measured in the effectiveness, efficiency, and satisfaction, and to which it supports the learning of users
Reliability	is able to perform required functions without failures
Security	protects sensible data and grants user access to these data according to their pre-defined privileges
Maintainability	can be modified measured in terms of efficiency and effectiveness
Portability/ Adaptability	can be transferred from one context to another (i.e., efficiency and effectiveness)

182. Whereas all quality attributes tend to be crosscutting concerns, not all crosscutting concerns are also quality attributes (cf. Pressman 2010, p. 52). As Bass, Clements, and Kazman (2013, p. 278) point out, crosscutting concerns are challenging aspects for agile methods that are based on the implementation of user stories, because such an approach “easily leads to an architecture in which every feature is independently designed and implemented. In such an environment concerns that cut across more than one feature become hard to capture” (see Ambler 2002, pp. 30–31, and the discussion of the ‘embrace change’ principle).

183. This form of compatibility is also called interoperability.

This 'design for issue mitigation' (Meier et al. 2009, p. 46) is based on the various lists that give an overview of quality attributes that a technical system can exhibit (e.g., Barbacci et al. 1995; McConnell 2004, pp. 463–466; Pressman 2010, pp. 400–406). The '2501n - Quality Model Division' of the ISO 25000 family distinguishes the following three quality models for software and data: (i) quality in use model (i.e., criteria of usage in a particular context), (ii) product quality model (i.e., static properties of software systems), and (iii) data quality model (i.e., inherent and system dependent data quality attributes). In respect to the reference architecture design, the primary concern is the product model, specified in ISO (2011, sect. 4.2), because both other models require a particular setting, not given in such endeavors, to deal with the comprised attributes. The quality criteria defined in the product model are summarized in table 8.9 (see also Leffingwell 2011, pp. 339–348; Wiegers and Beatty 2013, pp. 262–290). These crosscutting concerns can be, following Angelov and Grefen (2008, p. 1817), separated into those that have to be addressed in the construction of a concrete technical system and those that the design of a reference architecture can take into account. Although this distinction is not clear cut, but depends to some extent on the level of abstraction, the criteria listed in table 8.9 can be grouped into these two categories as follows: whereas the second part of compatibility, usability, and portability belong clearly to the former category, i.e., they depend on the technical system's realization[184], the remaining quality criteria are attributes that can be, at least partially, considered in the design of reference architectures[185].

Typical focal points of this quality attribute-driven architectural refactoring are the following issues and considerations (cf. Eckert 2005, pp. 3, 217–218; Meier et al. 2009, chap. 17): the assignment of privileges to access sensible data (i.e., authorization), the verification of identities (i.e., authentication), the handling of failures or exceptions of the system within the system (i.e., exception management), the abilities to customize the system or configure system parameters externally (i.e., configuration management), the accountability of performed actions based on diagnosing and auditing capabilities (i.e., logging and instrumentation), the persistence of system states (i.e., state management), or issues in regard to data look up, network traffic, and data processing (i.e., caching), the frequency and size of data exchange (i.e., communication), and considerations in regard of data consistency and rule violations (i.e., validation). Depending on the type of reference architecture that is to be designed, the architectural decisions to address these concerns range from quite concrete (e.g., prescription of specific data exchange formats) to rather abstract ones (e.g., the specification of abstract modules that serve as anchor point to integrate concrete functionalities).

Candidate Solution and Review

Based on the refactoring carried out in the preceding step, the final step in the architectural design cycle consolidates the created description by creating the iteration's candidate architecture. This can be described as follows:

184. This grouping is based on the following rationale: the second part of compatibility depends on contingently related entities unknown during the design, usability depends mainly on the usability of the realized system, and portability on the technology used to realize the technical system.

185. Reliability, defined as a function of application complexity, test effectiveness, and the complete operating environment (cf. Whittaker and Voas 2000, p. 39), is, for example, a quality attribute that can only be partially addressed in a reference architecture: whereas it is possible to reduce the architecture's complexity, the operating environment cannot be influenced. Similar arguments can be put forward for performance efficiency (e.g., the design of message exchange formats vs. the technological communication infrastructure) and security (e.g., consideration of validation components and points vs. the technical realization of those components).

> “A *candidate architecture* for a system is one that has the potential to exhibit the system’s required externally visible behaviors and quality properties. Most problems have several candidate architectures, and it is the job of the architect to select the best one [emphasis in the original]” (Rozanski and Woods 2005, p. 25).

In other words, the original approach uses the refactored architectural description of the preceding step to create prototypes and/or ‘architectural spikes’ (cf. Bass, Clements, and Kazman 2013, pp. 284–285; Meier et al. 2009, pp. 48–49), which allow to analyze architectural trade-offs and to explore possible technical issues (see also Leffingwell 2011, pp. 114–116). The insights gained from such experiments then function as additional input for subsequent iterations. In reference to the present inquiry’s goal, the development of architectural spikes and prototypes that are evaluated by potential users is not only unfeasible for reasons outlined in sections 5.2 and 5.3, but it is also, at least partially, unrewarding, because architectural spikes are mainly created to explore technical questions such as the behavior of third-party components or to measure performance attributes (cf. Bass, Clements, and Kazman 2013, p. 285). However, reference architectures neither make technology-specific prescriptions nor do they have a concrete context for testing purposes (see also the artifact-instantiation argument in section 5.2). Correspondingly, the present inquiry refrains from creating architectural spikes or prototypical realizations; instead it uses this step to summarize and reflect the results of the foregoing activities to refine the requirements model as well as to prepare the next iteration. The latter activity is carried out until the reference architecture fulfills the quality criteria of functional suitability (see table 8.9) and till the level of granularity has reached the one suggested by the reference architecture development framework (Angelov, Grefen, and Greefhorst 2012).

Before the two suggested methodical proposals are employed to create a decision support system for community-driven sustainable human development (SHD) initiatives (see part IV), the next chapter relates the elements of the inquiry’s research design to approaches in the disciplinary body of knowledge, explicates some inevitable limitations of the research design, and, as indicated in section 6.2, prepares the background for the exemplary application. This not only puts part IV in perspective, but it also lays the foundation for exploring future research options in chapter 14.

Chapter 9

Intermediate Reflection

As indicated in the introduction to the present inquiry, the Ph.D. pursues a dual strategy manifesting itself in two research purposes, problems, and questions. The elaborations in the preceding chapter, especially those in sections 8.1 and 8.2, served to answer the first of the two questions, which, as stated in section 6.1, reads as follows:

> *Which steps are required to design desirable, feasible, and constructive alternatives to factually existing information systems (IS) that can inspire and inform participants of practical discourses about potential options for the changes debated in these discourses?*

This question captures the inherent tension between the actual suitability of DSR as methodological underpinning of C&E research on the one hand, and the 'impossibility of C&E DSR projects' (Heusinger, forthcoming) on the other hand. It implicitly asks for reasons of the latter, to initiate a search for options that allow the former. The method suggested in section 8.1, complemented by the adapted version of the realist synthesis outlined in section 8.2, is the result of exploring alternative routes in both ISR traditions: DSRIS and C&E ISR. Thus, the method for the design of 'possible worlds' can be framed from two different angles: on the one side, (a) it can be seen as a method that uses the general procedure of C&E (IS) research endeavors and focuses on the transformative moment in this enterprise without making utopian proposals (see section 5.3), and on the other side, (b) it can also be perceived as an extension of the build-evaluate loop in respect to the context of discovery as well as the context of justification (see section 5.2). However, the method is not just an isolated and unrelated extension of the disciplinary knowledge base, but it also provides several anchor points to already existing contributions. The following discusses three of such approaches to differentiate the present inquiry's proposals from the methodical repertoire of ISR and to locate it more clearly within in the latter.

The first and probably most important anchor point is the relationship between the design of 'possible worlds' and conventional DSR approaches, especially those that are concerned with the design of socio-technical systems. One of the these approaches, already discussed in section 5.2, is the 'Effective Technical and Human Implementation of Computer-based Systems (ETHICS)' method (Mumford 1983, 1995, 2000; Mumford and Weir 1979). It is a participatory approach, a form of action research (Reason and Bradbury 2006a, p. 2), which is selected as representative for practical oriented socio-technical system design approaches, because of its closeness to the Ph.D. thesis' proposal: it is generally concerned with democratic purposes and it sees technical systems as means to achieve ends not as ends in themselves (Mumford 1983, p. 65). The ETHICS procedure, described more thoroughly in section 5.2, can be briefly summarized as follows (see Mumford 1983, p. 39; 1995, p. 29; Mumford and Weir 1979, p. 26, and figure 9.1): (1) analyze business as well as social needs and set efficiency as well as social objectives, (2) sketch socio-technical solutions having the potential to achieve these objectives, (3) select the best fitting alternative, flesh it out, realize it, and evaluate the emerging system (for a more detailed description see Mumford 1983, pp. 68–105; Mumford and Weir 1979, pp. 38–43).

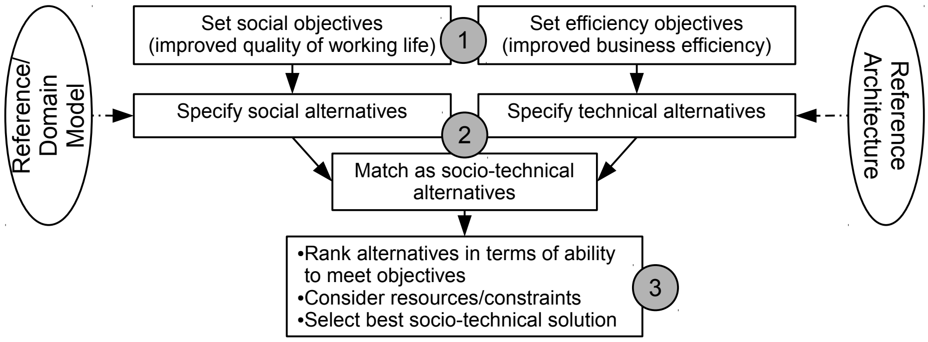

Figure 9.1: ETHICS and the Design of ‘Possible Worlds’, adapted from: Mumford (1983, p. 58) and Mumford (1995, p. 46)

As indicated by the two ellipses in figure 9.1 the ‘possible world’ as an abstraction of a desirable social system and the corresponding ‘reference architecture’ are seen as contributions to the second steps (2), which comprises the following activities (cf. Mumford 1983, pp. 92–95): (i) create ‘organizational options’ by identifying required work-activities as well as involved skills, governing rules, and distribution of responsibilities, (ii) search for ‘technical options’ potentially supporting the working environment, and (iii) evaluate all identified options separately against the goals set in the first step. As already mentioned in section 5.2, ETHICS, similar to all practical approaches, is, inter alia, prone to, what in reference to Sen (2013, p. 11) can be called, the downward adaption of employees’ expectations in respect to what is possible because of continual exploitation. Mumford partially recognizes this by proposing an alternated—in contrast to the design ‘expert’—role of the external social/technical system designer: the ‘experts’ have to be seen as ‘facilitators’ that help employees to organize the participative design, keep them interested and motivated, resolve emerging conflicts, and inform about organizational as well as technical options (see also Mumford 1983, p. 32–33, 91; 1995, pp. 98–99). The last mentioned responsibility allows to integrate the design of ‘possible worlds’ with the design of socio-technical systems: the design of ‘possible worlds’, extended by the development of accompanying reference architectures, provides exactly the type of knowledge that facilitators can utilize to inform participants in practical discourses about feasible and desirable options[186]. The socio-technical IS design science research (STISD) (Carlsson et al. 2011), which was also discussed in section 5.2, in contrast to the design of ‘possible worlds’, is an approach that is applied in the third step (3) depicted in figure 9.1.

Closely related to this framing of ‘possible worlds’ as abstractions of organizational options that inform socio-technical system design approaches are the ‘analysis patterns’ pro-

186. It has to be noted that a ‘possible world’, by virtue of being an abstraction, needs to be, if used to analyze or change real world contexts, complemented by data gathered in the focal settings (see Dazé, Ambrose, and Ehrhart 2009; DFID 2000a, 2000b; Frankenberger, Drinkwater, and Maxwell 2000a, 2000b; Frankenberger et al. 2002, for an overview of methods and techniques used in development practice).

posed by Fowler (1997). Fowler describes analysis patterns as “groups of concepts that represent a common construction in business modeling” identified as useful in one context, probably useful in other contexts in the same domain, and potentially useful in other domains (p. 8). However, as he points out, he does

> “not use any of the formal headings for patterns that are used by some patterns authors [...but instead] describe[s] each pattern in a form that is as close to the original project form as is reasonable, with a minimum of abstraction [...]. I [Fowler] follow the principle that this should be left to the reader” (p. xvii).

Thus, his study can better be described as an analysis of ‘pattern stories’:

> “What we can term *pattern stories* are narrative structures, i.e. they exist as complete and in the real world. As with many stories, they capture the spirit and not necessarily the truth of the detail in what happens. It is rare that our design thinking will so readily submit itself to named classification and sequential arrangement, so there is a certain amount of retrospective and revisionism. However, as an educational tool, such an approach can reveal more than conventional case studies, as each example literally tells the story of a design. This is a valuable aid in studying design through the study of designs [emphasis in the original]” (Henney 1999, p. 52).

In contrast, ‘possible worlds’, being not exclusively focused on the business environment (see section 8.3, especially footnote 170), are, more importantly, better comparable to ‘pattern sequences’. The latter “switch the focus from example to essence [...to] help us to generalize what we learn from the pattern stories and see how to reapply such knowledge” (Buschmann, Henney, and Schmidt 2007b, pp. 255–257). Although the focus of Buschmann, Henney, and Schmidt is on pattern sequences, which might even evolve into pattern languages, utilized in the design of technical systems, the general idea equally applies to social systems. This is, for example, demonstrated by the elaboration of Cunningham (1996), who discovered and identified those patterns that underlay agile development approaches such as the one discussed in the preceding section and, by implication, the various technical systems that support concrete agile development projects[187]. Correspondingly, there is a relation even between technical systems and abstract organizational patterns. However, the claim is not that those technical systems were developed based on these patterns. Rather, Cunningham describes patterns and their relations, e.g., the work queue (p. 377), comparable to the afore-mentioned backlog, which underpins todays agile development approaches. The above-mentioned tools were developed to support concrete instantiations of the identified organizational patterns, i.e., the agile development approaches found in the literature. Similar, Fowler introduced, exactly for this purpose, ‘support patterns’, which “address problems in building computer systems around the analysis patterns” (Fowler 1997, p. 238). In this view, the design of ‘possible worlds’ and the construction of reference architectures based on the former, resembles this relationship between analysis patterns and computer systems on a higher level of abstraction, that is, on the theoretical level.

Consequently, the final comparison with existing approaches of the disciplinary knowledge base unfolds, as a combination of the first two contrasts, on the level of design the-

187. See, for example, AxoSoft’s OnTime (`http://www.axosoft.com/`, accessed May 25, 2015), Atlassian’s JIRA Agile (`https://www.atlassian.com/de/software/jira/agile`, accessed May 25, 2015), or Rally’s various Platforms and Products for agile development (`http://www.rallydev.com/platform-products/`, accessed May 25, 2015).

ories. The recently proposed ‘Design Science Research Theory Development Framework’ (W. L. Kuechler and Vaishnavi 2012a) is, because it incorporates and relates insights of several important contributions in this domain (e.g., Goldkuhl 2004; Gregor 2006; Gregor and Jones 2007; B. Kuechler and Vaishnavi 2008; Walls, Widmeyer, and El Sawy 1992), the perfect candidate for such an endeavor. The framework comprises multiple perspectives, the presently most relevant of these is the ‘typological perspective’. It is divided into three areas (cf. W. L. Kuechler and Vaishnavi 2012b, p. 348; 2012a, p. 398): (i) the solution space, which comprises kernel theories and tactic theories, (ii) the concrete problem solution in form of ‘artifacts’[188], and (iii) the conceptual intermediaries, i.e., two types of middle range design theories (see section 8.1), which bridge the distance between (i) and (ii). Correspondingly, developing design theories in ISR is equalized with the construction of one of these two types of middle range theories, which are distinguished as follows (cf. W. L. Kuechler and Vaishnavi 2012b, pp. 350–351; 2012a, pp. 396–398, 403–404): whereas information systems design theories (ISDTs) (Walls, Widmeyer, and El Sawy 1992) capture the high-level information of a class of ‘artifacts’ (i.e., a single ‘artifact’ is an expository instantiation of this class) as well as related methodical considerations as outlined in the structure proposed by Walls, Widmeyer, and El Sawy (1992, pp. 43–44), design-relevant explanatory and predictive theories (DREPTs) explain—probably better are expected to explain—how and why ‘artifacts’ evolving from an ISDT have the impacts they have. This is achieved by translating relevant kernel or tactic theory constructs into the technological domain, i.e., DREPTs capture the explanatory knowledge that emerges during the translation. In other words, DREPTs are issue- or feature-centered technological specifications of kernel or tactic theories, which are utilized in the development of ISDTs that incorporate the respective focal feature. As indicated by the artifact in inverted commas, the understanding of ‘artifact’ differs considerably from the one H. A. Simon (1996, p. 9) gives (see section 5.2), i.e., artifacts are equalized with ICT applications. As indicated before, this narrow view of IS[189] does not recognize that ICT applications are ‘path dependent’ (David 1985), i.e., they are embedded in a socio-historical context, and that the conditions within this context are vital for understanding the relationship between ICT applications’ features and their effectiveness in a particular setting (see section 7.3). To close this gap, an additional middle range theory needs to be added—the ‘possible world’. Such an integration can increase the effectiveness of the design of ISDTs, because ‘possible worlds’ captures the necessary-related contextual entities that determine the meta-requirements in ISDTs, which, in turn, influence the selection of DREPTs. Correspondingly, if IS are seen as socio-technical systems, a perspective supported by numerous good reasons and arguments (see sections 5.1, 5.2, and 5.3), then ‘possible worlds’ are a necessary complement in this interplay as pointed out by Hooker:

> “I [Hooker] now seem to have reached an impasse. I distinguished design theory from socio-psychological theories of design practice. But since design is a practice, a theory of design must be a theory of design practice, and it is unclear how one can have a theory of a practice except in a socio-psychological sense (Hooker 2004, p. 76).

188. As explicated more fully below, the definition of ‘artifact’ used by B. Kuechler and Vaishnavi differs considerably from H. A. Simon’s (1996, p. 9) as discussed in section 5.2 and mainly refer to ICT application, that is, to the narrow view of IS.

189. Although W. L. Kuechler and Vaishnavi (2012a) start with a broad definition of IS, somewhere within the report they implicitly switch to the narrow view.

A viable 'avenue to escape from this impasse', Hooker (2004, pp. 76–77) states, is to have a comprehensive, supporting theory about the 'subject matter' that is uniquely tied to the design practice of a particular discipline or field. In other words, if ISR is underpinned by a broader view of IS, that is, socio-technical systems are the 'subject matter', then artifacts such as 'possible worlds', extending the technical focus to include social facets, are necessary to have a complete theoretical view on the subject matter. Figure 9.2 locates the design of 'possible worlds' in the 'Design Theory Development Framework' (W. L. Kuechler and Vaishnavi 2012a) and depicts the briefly sketched relationships. A further elaboration follows in chapter 14.

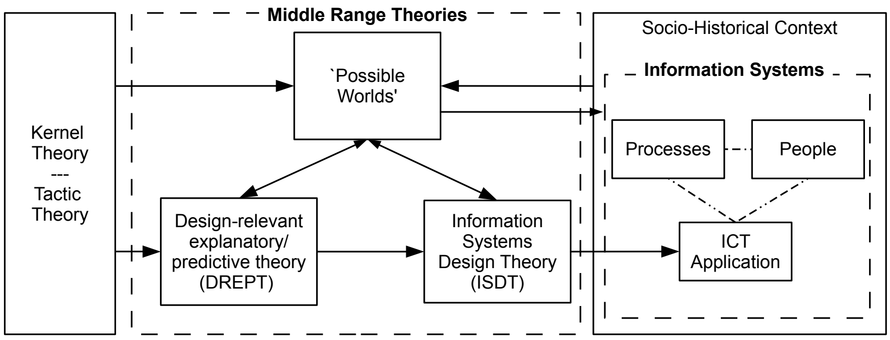

Figure 9.2: 'Possible Worlds' and Design Theories, adapted from: Heusinger (2013a, p. 342), based on W. L. Kuechler and Vaishnavi (2012a, p. 399)

Although a deeper exploration of the relations between the design of 'possible worlds' and the three discussed approaches in the disciplinary body of knowledge is a fruitful ground to more clearly specify how the division of labor within ISR can be better coordinated to enhance the discipline's progress, it also indicates avenues to overcome some of the inevitable challenges the method has to face. The most serious, at least for some researchers, of these problems is the issue emerging from the putative equality of practical utility or pragmatic success and 'real' applied research; a perspective that completely neglects epistemic utility instead of, as done in other applied disciplines such as policy design, skeptically embracing efforts in this direction (see section 5.2). Although ISR starts to consider theoretical DSR outputs as valid scientific contributions (e.g., Gregor 2009, p. 7; Heusinger 2013a, p. 342; forthcoming; Iivari 2010, p. 56; forthcoming), an undifferentiated view between practical and epistemic utility makes it hard for some to accept the latter without a demonstration of the former. However, theoretical endeavors, even without 'proven' practical utility[190], impossible in fields such as ISR, due to open systems, are necessary for the discipline to become a science (see also the quote of Kant ([1793] 1974, p. 275) introducing section 5.3):

> "the truth of a theory of applied science implies only its *potential* pragmatic success: e.g., it may happen that someone makes a theoretical proposal for an educational reform, which *would* have its claimed effect, but this proposal is actually never implemented. In this sense, it is possible that there is cognitive progress in applied science which is not, nor will be, cashed out in practice [emphasis in the original]" (Niiniluoto 1993, p. 6).

190. It has to be noted that evaluations of socio-technical systems are often not as they appear to be (Baxter and Sommerville 2011, p. 14): "The types of questions asked during evaluation are therefore not 'does this work?' but 'how can we make this work?'. Nevertheless, as will be explored in section 14, 'possible worlds', as artifacts that strive to enlighten society, can be 'empirically validated', at least in a discourse-sense, using the 'applicability checks' proposed by Rosemann and Vessey (2008) in a simplified and modified version (cf. Heusinger, forthcoming).

On the other side, demonstrating practical utility in one practical setting is unable to generate trans-contextual knowledge, considered to be a central element in the scientific enterprise and ISR (cf. Carlsson 2010, p. 219; Fettke, Houy, and Loos 2010, p. 356; Frank 2006, p. 28; 2010, p. 37; Zelewski 2007, pp. 93–94), which immediately raises the question of how it is possible to justify the scientific characteristics incorporated in the term 'design science research in information systems (DSRIS)':

> "That a specific knowledge is useful in particular contexts tells us nothing about what is actually possible or impossible, either in these contexts or in others" (Danermark et al. 2002, p. 25).

Correspondingly, theoretical endeavors such as the design of 'possible worlds' are not scientific because they carry out an evaluation of an instantiation, which provides, as it is believed, (empirical) evidence for the 'truth' of the designed artifact, impossible due to artifact-instantiation difference and open systems (see sections 5.2 and 7.3 respectively)[191], but because they are conducted with a 'scientific attitude' (cf. Robson 2002, p. 18), i.e., systematically, skeptically, and ethically. However, the recognition of open systems leads to another, unfortunately unaddressed, problem: social aspects, in contrast to the 'objective' technical entities, change intrinsically. This implies that 'possible worlds' need to be continuously revised and updated:

> "[I]t is a social system's dominant characteristic that rules and routines can be revised and become subjects of negotiation, and it cannot be predicted whether and when anticipatable behavior is no longer sustained but becomes subject of evolutionary or emergent change" (Fischer and Herrmann 2011, p. 4).

In other words, 'possible worlds' are fallible interim results that need revision and refinement. The possibilities of modifying and rewriting, however, are limited by current publication practices. Basing the design of 'possible worlds' on the existing body of knowledge and on the adapted version of the realist synthesis presented in section 8.2, imposes the following restrictions on the research design: firstly, confining the literature base to peer reviewed journal articles entails the problem that this type of literature excludes important information for creating full-fledged program theories (cf. Hagen-Zanker and Mallett 2013, p. 5; Pawson et al. 2004, p. 22; 2005, p. 29); the primary reason why Pawson (2006, p. 86) suggests to include 'grey literature' (see also Hagen-Zanker and Mallett 2013, p. 11; Pawson et al. 2004, p. 21; 2005, p. 29). In other words, it is difficult to identify in which way mechanisms are blocked in certain contexts, because only successful studies get published (cf. Couzin-Frankel 2013, p. 68). Although this cumbers the identification of adequate options for participants of practical discourses, it is less a problem that affects the design of 'possible worlds', because these issues have to be addressed in the technological and economic possibility assessment, none of which is part of the design process (see section 8.1). Two further issues of literature-based studies emerge from the selection process: on the one side, literature reviews are often accused of being subjective (secondly), especially in respect to the selection of documents included, and on the other side, they are criticized for not discussing excluded articles (thirdly) (cf. Hagen-Zanker and Mallett 2013, pp. 5, 15). Even though the former criticism immediately raises the question of why endeavors such as DSRIS, which are explicitly based on creative leaps and tactic knowledge (see section 5.2) and therefore cannot free themselves

191. It might even be possible to argue, based on 'the new riddle of inducation' (Goodman 1983, p. 72–81), also known as the 'grue problem' or paradox, that this is also a problem of closed systems.

from subjectivity, are considered to be scientific, the definition of inclusion and exclusion criteria enhances the selection process's transparence and thereby, at least to some degree, mitigates the subjectivity criticism. In respect to the third issue an argument similar to the one put forward to counter the first problem applies: 'possible worlds' are not only fallible interim results, but they are also purposively designed artifacts. Consequently, even if excluded documents might contain knowledge about failure or stumbling blocks in one context, improbable due to the afore-mentioned publication practice, this does not impair the theoretical possibility derived from the success in another context. Finally, and this tends to be the most challenging aspect, the extraction of draft meanings and organizational options from articles that report about factually existing contexts might raise the objection that a designed 'possible world' is merely a description of real world contexts, eventually deflating the 'factual world' and the 'possible world'. However, there are good reasons to support the claim that both these abstractions differ in important respects: (a) the context of discovery, i.e., criticism as reason for change, that underpins the design of 'possible worlds' not only provides a normative justification for initiating change, but it also indicates that there are indeed differences between the 'factual world' and the 'possible world'; (b) although progressive meanings are already present in at least one context, the novelty demand for scientific publications (see section 2.3) suggests that it is not present in many, which implies that the 'possible world' can maintain its function to inform the cross-sectional 'factual world'; and (c) the 'possible world', underpinned by the carved out mechanism that binds together or connects the variety of draft meanings and organizational options, each originating in a different context, is, due to the embedded trans- and meta-contextual knowledge, able to inform contexts from which certain aspects were taken by the progressive aspects extracted from other settings. In short, the skeptical, ethical, and systematic procedure employed ensures that 'possible worlds' can maintain their inspiring potential despite the 'piecemeal engineering' (Popper 1967b, pp. 139–140) that underpins their construction.

Before turning to the justification why this research design is suitable, it might even be called necessary, for carrying out the 'second research project', or more precisely the exemplary application as feasibility argument, comprised in the present inquiry, two remarks in respect to the technical facets of the socio-technical system designed in the next part are inserted to put the latter in perspective. As indicated in the Ph.D. thesis' introduction (see part I), the foregoing discussion is the central focus of the present inquiry and the following is seen as a demonstration of the feasibility of what was proposed. In respect to this focus, the reference architecture design method presented in section 8.3 is, due to the unavailability of a dedicated approach in the existing knowledge base, provisory in nature. This interim characteristic, although not directly impairing the actual design process, shows up in (i) the requirements model creation phase as basis for the construction and (ii) the non-existing, because excluded, evaluation of reference architectures as 'conclusion phase'.

Within the elaboration of the method for the design of 'possible worlds' in section 8.1 it was argued that the institutional analysis and development (IAD) framework (cf. Ostrom 1986, 1990, 2009, 2010a, 2010b, 2011) is an ideal candidate for decomposing the unit of analysis into its constituting entities. However, the option of using this framework as a basis for the elicitation of requirements was not explored (i). Nevertheless, there are requirement analysis techniques that could free this phase from its pragmatic properties and connect it more closely to the design of 'possible worlds'. This includes, inter alia, approaches such as the following: Sommerville et al. (2009) discuss the possibility of eliciting requirements from responsibilities, Sutcliffe (2000), also providing an overview of modeling notations in requirements analysis, and España, González, and Pastor (2009) explore different options for gathering requirements from the analysis of communication paths between different actors. Exploring these and other possible options for a closer integration between the social and the technical facets of socio-technical systems is subject of future research (see chapter 14).

Secondly, the evaluation or assessment of reference architectures is completely faded out (ii), because the aim of demonstrating that technical systems can be designed based on 'possible worlds', i.e., not yet existing context, does not depend on the 'downstream process' of evaluation. Furthermore, although there are various approaches to evaluate software architectures (see Bass, Clements, and Kazman 2013, chap. 21; Clements, Kazman, and Klein 2002; Rozanski and Woods 2005, chap. 14, for overviews), the evaluation of reference architectures is, due to the abstract nature, different and, analog to their essence and development (see section 5.4), largely unexamined (see Angelov, Trienekens, and Grefen 2008, for an initial attempt).

After this critical reflection of the foregoing efforts, this chapter closes, partly anticipating the following discussion, by justifying that the proposed research design is a suitable underpinning to address the second research problem outlined in part I. The research question guiding this study, which is simultaneously the exemplary application of the design of 'possible worlds', reads as follows (see section 6.1):

> *Is a community-driven SHD initiative, if possible at all, able to contribute to the resolution of the issues associated with SHD and, based on an affirmative answer of the former, how can its decision-making processes be supported by ICT applications?*

Without going into the details of community-driven SHD initiatives, the focal points of this question, by intention, closely resemble the division of the research design outlined in the preceding chapter. The justification of why the suggested design is suitable, simultaneously demonstrating the proposal's novelty, unfolds in respect to the challenges of tackling this question utilizing the conventional methodical repertoire. As indicated in the foregoing discussion and section 5.2, the ISR-related technical facets of the research question are traditionally answered through activities carried out in a practical setting, which serves as the source of the problems to be addressed but also as a basis for the evaluation of the construction process. However, as the question is more general, that is, context-independent, approaching it in the conventional way would require to create the respective setting in the first place. Given that the project's goals are acceptable, such a process, further assuming successful in the end, not only takes financial resources, but it also requires time, often several years, and patience due to lengthy negotiations and persuading (cf. Kelly, Caputo, and Jamieson 2005, p. 317; Mathews 2013, p. 144; Mumford 1983, p. 61, and figure 9.3).

In other words, employing one of the existing approaches to answer the question would require years of preparatory work. It is questionable if researchers want to or even could invest such efforts. The latter applies especially to younger researchers, who, if applying for academic positions, need not only a long list of publications, but, in the best case, also have an even longer list of externally funded projects (cf. Wilkinson, Sud, and Thelwall 2014, p. 798). Although not ideal, for research projects such as Ph.D. theses, which are inevitably constrained in terms of financial and temporal resources, a theoretical approach is often the only viable solution (see also Kanungo 2004, p. 419, for an argument in C&E in general). However, this practical argument only complements the afore-mentioned normative consid-

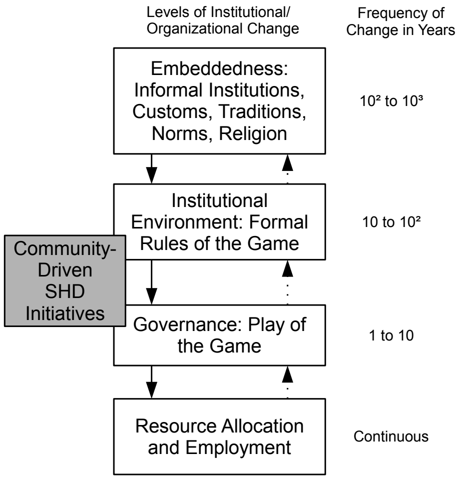

Figure 9.3: Temporal Dimension of Institutional Change, adapted from: O. E. Williamson (2000, p. 597)

erations: to avoid paternalistic tendencies C&E research should inform people, who initiate and operationalize change. Correspondingly, action research (cf. Herr and Anderson 2005; Reason and Bradbury 2006b, and the cited references), which is traditionally conducted by practitioners of a concrete setting (Reason and Bradbury 2006a, p. 2), is the natural complement to the present inquiry's proposal.

Part IV

Community-Driven SHD Initiatives

Chapter 10

The Design of ‘Possible Worlds’

“Historically, concerted responses have been a reaction to crises rather than the result of forward thinking”

McGranahan et al. (2005, p. 821)

Within this fourth part the present inquiry translates the research design outlined in chapter 8 into a concrete research project. Although this ‘second research project’ mainly serves to demonstrate the feasibility of the design of ‘possible worlds’ developed in section 8.1, it is still a self-contained critical and emancipatory (C&E) design science research (DSR) project. In contrast to the reactive attempts mentioned in the introductory quote (see also section 5.3), the design of ‘possible worlds’, the pivotal element in such C&E DSR endeavors, is a method that allows to be more foresighted. This characteristic is illustrated by designing a ‘community-driven sustainable human development (SHD) initiative possible world’ (Heusinger 2013b, and section 5.5), which is a pro-active proposal or response to the issues looming in the way the challenges of the 21st century are currently addressed. More specifically, the problem context, as discussed in section 5.5, comprises the following three concerns: firstly, human development (HD) is mainly framed as an issue emerging in the Southern hemisphere, entailing the claim that the way in which HD was achieved in ‘developed’ countries can function as a role model for ‘developing’ countries; secondly, sustainable development (SD) is, in the best case, understood as an umbrella term for attempts to resolve environmental problems, that is, HD considerations are stripped off; and thirdly, SD in the narrow sense is increasingly constructed as a technocratic enterprise, i.e., as a problem that needs to be tackled by the two ‘systems’ outlined in section 2.1. Nevertheless, in sections 5.5 and 6.1 it was also indicated that (i) the separate and sequential treatment of HD and SD is, due to their intertwined relationship, an infeasible approach, and that (ii) the technocratic framing of SD furthers the colonization of the lifeworld, which signifies itself in the growth of the ‘Fourth World’ (see section 6.1) as well as the increase of social pathologies manifested in phenomena such as the lack of community cohesion and rising rates of social fragmentation (see section 5.5). As suggested in section 6.1, to avoid that the inherent issues of (ii) fully unfold, the public sphere needs to be strengthened by creating spaces where true public opinion can be formed. As Habermas ([1964] 1974, p. 55) points out, the key element to foster such a development is to establish opportunities for communicative action within civil society organizations (see chapter 2). The following design of a ‘possible world’, comprising the community-driven SHD initiative as its pivotal element, is an attempt to address exactly those issues summarized in (ii). Furthermore, as will be outlined in the following, such initiatives are also central building blocks to reunite or integrate the separated streams of HD and SD as demanded by (i).

However, as discussed in section 8.1 and chapter 9, the design of ‘possible worlds’ is, seen from the practical point of view, informative in nature, i.e., it is primarily concerned with structural elements, manifesting themselves in the variety of draft meanings and organization options, that result from practical research endeavors such as action research projects. Conversely, transient structures or technological means to, for example, stoke up local citizens[192] to create such initiatives, are out of the present inquiry’s scope and subject of future or additional research cycles. The exclusion of these considerations is one of the implications following from the division and prioritization of research audiences specified in section 3.1[193]. In other words, scholars concerned with design science research in information systems (DSRIS) and C&E information systems research (ISR), the two focal audiences of the present study, are expected to be interested in (a) the possibility to construct information and communication technology (ICT) applications without being limited by factual constraints and systemic imperatives and (b) the opportunity to make constructive, non-utopian proposals to counterbalance the destructive negativism plaguing C&E ISR respectively.

Based on the abstraction of the ‘factual world’ as a unit of analysis of the ‘second research project’ carried out in section 10.1, these needs are satisfied as follows: whereas (b) is met by sketching the ‘community-driven SHD initiative world’ as a more desirable counterproposal to the ‘factual world’ (see section 10.2) and justifying that the transition from the ‘factual world’ to the ‘possible world’ is at least theoretically possible (see section 10.3), the interests captured in (a) are met by using the sketched and refined ‘possible world’ (see sections 10.2 and 10.3 respectively) as a basis for the elicitation of requirements to construct a reference architecture potentially supporting the processes within a ‘possible world’ instantiation (see chapter 11). Correspondingly, the research objectives for the ‘second research project’ of the present study correspond to the activities extensively discussed in chapter 8: firstly, select a unit of analysis and create an abstraction, i.e., the ‘factual world’, as starting point for the research endeavor; secondly, sketch the ‘possible world’, explicate the underpinning value position, and criticize the ‘factual world’ to identify the intervention entry points as reasons for change; thirdly, carry out a realist synthesis to justify that the derivation from the ‘factual world’ is not only desirable but indeed possible; fourthly, extract draft meanings and organizational options that can result from the transition; and finally, utilize the structural elements as bases for the design of a reference architecture. Whereas the first four of these objectives are discussed in the following, the fifth research objective is the subject of the next chapter.

10.1 Abstraction of the ‘Factual World’

Identifying a social unit at which the issues of SHD can be adequately addressed is a troublesome task, because relevant challenges exist at all spatiotemporal scales. This, in turn, might

192. As discussed more thoroughly in the following sections, local citizens are, in reference to Collins and Ison (2009, p. 370), defined as “intelligent, responsible agents who are willing to act in the collective interest, when institutional arrangements enable them to learn through building their stakeholding in an issue and when they are assisted to co-create (or co-design) the further institutional conditions in which they can rely on reciprocal arrangements.”

193. Although the present inquiry also sets out to show a different way to tackle SD concerns in the broader sense in research and practice, a similar argument can be put forward for academics interested in this facet of the present inquiry (see section 3.1). In principle, the afore-mentioned ambition is achieved by designing a ‘possible world’ whose core element is a community-driven SHD initiative which addresses the challenges outlined in section 5.5. However, this aspect is, due to the lower priority assigned to the respective audience, tackled only implicitly within the sections of the present chapter.

raise the objection that there is no special unit of analysis that can underpin an endeavor such as the one outlined above (see also section 6.1). Even though this contains a grain of truth, one aim of this section is to argue that a specific scale is predestinated to deal with SHD concerns. The basis of this discussion, although being concerned with human security instead of SHD, is the following assertion:

> "Threats and opportunities (or risks) exist at all time and space scales, from the acute and local to the chronic and global. It is at intermediate regional spatial scales and decadal time scales that some of the most critical contemporary threats arise, and some of the best opportunities for helpful initiatives exist. Popular efforts to establish agreement at the global level on 'the' most important challenges for human security are therefore likely to be much less effective than suitably contextualized efforts. Likewise, an exclusive focus on either immediate or very long- term interactions is less likely to promote progress than a dynamic focus on intermediate temporal transitions" (Khagram, Clark, and Raad 2003, p. 301).

The authors not only emphasize the importance of 'piecemeal engineering' (cf. Popper 1967b, pp. 138–148), i.e., to remove manifested injustices incrementally, they also stress that efforts on every level of the social hierarchy are important. Nevertheless, they point out that human security challenges are most effectively addressed at an intermediary spatiotemporal scale. The present inquiry generally shares the intermediary argument, but defends, in contrast to the regional level as suggested by Khagram, Clark, and Raad (2003, p. 301), a lower level, i.e., the 'community' level, as the most adequate social unit. Although the term 'community' is not uniquely defined, Bridger and Alter (2006, p. 14) point out that most definitions entail the following four elements: a locality, a local society, collective actions, and a mutual identity. However, as indicated by, for example, the lack of community cohesion, the connotations of the term, especially the common identity, might be misleading in the present inquiry (see also Gaffikin and Morrissey 2011, p. 1112). Therefore, the following will use the term 'community' to refer to cultural subsystems, that is, to local societies that comprise people who categorize themselves as identity-based group that differs from other local societies in respect to the identity. This identity-based self-categorization–demarcation interplay is the core mechanism leading to a lack of community cohesion and social fragmentation. Correspondingly, to address these issues in addition to the concerns of SHD, the unit of analysis has to be a social unit that comprises multiple communities. On the other side, the aim of strengthening the public sphere by opening up spaces in which a public opinion can be formed suggests that this unit of analysis should not be too distant from the everyday interactions of individuals. The level that incorporates both these demands is that of the 'locality', i.e., a spatially confined area in which individuals who belong to different cultural subsystems have most of their everyday encounters with other individuals.

Before carving out the 'factual world' abstraction and before defending the locality as the social unit at which SHD concerns are most fruitfully addressed, the validity of the claim that most of the interactions of individuals take place in a geographically constrained area needs to be justified. Although "none of us lives in a Petri dish divorced from place [. . .]" (Mathews 2013, p. 138), the rise of the 'global village' (McLuhan 1962) in the context of globalization casts serious doubts over the suitability of the locality: "a person usually belongs to only one residentially based place-community at a time, [however] one can easily belong to many regional and international post-placed communities" (Bradshaw 2013, p. 17) in which people interact with individuals located in different place-based communities.

Within his 'theoretical framework of complexity' (cf. H. A. Simon 1962; 1996, pp. 183–216)[194], H. A. Simon uses the frequency and magnitude of a focal system's interactions (e.g., an individual) as proxy to decompose society into a hierarchy of different social units. He emphasizes that representing a society as a hierarchic system does not necessarily imply that social units overlap with a geographical area, because social interactions are channeled through communication and transportation systems (H. A. Simon 1996, p. 187). Although these means allow people to develop long-distance relationships, the basis of regional and international 'interest-based' (Wellman, Carrington, and Hall 1988, p. 134) or 'post-place communities' (Bradshaw 2013), there is empirical evidence that most of the strong social interactions—even in the 'global village'—concentrate on a spatially constrained area (see Hampton 2002, p. 230; Hampton and Wellman 2003, pp. 281–284; Kowald et al. 2013, p. 242; Mok, Wellman, and Basu 2007, p. 433; Wellman, Carrington, and Hall 1988, pp. 151–153). In other words, it is an empirical phenomenon that geographical distance, even in times when relationships are often mediated through ICT and transportation arrangements, is still an important determinant. It manifests itself in the fact that many of the interaction partners with whom a focal individual forms strong social bonds live in spatially close proximity. Furthermore, Bradshaw (2013, p. 20) points out that the majority of local citizens in the United States of America (USA) have lived in their placed-based community for more than 10 years and less than 50% would leave it to improve their current living conditions. In short, if individuals are taken as elements and interactions, manifested in strong social bonds, as relationships connecting these elements, the social units in the emerging hierarchical structure tend, at least in the presently relevant cases, to overlap with a particular geographical area[195]. Correspondingly, from the perspective of the everyday interactions of individuals in the lifeworld, incorporating space as characteristic in the specification of the unit of analysis is a viable move. However, as pointed out above and in section 5.5, an integrated SHD approach requires, due to the adverse effects of the 'opportunity competition' on individuals' well-being, a broader perspective[196].

194. The main line of argument in the 'theoretical framework of complexity' (H. A. Simon 1962; 1996, pp. 183–216), another insightful contribution of the DSR forefather H. A. Simon, can be summarized as follows: social systems are 'nearly decomposable systems' for which a hierarchy, in a sense that goes beyond authoritative subordination, of subsystems can be approximated by distinguishing the frequency and magnitude of interactions (H. A. Simon 1996, pp. 187,197–204); see also the 'ladder of abstraction' put forward by Hayakawa (1947, pp. 92–98). H. A. Simon (1996, p. 198) asserts that such nearly decomposable systems tend to have two characteristics (see also H. A. Simon 1962, p. 473): (i) the short-run behavior of each subsystem is independent of the short-run behavior of all other subsystems in the system and (ii) in the long-run the behavior of a subsystem depends only in an aggregated way on the behavior of the other subsystems. Based on these two assumptions, he argues that social systems can be, analog to ICT applications and modules, decomposed into different subsystems or social units, whereby the strength of interactions is demarcation criterion. Furthermore, he argues that the overall fitness of a system results from the relative or comparative fitness of different subsystem designs, which can, following from the two characteristics, in large parts be determined independently of the other subsystems (H. A. Simon 1996, p. 205). The information required for the selection of 'fitter' subsystems can come from two sources (H. A. Simon 1962, pp. 472–473; 1996, p. 195): either from the feedback of trial-and-error attempts or from previous experience. In contrast to biological systems, in which the second source of selectivity corresponds to reproduction (H. A. Simon 1962, p. 473; 1996, pp. 195–196), social systems utilize culturally transmitted values and learning (H. A. Simon 1996, p. 215).

195. This, of course, does not equally apply to individuals involved in higher level social units such as federal or national governments. However, as indicated in chapters 2 and 6, the present inquiry is primarily concerned with lower levels of the social hierarchy.

196. Although the present inquiry is mainly concerned with the normative angle of cultural diversity, one of the arguments H. A. Simon makes in the 'theoretical framework of complexity' (see footnote 194) is that the structure and processes of subsystems, and this is assumed to apply to cultural subsystems as well, are relative efficient in contributing to the fitness (and survival) of the overall system (cf. p. 205). Based on the fact that cultural subsystems are part of a larger social-ecological system, it is possible to argue that existing cultural subsystems evolved in a way that makes them relative efficient or adapted to their specific environment. In literature this is, inter alia, referred to as traditional ecological knowledge or ecoliteracy (cf. Berkes, Colding, and Folke 2000, pp. 1252, 1256; Cullen-Unsworth et al. 2012, p. 352 ; Pilgrim, Smith, and Pretty 2007, p. 1742; Roseman and Stern 2003), which is defined as the cumulative body of placed-based, (tactic) knowledge of local ecosystems components and their

A model that can be adapted to build upon and extend the foregoing discussion in this respect is the 'bioecological model of human development' initially proposed by Bronfenbrenner (1979), refined in Bronfenbrenner (1993) and Bronfenbrenner and Morris (2006). The central argument of this model is that the development of an individual depends on four distinct, nested, contextual levels (Bronfenbrenner 1979, pp. 3–42; 1993, pp. 39–42; Bronfenbrenner and Morris 2006, pp. 814–819)[197]: the microsystem as a system of those immediate contexts in which an individual engages in direct interactions (e.g., family, workplace, or peer-groups); the mesosystem, resembling the above described social unit, as the system of microsystems connected by a focal individual (e.g., the relationships between family, workplace, and peer-groups); the exosystem as the system of non-microsystems that directly interact with the individual's microsystems (e.g., community organization or public service provisioning); and finally, the macrosystem that as 'societal blueprint' provides the larger environment in which the three lower levels are embedded (e.g., policies or laws). Bronfenbrenner (1979, pp. 4, 8, 26) states that the structural and dynamic aspects of the former three systems are, with variations, similar for given social groups and that differences (e.g., languages) are higher level phenomena (see also Chambers and Conway 1992, p. 6). Correspondingly, the exosystem is the lowest level, i.e., not too distant from the lifeworld, at which changeable differences between parallel existing cultural subsystems in a spatial area can be reflected and, following from the former, reorganized. Comparable arguments can also be derived from the HD literature:

> "It has to be borne in mind that quite often the isolated individual has very little opportunity of going against established patterns of behaviour and socially accepted norms. The power of the individual—and even of the family—can be heavily constrained, in this case, by the social climate" (Sen 2013, p. 17).

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interactions that is embodied in a holistic, cultural-specific worldview, created and dynamically adapted to changing circumstances by generations whose survival depends on this type of knowledge and that is transmitted between different generations through cultural practices. From this point of view, the arguments put forward for biological diversity apply to 'cultural diversity' as well; given that the appropriate conditions are met (see footnote 6 in Putnam 2007, p. 166). Bio diversity, characterized by heterogeneity, variability, and complexity (cf. Gatzweiler 2006, p. 297–298), is often divided into three analytically distinct, hierarchical categories (WRI et al. 1992, p. 2): (a) genetic variety (i.e., the genetic variability within species), (b) species diversity (i.e., the variability of species in a certain region), and (c) ecosystem diversity (i.e., the variability of species-communities). The variability of species is considered important for the ability of ecosystems to provide life-supporting functions such as soil fertility or absorption of pollution (UNDP 2011, p. 16; WRI et al. 1992, p. 4). Genetic variety is important for the adaption of this very species to different and changing environmental conditions (e.g., 'the resistance gene' that protects rice from the brown plant-hopper) and, eventually, its survival (WRI et al. 1992, pp. 4–5). Finally, variability of species-community is important, because species are the result of coevolutionary specialization processes (cf. Soulé 1985, p. 729). This interdependency of species is, for example, captured in the GAIA hypothesis (Lovelock [1979] 2000, pp. 30–43). The loss of this diversity is, therefore, not only related to intrinsic values but also to increased diseases of flora and fauna, including human beings (Yang 2013, p. 310). Transferring these insights onto cultural diversity, Bendt, Barthel, and Colding (2013, p. 19) argue that cultural diversity is important to combat the 'extinction of experience' (Pyle 2002; 2003, p. 206) among urban citizens as well as to ensure persistence over time. In other words, cultural diversity, manifested in the variety of social structures, is important to resilience and the ability to deal with the widest possible range of challenges (cf. Carlsson and Berkes 2005, p. 72; Dale and Newman 2006, p. 21; Dietz, Ostrom, and Stern 2003, p. 1907; Folke, Holling, and Perrings 1996, pp. 1021–1022; Galaz 2012, p. 211; Henriques 2004, p. 31; Loreau, Mouquet, and Gonzalez 2003, p. 12765; Rammel 2003, sect. 2.2; Stern, Dietz, and Ostrom 2002, p. 63): "Thus, a major reason to protect institutional diversity is to reduce the costs of failure when policies are imposed on entire regions without taking into account their diverse ecological, social and economic structures" (Ostrom 2012, pp. 129–130). In sum, although the conflict about cultural differences can adversely affect the well-being of individuals, the maintenance of cultural differences can also be seen as an important element of the adaptiveness of humanity. As will be explicated in the following sections, this is a pivotal element to achieve progress in terms of SHD. However, these practical reasons only complement or support the normative considerations on which the present inquiry focuses.

197. Note that this distinction is substantially different from other conceptualizations (e.g., Stewart 2005, pp. 201–202), which can be found in the HD literature.

In other words, individuals might have only limited control over constraining influences, which does not imply that adjustments are impossible; rather, it emphasizes that changing social structures requires collective action across local societies (cf. DFID 1999, p. 4; Heusinger 2013b, p. 14; Ostrom 1990, p. 21; Uphoff 1986, p. 10, and the 'collective capability' discussion in section 5.5). Similarly, reports of development agencies, which mainly use governmental structures as criteria to identify levels of interventions, suggest that interventions are most effective in relatively small, spatially constrained areas (cf. Binswanger-Mkhize, Regt, and Spector 2009, pp. 40–41; 2010, pp. 2–3; Frankenberger et al. 2002, p. 9; Helling, Serrano, and Warren 2005, pp. 10–11): the administrative level of municipalities is the lowest level of the governmental hierarchy that is small enough to facilitate communication and accountability, while simultaneously being large enough to allow for specialization and economics of scale (Helling, Serrano, and Warren 2005, p. 12).

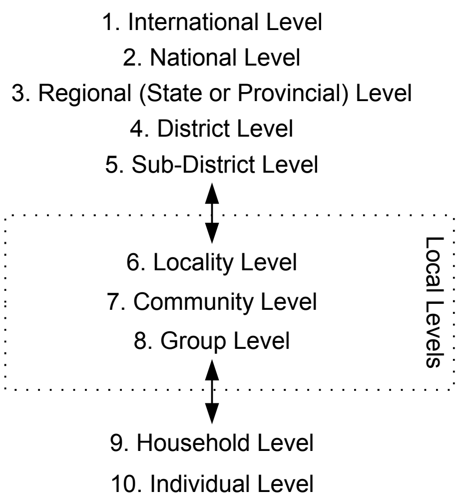

Figure 10.1: Levels in the Social Hierarchy, adapted from: Uphoff (1986, p. 11)

In sum, the term 'locality', as used in the following, is a spatial area that is large enough to comprise several communities, defined by strong socio-cultural interactions between individuals, and that does not exceed the spatial area, possibly comprising multiple localities, governed by the lowest level of the governmental hierarchy[198]. The relationship between these three social units is schematically depicted in figure 10.1, which gives an overview of social levels frequently distinguished in literature (see also Blackwell 1949, pp. 178–179). Therefore, the concept of locality, similar to the above touched concept of community, "merges the administrative, the spatial and the social" (Berner and Phillips 2005, p. 23). Locating the initiative at this level allows participants, due to the closeness to the lowest level of the administrative hierarchy, to hold governmental actors accountable for the way the locality is governed as well as to actively engage in the reorganization of social structures to enhance local citizens' capabilities and to counterbalance the mechanisms that generate social fragmentation and community incoherence. These more HD-related opportunities are comple-

198. Although it might be argued that this definition of locality is under- or unspecified, in the sense of not providing any concrete guideline on how to identify localities in the 'real world', a further refinement is, according to the 'underdesign principle' (Fischer and Herrmann 2011, and section 8.1), not desirable and might even be obstructive. One of the several insights gained in research on common-pool resources is that those organizational arrangements in which participants themselves defined the 'boundary rules' (see table 8.1 in section 8.1) were more successful, because rules were perceived to be more legitimate (cf. Ostrom 2002, p. 1332; 2007, p. 33; 2012, pp. 136–138). In short, although the rather vague definition of locality might make it challenging to identify localities, it nevertheless functions as a negative criterion to exclude unsuitable social units (see section 8.1).

mented by those that allow to incorporate SD considerations. The closeness to the lifeworld of local citizens and their direct engagement in the initiative is important to initially create knowledge and competencies that SD presuppose (cf. Bendt, Barthel, and Colding 2013, p. 18; Berkes, Colding, and Folke 2000, pp. 1252, 1256; Bolund and Hunhammar 1999, p. 300; Cullen-Unsworth et al. 2012, p. 352; Pilgrim, Smith, and Pretty 2007, p. 1742, and footnote 196): ecoliteracy, i.e., the key determinant for the ability and willingness to conserve ecological systems. The initiative, from this point of view, is therefore a sort of 'green hub' (see section 10.3): "a potentially proactive force for community sustainability, cohesion and engagement, and wider social inclusion" (Burrage 2011, p. 167). Establishing the initiative at the level of localities allows to create a place where local citizens can interact as individuals, form a public opinion, learn about others and their environment, and be actively involved in processes of change, that is, they are not treated as passive beneficiaries or 'patients'. These possibilities, complementing the demand of the 'unfinished project of modernity' outlined in section 6.1, cannot conceal the fact that not all challenges can be addressed at this level (cf. Khagram, Clark, and Raad 2003, p. 301; Uphoff 1986, p. 2)[199]. However, fostering development within localities is also an important contribution to increase the effectiveness of efforts at other levels (see also Kelly 2012, pp. 302–303):

> "Typically, rationally motivated assent will be combined with empirical *acquiescence*, effected by weapons or goods, to form a belief in legitimacy whose component parts are difficult to isolate. Such alloys are interesting in that they indicate that a positivistic enactment of norms is not sufficient to secure their lasting social acceptance. Enduring acceptance of a norm also depends on whether, in a given context of tradition, reasons for obedience can be mobilized, reasons that suffice to make the corresponding validity claim at least appear justified in the eyes of those concerned. Applied to modern societies, this means that there is no mass loyalty without legitimacy [...] [emphasis in the original]" (Habermas [1983] 1990, p. 62).

After the selection and justification of a unit of analysis, the final tasks in the first step of the design of a 'possible world' are the identification of necessary elements and relationships between elements. Even though this could be done by collecting primary data (see DFID 2000b, p. 8, for an overview of feasible methods), the present inquiry, as indicated in figure 8.1, carves out the structure of the unity of analysis from the existing body of knowledge. More specifically: it uses the wealth of insights accumulated in the reports of development agencies as these documents provide trans-contextual knowledge to guide development practitioners in their efforts. Although such reports are often considered to be scientifically inadequate, primarily because they have not passed, as indicated in section 8.2, the scientific quality control of being peer-reviewed (see Bohannon 2013; Ioannidis 2005; Labbé and Labbé 2013; Rabesandratana 2013, p. 67, for a critical review of the 'peer-review' practice), larger development agencies such as the Department for International Development (DFID), the Overseas Development Institute (ODI), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), or the World Bank Group employ well-educated scholars and/or work closely with academics to produce these reports, which are, despite not being peer-reviewed, of high practical relevance. The latter, particularly important for the relationship between the design of 'possible worlds' and action

199. For an extensive discussion of how to restructure and reorientate higher-level institutions to foster this type development see Uphoff (1986, chap. 7.5) and the discussions in section 10.3.

research projects (see chapter 9), suggests that using such reports is suitable in respect to the aim of informing the lifeworld. Before diving into the analysis itself, a brief remark in regard to its structure is inserted: the illustrative character of the ‘second research project’ as well as the preliminary nature of the reference architecture development method, indicate that using the institutional analysis and development (IAD) framework is presently unrewarding (see chapter 14)[200], mainly because the ‘create requirements model’ phase does not include the requirements elicitation approaches briefly touched in chapter 9.

The sphere of the development practice’s knowledge base that deals with concepts comparable to localities as specified above is the ‘local development’ field. Although this development concept is actually a reformation of an earlier idea, i.e., the area development programs that preceded approaches with a household or individual focus emerging during the 90’s (cf. Binswanger-Mkhize, Regt, and Spector 2010, p. 28; Frankenberger, Drinkwater, and Maxwell 2000a, p. 3), local development is one of the more recent and particular promising fields in the development domain (Wong 2012, p. 1). Almost all large development agencies such as the Cooperative for Assistance and Relief Everywhere (CARE), the DFID, or the ODI have contributed, in relation to the respective organization’s vision and purpose, to the wealth of knowledge about local development. However, the ‘local development framework’ proposed by Helling, Serrano, and Warren is particular suitable in the present case: (i) it is specifically developed in relation to different approaches whose insights are synthesized in the framework (see Helling, Serrano, and Warren 2005, sect. 4 and 5) and (ii) it is one of the guiding development schemes in the World Bank Group, the largest multi-national development agency (World Bank 2011, p. 1). Whereas the former allows practitioners to contrast the approach more easily, the latter gives the framework a particular prominence and practical credibility. The framework itself provides a sort of lens that is used to analyze the structure of a concrete context or locality (Helling, Serrano, and Warren 2005, p. 3). The central aim of such an endeavor is to determine which external intervention is most promising to lift the respective locality out of a ‘locality poverty trap’[201], i.e., a situation in which a locality’s self-development is hindered by structural deficits that the locality cannot overcome in its own right:

> “Thus the local development framework identifies the elements of a self-reinforcing system through which empowered local actors contrib-

200. For the sake of completeness and in anticipation of the following discussion, the extraction of data along the dimensions outlined by the IAD framework in section 8.1 can be summarized as follows: (i) positions: local citizens (LC), local government (LG), local administration (LA), local cooperatives (LCo), formal and informal local businesses (LB), central government (CG), and development organizations (DO), including public, non-governmental, and community-based organizations; (ii) boundary rules: LC are, in most cases, born to be local citizens, LG and CG are elected by LC, LA officials and DO members are appointed or employed, and LCo and LB are, in democratic societies, created by LC; (iii) authority rules: LC may elect the LG and participate in local governance processes, the LG may plan local development, formulate policies, make decisions about local development, and has to ensure the transparency of public processes in locality, the LA has to mobilize and manage resources for service delivery as well as to manage and deliver revenue generating services, LCo mainly provide services to the LB, the CG has to provide resources, foster the development of civil society as well as to implement laws, policies, and procedures supporting institutional capital of locality (i.e., decentralization) and private sector, DO are mainly concerned with the development of civil society and the building of local capacities (i.e., human, social, and institutional capital), and LB concentrate on producing goods and services and investing in the local infrastructure as well as the service delivery system; (iv) scope rules: the main category of relevant outcomes is economic capital, including the economically relevant aspects of human and social capital; (v) aggregation rules: there are various regulations that determine the decision horizon of the actors or positions defined above (e.g., national policies, the cultural institutional environment, the rules and regulatory mechanisms of the local governance system, the rules of extra-local enterprises for local branches, and specific rules of local organizations); (vi) information rules: in democratic localities the ‘open information rule’, defined as the absence of restrictions on the communications ways between positions and the initiation of communications (Ostrom 1986, pp. 13–14), tends to apply in most cases; and finally (vii) net costs: contingently related fiscal equalization schemes.

201. This term is an adaption of the term ‘poverty trap’ which is used by Banerjee and Duflo (2012).

ute to governance processes and service provision in order to accumulate and invest human, social, and economic capital for their mutual benefit" (Helling, Serrano, and Warren 2005, p. 7).

The drawback of this model in particular and development reports in general, is, as indicated in the introduction to this chapter, that they are mainly concerned with the planning of development interventions in 'developing' countries. However, as the framework is seen as a role model or guiding schema to improve the structural organization of localities in 'developing' countries, it can also be framed as the minimum requirements that a locality should meet to be considered 'developed'. From this point of view, the framework, closely resembling what was discussed as 'factual world' in section 8.1, can function as an abstraction of 'developed' localities in Western, democratic countries, that is, of those localities that are of interest to the present inquiry (see section 6.1). Correspondingly, the following brief discussion of the framework's seven elements and their relationships, depicted in figure 10.2, provides the basis for the next steps in the design of 'possible worlds' (see Helling, Serrano, and Warren 2005, sect. 3, for a more detailed elaboration of the framework).

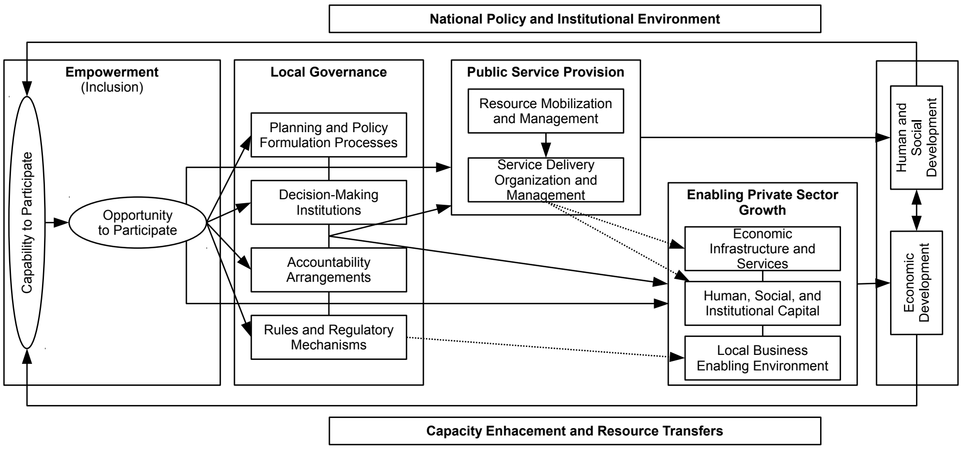

Figure 10.2: The Local Development Framework, source: Helling, Serrano, and Warren (2005, p. 14)

Firstly, on the right side of the figure 10.2, the three endpoints, i.e., the indicators to measure progress, considered in the framework are specified. Helling, Serrano, and Warren (2005, p. 7) suggest that economic, human, and social capital are the key determinants of local development efforts. The three included capital types can be defined as follows (see DFID 1999, pp. 7–16, for discussion of these and other capital types): (i) economic capital refers to the capacity of individuals and firms to invest, produce, and merchandize, i.e., to financial capital, skills and technology, and physical resources (Helling, Serrano, and Warren 2005, pp. 7, 9); (ii) human capital can, following Smith ([1776] 1979, pp. 279–282), be defined as the set of a person's "acquired and useful abilities" or talents, which the individual employs, especially if belonging to the class of the "labouring poor" who often do not possess other productive assets, to generate a revenue; and (iii) social capital which in reference to Putnam (1993, p. 167) can be defined as "features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions [...]". Although these three indicators are depicted as equally important, the first tends to be the primary target of their framework, not only because there is a considerable overlap between these three categories, i.e., economic capital is defined as a broader and encompassing category, but also because the latter two, despite referring to intrinsic valuable capabilities such as education, health, and capacity for collective action, are merely seen or better reduced to means for achieving 'local economic development' (see also section 5.5). Nevertheless, local development efforts, if successful, increase all or a subset of these three capital types and thereby contribute to local empowerment, the element on the left side.

Secondly, 'empowerment' refers to 'opportunities' and 'capabilities' of local people to participate in social, political, and economic activities (Helling, Serrano, and Warren 2005, p. 15, and section 5.3). 'Capabilities', a term that differs substantially from the terminology introduced in section 5.5, is used as umbrella to denote those resources, including human and social capital, that are employed to exploit locally existing opportunities, i.e., economic options provided by the 'local environment's' structure and processes (see also DFID 1999, p. 17; 2001b, p. 1; Scoones 1998, pp. 12–13). The 'local environment', in turn, comprises the following three interrelated systems: the local governance system (political participation), the local service provisioning system (social participation), and the 'private sector growth' or local economic system (economic participation). The processes within as well as between these three systems are the central focus of the framework. The following discussion of these entities will underline the above made claim that people—the actual and ultimate end of development (cf. Anand and Sen 2000, p. 2032)—are only considered in terms of their 'capabilities', that is, in their nature as contributions to local economic development (see also Morse, McNamara, and Acholo 2009, p. 14, and section 5.5).

Thirdly, the 'local governance' system comprises three processes and formal rules about these processes (Helling, Serrano, and Warren 2005, pp. 17–22): a process in which local development is planned and policies are formulated, a process in which decisions relevant to local development are made, and an accountability process, including, for example, procedures to ensure transparency (cf. Uphoff 1986, pp. 202–203), that allows local citizens to hold local governments and other civil society organizations accountable for the activities involved in the former two processes (cf. DFID 1999, p. 18; 2000b, p. 7). Although civil society organizations are mentioned, the key player in this system, due to its legal authority, is the local government (Helling, Serrano, and Warren 2005, p. 19). It can be defined as a body, which, because it is elected by local citizens, has the democratic legitimacy to carry out regulatory tasks in the locality (Uphoff 1986, p. 4). However, localities with high levels of self-development, that is, those that have overcome the locality poverty trap, enable local citizens to participate in—or at least to influence—those activities in which these rules are defined by giving them a voice in governance processes (see also Crowe 2006, p. 591, and section 10.3).

Fourthly, the 'public service provision' system, the second 'environmental element', comprises two processes (Helling, Serrano, and Warren 2005, pp. 23–25): on the one side, a process to mobilize and manage the resources of local development, and on the other side, a process for managing and delivering public services (see also DFID 2000b, p. 7). The main actors in this system, responsible for the delivery of social services (i.e., health and education) and infrastructure services (i.e., transport, water, electricity, telecommunication, buildings for service delivery), are decentralized sectoral agency organizations or 'local administrations', which Uphoff (1986, p. 4) defines as "local agencies and staff of central government ministries". In contrast to the local government, these organizations are not accountable to local citizens but only to their bureaucratic superiors (cf. Thomson 2000, p. 105; Uphoff 1986, p. 4). Additional actors, less relevant but still important, are cooperatives, defined as "local organizations that pool members' economic resources for their benefit" (Uphoff 1986, p. 4), that provide services, e.g., information exchange, marketing campaigns, to local businesses (Helling, Serrano, and Warren 2005, p. 66).

Fifthly, the final 'environmental system' Helling, Serrano, and Warren (2005, pp. 25–29) discuss in their framework contains, in contrast to the former two, only three generally applicable interventions that are expected to foster local economic development: access to the economic infrastructure, strengthened human, social, and institutional capital, and improved local business environment (see also DFID 1999, p. 19). Although this system is an abstraction of the local economic system, which comprises private businesses that are "either independent operations or branches of extra-local enterprises engaged in manufacturing, services and/or trade" (Uphoff 1986, p. 5), the concrete arrangement depends on contextual elements (e.g., available resources, cultural values, etc.). In other words, the entities of this system cannot be further specified without incorporating contingently related elements.

Finally, the two remaining entities of the framework are two 'enabling elements' that embed the locality in a surrounding environment (Helling, Serrano, and Warren 2005, p. 8): on the one side, the policy and institutional environment, indicating that the locality is related to higher level social units that influence local development through their formal and informal institutions (see also Hodgson 2006, pp. 9–13; North 1990, pp. 36–53), and on the other side, the capacity enhancement and resource transfer element, which functions as a placeholder for economically relevant, contingently related interactions between the locality and other systems such as the capacity building support of donor organizations or the intra-governmental resource transfer.

10.2 Critical Analysis of the 'Factual World'

Up to this point, the preceding discussions were merely theoretical efforts guided by epistemic considerations. Despite the argument that such theoretical endeavors are not, as often mistakenly framed, impractical, the claim that introduced the present study, i.e., to address questions of the lifeworld (cf. Wittgenstein 1963, §6.52), has not been taken up. The aim of this section is to deliver on this promise by pointing out reasons for changing the 'factual world'. In respect to the overarching goal of the fourth part, this serves to illustrate how DSR projects can tackle 'relevant' issues, in the broadened context of discovery, without confining themselves to the problems articulated by 'important stakeholders' (see sections 5.2 and 5.3). According to the elaboration in section 8.1, this step of the design of 'possible worlds' entails the following three tasks: (i) sketch the idea of a 'possible world', (ii) explicate its underlying value position, and (iii) criticize the 'factual world' to identify intervention entry points, i.e., to prepare the basis for the search of contributions that deal with those injustices that become visible if the 'possible world' is taken as vantage point.

Sketch of the 'Possible World'

As indicated before, the exemplary application of the design of 'possible worlds' is concerned with a 'possible world' that has a 'community-driven SHD initiative' (Heusinger 2013b) (hereinafter: initiative) as its central element[202]. The proposal of this 'possible world' rests

202. Similar to the discussion in section 5.5, the following will be based on a substantially extended and refined version of the arguments presented in Heusinger (2013b).

on the following three rationales: (i) tackling HD and SD concerns separately is, due to their intertwined nature, infeasible; rather, an integrated, holistic SHD approach is required, (ii) the locality as specified above is a suitable social unit to deal with some of the issues hampering SHD, especially community incoherence and social exclusion, and (iii) the limitations of the current, mainly, technocratic development practice, in addition to the normative considerations of C&E research (see section 5.3), suggest that community-driven endeavors are critical to prevent the decline of already made HD achievements in 'developed' democracies.

These three arguments culminate in the idea of a contextualized, organizational version of 'issue networks' (Heclo 1978), nowadays discussed under the heading of 'policy communities' and 'policy networks' (Ryan 1999, p. 564), which are characterized as fluid and open, level-stretching, unbounded, extra-governmental networks that engage in the framing and redefinition of public policy issues and that work out alternative policy options (cf. Heclo 1978, pp. 99, 102, 105; Dahan, Doh, and Guay 2006, p. 1578). These networks are formed through the relations between highly issue-skilled individuals with specialized knowledge, the technopols, who participate in the network not solely, if at all, for professional reasons but because they are emotionally committed to the focal issue (cf. Heclo 1978, pp. 94, 105–116; Ryan 1999, p. 564; Smith and Larimer 2009, pp. 79–80). Transferred to the 'possible world', the initiative can therefore be understood as a network formed by local citizens committed to the locality, i.e., to the living conditions within it, as the focal issue. Such an initiative, a necessary complement because of (iii), addresses (ii) as follows: on the one side, it functions as an interaction space that allows to create a local, diversity appreciating identity, which overwrites the primacy of community identities without supplanting them. The mechanism expected to generate this outcome is based on a communicatively reached shared vision, i.e., a public opinion, for the locality and on the inter-community trust generated by collective action carried out to realize the shared vision. If the principles of SHD are incorporated into this vision, the initiative not only helps to overcome the issues of community incoherence and social fragmentation, but also prevents HD achievements from being sacrificed for the necessary SD endeavor. On the other side, to simultaneously make progress in terms of SD, the initiative also engages, as one of the collective action projects, in the management of ecological systems, not only to improve the locality's ecological footprint, but also to build awareness and understanding that support SD efforts. However, the interconnected and interdependent nature of ecological systems demands that these local efforts are aligned with those extra-local activities carried out in other, connected ecological systems. The engagement in such an exchange is not only mandatory from the perspective of larger ecological systems that cross administrative boundaries, but it also infuses the locality with extra-local perspectives that influence the nature of the identity created within in it. The latter is, in turn, necessary to align it with SHD imperatives.

In respect to the 'factual world' outlined in the preceding section, the 'possible world' thus differs in at least two respects[203]: (a) the set of appropriate or acceptable local devel-

203. For the sake of completeness, the explication of the 'factual world' along the rules suggested by the IAD framework (see footnote 200) is changed only in five respects. Whereas two of these differences are discussed in the following, one change will only be carved out in the succeeding critical reflection, i.e., that one of the initiative's activities presupposes a 'co-management arrangement' (cf. Ostrom 2012, pp. 138–139). The latter is, in anticipation of the discussion in section 10.3, an interaction platform on which different actors who have a stake in a particular ecological system interact with each other to align their efforts to achieve a common goal. Correspondingly, in addition to the initiative the 'possible world' adds another actor to the before-mentioned action situation. This implies that two new boundary rules have to be added as well. In anticipation of the discussion in section 10.3, these rules can be stated as follows: (i) local citizens become a member of the initiative by becoming a resident of the locality and (ii) an actor becomes engaged in the co-management arrangement by carrying out inter-organizational

opment outcomes is confined to those results that do not endanger the conditions defined in the shared, SHD-compatible vision, i.e., the limitations of the natural environment are recognized instead of assuming a boundless world (see section 5.5), and (b) a new position or actor, that is, the local citizen-driven initiative, acting as facilitator of (a), is added to the action situation outlined in section 10.1. To fulfill its role, the initiative has to carry out the following four activities or actions: firstly, it has to define and continuously refine the shared vision of the locality because it provides the basis for and the guiding principle of the initiative; secondly, it has to ensure that extra-local interventions do not hamper or endanger but foster the achievement of the shared vision; thirdly, it has to organize 'complementary action' (Mathews 2013, pp. 152–154) to make progress in terms of realizing the shared vision and to generate the 'we-feeling' or the trust pivotal to create a local identity; and fourthly, it has to lobby the local government and other actors to change 'higher tier' rules (cf. Mincey et al. 2013, p. 564; Ostrom 2002, pp. 43–46; 2007, pp. 27, 44–46; 2011, pp. 10–11) that cause intra- and extra-local injustices, i.e., it has to contribute, following from the obligation discussed in section 5.5, to the global project of SHD.

Before this, following from the 'underdesign principle' (Fischer and Herrmann 2011, pp. 15–17), shortened sketch of the 'possible world' is employed for the critical analysis of the 'factual world', that is, for the identification of intervention entry points, the next task is to explicate the value position that underpins the outlined proposal.

Underpinning Value Position

Following from the present inquiry's understanding of SHD explicated in section 5.5, the proposed 'possible world' is underpinned by the thoughts of Sen, specifically, but not only, his '*The Idea of Justice*' (Sen 2009). Although it is impossible to do justice to an account that developed over a half century, it is necessary to explicate at least the core principles to give a glimpse of the insightful and powerful arguments that shaped the ideas underpinning the current proposal. The starting point of the '*The Idea of Justice*' is Rawls' '*A Theory of Justice*', which Sen (2009, pp. 5–6), in all his courtesy, criticizes as an attempt belonging to the category of contractual or transcendental institutionalism[204], i.e., as an approach that hypothesizes a universally agreed upon social contract in which just institutions are specified and that makes behavioral assumptions with which people have to comply (see also Sen 2012, p. 326). His main line of reasoning, eventually leading to the counterproposal, concentrates on the elements in the composed term that he puts forward to contrast the two approaches: firstly, Sen (2009, p. 9–18, 410) argues that a transcendental approach, i.e., devising a perfectly just society, is, as discussed more thoroughly below, not realizable and, even if granted it was, is redundant—neither sufficient nor necessary—in the endeavor to remove factually existing, manifested injustices (see also Freeman 2012, pp. 169–170, 172–194; Osmani 2010, pp. 600–604; Satz 2012, p. 278; Sen 2006, pp. 96–105; 2008, pp. 336–340; Watene 2013, p. 28, the first for a critical reflection of the account). Instead, he argues for a comparative assessment of justice (cf. Sen 2008, pp. 336–340), i.e., a "theory of justice for the imperfect world" (Osmani 2010, p. 604), which resembles what Popper (1967b) suggests as 'piecemeal social

projects or partnerships with other associations that have a stake in the focal ecological system. The transition from the 'factual' to the 'possible world' does not—at least not from the 'second research project's perspective—require a reform or change of the remaining action situation entities outlined before.

204. According to Sen (2009) the approaches of Hobbes ([1651] 1909) and Rousseau ([1762] 2011) also fall in this category. For a discussion of the role of institutions and social contract theory in regard to Sen's '*The Idea of Justice*' see also Sen (2012, pp. 327–329) and Gaus (2012, pp. 267–272).

change' in response to the '*The High Tide of Prophecy: Hegel, Marx, and the Aftermath*'.

Secondly, in regard to the second term, he states that assessing justice solely in terms of institutions is incomplete; rather, justice manifests itself in the equal distribution of freedom, which, in turn, suggests that not only structural arrangements but, even more importantly, the realizations or freedoms they allow need to be considered in the identification of injustices (cf. Freeman 2012, pp. 196–198; Sen 2008, p. 334; 2009, pp. 6–27, 95, 117, 169; 2012, pp. 323–324). Particular important aspects of freedom are capabilities, which define the substantive opportunities people have (Sen 2009, pp. 287, 295, see also section 5.5). However, Sen (2009, p. 296) argues that the concept of freedom goes beyond capabilities and incorporates a process perspective that captures the "freedom of citizens to invoke or utilize procedures that are equitable". It is this extension that prevents that Sen's 'idea' degenerates into a "narrowly consequentialist theory" (Osmani 2010, p. 604) that solely focuses on 'culmination outcomes' (Sen 2009, p. 230). On the contrary, his approach to justice is concerned with 'comprehensive outcomes' (see also Gaus 2012, pp. 263–264), which, in addition to the former, comprise agency, relations, and processes (Sen 2009, pp. 220–221).

Both these lines of reasoning culminate in the argument that justice is essentially based on the comparative assessment of interventions in a public reasoning framework. He argues that "undertaking non-self-centered and non-parochial scrutiny through paying attention to distant perspectives" (p. 408) is the "way to extend the reach and reliability of valuations and of making them more robust" (p. 241) which eventually helps to get things right (Sen 2009, p. 243; Osmani 2010, pp. 604–605); whereby getting things right refers to removing what is unjust (cf. Kelly 2012, pp. 295–296). This procedural approach to justice is based on two activities: personal and public reasoning. The interplay between both demands that "individuals first subject their own values and views to a critical and impartial scrutiny so that when they engage in public reasoning they can defend their views to others with reasons" (Osmani 2010, p. 604). This impartial personal reasoning is guided by 'what cannot be reasonably rejected', a principle proposed by Scanlon (1982, p. 116), who asserts (see also Scanlon 1998; Barry 1989, pp. 282–292; 2002, pp. 67–72):

> "The desire to be able to justify one's actions to others on grounds they could not reasonably reject will be satisfied when we know that there is adequate justification for our action even though others in fact refuse to accept it [...]" (Scanlon 1982, p. 116).

The incorporation of this idea, especially the extension of 'even though others in fact refuse to accept it', in Sen's account directly connects to two further, closely intertwined aspects: 'incompleteness' and public reasoning. In regard to the former[205], Sen (2009, p. 397) points out that in any decisions there might be reasonable and non-arbitrary claims[206] that diverge and are incommensurable. This is the principal reason why it is impossible to

205. This is essentially a reworking of Arrow's impossibility theorem (Arrow 1963), which states that, given, as discussed by Arrow (1963, chap. 3), plausible assumptions such as a set of individuals preference rankings of three alternatives, a positive association of social and individual values, the independence of irrelevant alternatives, citizens' sovereignty, and the condition of nondictatorship, there is no social welfare function that can translate individuals' rankings of alternatives into a complete ranking while simultaneously fulfilling all these conditions. For a detailed elaboration of Sen's response see Sen (1970), Sen (1977c), and Sen (1977a).

206. He illustrates this using the 'flute' example (Sen 2009, p. 13–15). In this example there are three children quarreling about a flute (see also Gaus 2012, pp. 247–248; Habermas [1991] 1994, p. 152; Sen 2012, pp. 322–323): Anne is the only one who can play the flute, Bob has no other toys to play with, and Carla has worked for month to make the flute. All of these three claims "point to a different impartial and non-arbitrary reason" (Sen 2009, p. 15). Correspondingly, the distribution question cannot be answered unambiguously (p. 13–14): (i) utilitarian hedonists would favor Anne because of human fulfillment, (ii) egalitarians would favor Bob in order to remove poverty, and (iii) libertarians would favor Carla because of her entitlement.

define or agree upon, as implied by the transcendental institutionalists' endeavor, a perfectly just society (see also Gaus 2012, pp. 249–251; Osmani 2010, p. 605; Paavola 2007, p. 96; Sen 1985, p. 180; 2009, p. 397; 2012, pp. 323–324; Silver, Scott, and Kazepov 2010, p. 459; Wunsch 2013, p. 224):

> "In many cases, Sen argues, it is sufficient to stop at a partial ranking without having to look for complete agreement over all rankings. Thus reasoned partial agreement that one state of affairs is more just than another is all that is needed to start making the world less unjust. We do not need knowledge of what a just state of affairs is or what just institutions are" (Deneulin 2011, p. 790).

In other words, recognizing the pluralism of values (Habermas [1983] 1990, p. 65; 1998, p. 57), which manifests itself, for example, in the community cohesion problem described in section 5.5, does not necessarily impair the removal of injustices; on the contrary, incompleteness indicates where unresolved conflicts exist (Sen 2009, p. 144), which might help to focus public discussion and reasoning (cf. Osmani 2010, p. 605). Nevertheless, it demands, as implied by terms such as 'plurality' or 'conflict', a public reasoning framework and, by implication, renders monological approaches to justice infeasible as, for example, shown by the forceful criticism put forward against the approach of Kant ([1786] 1974)[207]. One of the constructive proposals that unfolds on this line of reasoning is the 'discourse ethics' of Habermas[208], a facet of his far-reaching research program[209] indirectly touched in the discussions in part I and section 5.3. It is essentially a continuation of Kant's reconstruction of the presuppositions that underpin the justification of the rightness of actions: on the one side, it conserves the basic intuition of the Categorical Imperative, i.e., "the perspective from which moral norms and principles can be judged in an impartial manner" (Habermas 1998, p. 81), which is constitutive for all meta-ethical positions that consider moral statements to be truth-apt (Habermas [1983] 1990, pp. 43, 63; [1991] 1994, p. 52), but on the other side, it pushes the focus from the individual to the public realm. The rationale underlying the latter shift can be summarized as follows: ensuing from the established universality of communicative action (cf. Habermas 1998, p. 38), Habermas ([1983] 1990, pp. 59–60) argues that communicative action, aiming to reach rationally motivated understanding (see section 2.1), creates a binding/bonding effect, because the speaker persuades the hearer through the guarantee that she or he can redeem the implied validity claims (see also Habermas [1981] 1987a, pp. 128, 141–151). The, in respect to the foregoing discussion, relevant dimension is the social world, that is, those validity claims that are based on, in the context valid, normative rules governing

207. Another criticism why the monological approach of Kant ([1786] 1974) is infeasible in the present case, can be derived from the context in which the problems summarized under the heading of SHD unfold (see section 10.3). In highly complex and systemic environments the rightness of actions does not solely depend on an individual's perception (cf. Habermas [1983] 1990, p. 66–67): "it becomes increasingly difficult to identify individual agents that can be considered causally let alone morally responsible for systems level effects, which emerge in complex ways from the interactions of multiple agents. Even where agents can be individuated, features of systems such as non-linearity, opaqueness, positive feedback loops, and complexity mean that agents are frequently unable to predict the outcomes of actions, assess the potential for unintended negative consequences, or even clearly distinguish cause and effect" (Johnstone 2007, p. 74). Furthermore, for a discussion of Hegel's ([1820] 1991) criticism of Kant's ([1786] 1974) Categorical Imperative see Habermas ([1983] 1990, pp. 195–215), Sedgwick (1996, pp. 580–581), and Korsgaard (1985); for an investigation of the allegedly Hegelian elements in Habermas' discourse ethics see Khan (2012).

208. Although Habermas is commonly associated with discourse ethics, it was initially proposed by Apel (1989). For a critical reflection of Apel's approach see Habermas ([1983] 1990, pp. 82–98) and Habermas ([1991] 1994, pp. 76–78); for a comparison of both approaches see Gamwell (1997) and Kettner (2011).

209. This stream of critical social theory, in line with the arguments of Sen, differs from Foucault's by standing for "consensus, rational deliberation and the bracketing-off of power in the name of attaining a discoursive formation of the collective will" (Silver, Scott, and Kazepov 2010, p. 457). For further comparisons see Flyvberg (1998), Purcell (2008, pp. 40–74), and Silver, Scott, and Kazepov (2010, pp. 457–465).

interpersonal relationships. Social interactions are stable as long as these validity claims are perceived to be legitimate[210] (see also Habermas [1976] 1979, p. 178):

> "moral utterances serve to coordinate the actions of different actors in a binding or obligatory fashion. 'Obligation' presupposes the intersubjective recognition of moral norms or customary practices that lay down for a community *in a convincing manner* what actors are obliged to do and what they can expect from one another [emphasis in the original]" (Habermas 1998, p. 3).

This, on the other side, suggests that the success of endeavors striving for the removal of identified injustices is essentially based on reasoning that contests the legitimacy of social structures (see section 5.5). This reflexive form of communicative action is institutionalized in argumentations or discourses[211] (cf. Habermas [1985] 1987, p. 323; [1991] 1994, p. 50; [1992] 1996, p. 98; 1998, p. 41). Although argumentations actually refer to the type of speech act in which participants engage if, based on a failed communicative action, the intersubjectivity of validity claims—underpinning social order and stability—should be re-established by redeeming arguments supporting the validity claims in question (cf. Habermas [1981] 1987a, pp. 37–45; [1991] 1994, pp. 8–17), they are, or probably have to be, utilized to deliberatively contest validity claims with reasons that, ideally, cannot be reasonably rejected to lay down in a convincing manner why current social structures are unjust, which, in turn, is the foundation for initiating structural changes. Nevertheless, discourses are, independently of the aim, guided by the cooperative competition for the better argument[212], that is, the acceptability of the outcome of discourses is based on the rational force of the reasons put forward to justify validity claims (cf. Habermas 1998, p. 44):

> "Reasons [...] are the currency used in discursive exchange that redeems criticizable validity claims. Reasons owe their rationally motivating force to an internal relationship between the meaning and the validity of linguistic utterances" (Habermas [1992] 1996, p. 35).

It is this characteristic of argumentations, a universal human practice, which provides a way out of the dilemma, emerging due to the absence of a metaphysical background or a shared idea of a good life (see section 3.2), that normative orientations can be given only by human beings themselves (see also Habermas [1981] 1987a, p. 39; 1998, p. 39): "The

210. Intersubjectively shared and recognized norms, i.e., norms 'existing' or legitimate in a certain context, have to be distinguished from norms satisfying the criterion of rightness or "worthiness to be recognized", because the latter cannot, in contrast to the former, lose their legitimacy (Habermas [1976] 1979, pp. 178–179; [1983] 1990, p. 61).

211. Habermas ([1981] 1987a, p. 71) used to use the term 'discourse' only for such argumentations that test the justification of universalizable validity claims (e.g., truth, rightness, and well-formedness). The internal relations of validity claims in these dimensions suggest that an agreement between participants is generally possible, if the argumentation is carried out long enough. On the other side, authenticity claims do not fulfill the strong criterion of universalization, because they are bound to questions of the good life (Habermas [1991] 1994, pp. 9–14). Although the same principles apply, the difference between the former and the latter is that universalizable validity claims can, in principle, win the acceptance of an universal audience, whereas ethical claims "are addressed to those who share a particular history and tradition of values" (Bohman and Rehg 2011, p. 27), i.e., universal acceptance cannot be expected (cf. Habermas [1991] 1994, pp. 9–14; [1992] 1996, p. 108). However, in his later writings Habermas also uses the term 'discourse' to refer to ethical argumentations: ethical-existential and ethical-political discourses (Habermas [1991] 1994, pp. 1–18). Therefore, the present inquiry uses the terms 'discourse' and 'argumentation', if not noted otherwise, interchangeably.

212. It has to be noted that Habermas ([1981] 1987a, pp. 47–50) distinguishes three different perspectives of the social practice of argumentation (see also Bohman and Rehg 2011, pp. 22–25): firstly, arguments can refer to reasons that are issued to support validity claims and that, due to their intrinsic properties, can be accepted or rejected (see also Toulmin 2003, and the detailed elaboration of argumentation theory, also including a discussion of an earlier version of the former, in ( )(and the detailed elaboration of argumentation theory, also including a discussion of an earlier version of the former, in ( )()[][pp. 44–71]Habermas.1987a,)[][pp. 44–71]Habermas.1987a,); secondly, arguments can be understood as procedures, i.e., as specially regulated interactions in which reasons—arguments as products—are put forward to test the validity claims of interlocutors; and finally, arguments can also be seen as a process, that is, as an idealized speech situation, which is discussed more thoroughly in the following.

missing 'transcendental good' can be replaced in an 'immanent' fashion only by appeal to the intrinsic constitution of the practice of deliberation" (Habermas 1998, p. 41). The guiding principle of such endeavors is the discourse principle (D) (cf. Habermas [1983] 1990, pp. 66, 93; [1991] 1994, p. 50; [1992] 1996, p. 107), which states that only "those norms can claim validity that could meet with the acceptance of all concerned in a practical discourse" (Habermas 1998, p. 41); whereby 'acceptance' (*Zustimmung*) refers to the context-dependent 'agreement' (*Einverständnis*) given by participants in response to epistemic reasons (p. 42), which, by virtue of its impartiality (i.e., acceptance of all), deserves general recognition by all affected, i.e., the agreement unfolds a morally binding force (Habermas [1983] 1990, p. 65; [1981] 1987a, p. 39; [1991] 1994, p. 8). However, validity claims standing the scrutiny of public discourses and, by implication, rules supported by the former, are not fixed; rather, they "are constantly exposed to the risk of being invalidated by better reasons and context-altering learning processes" (Habermas [1992] 1996, p. 36). The embodiment of these discourses in modern societies, as already outlined in part I[213], takes, according to Habermas ([1991] 1994, pp. 16–17), the form of deliberative democracy. Although coming from a different angle, Sen's endeavor converges against the same insight. He argues that the pursue of justice is internally connected to deliberative democracy, which, in addition to the latter's intrinsic value, brings out its instrumental importance (see also Kelly 2012, pp. 308–315; Paavola 2007, p. 96; Silver, Scott, and Kazepov 2010, p. 459):

> "The crucial role of public reasoning in the practice of democracy makes the entire subject of democracy relate closely with the topic that is central to this work [*The Idea of Justice*], namely justice. If the demands of justice can be assessed only with the help of public reasoning, and if public reasoning is constitutively related to the idea of democracy, then *there is an intimate connection between justice and democracy, with shared discursive features* [emphasis added]" (Sen 2009, p. 326).

Although both, Habermas and Sen agree that deliberative democracy is outstandingly important in value pluralistic, modern societies—underlining the contribution of the 'possible world'—, the different emphases of their research programs allow to be more specific in regard to the value position guiding the 'second research project': whereas Habermas provides general guidance on the procedural aspects, as manifested in the conditions of an ideal speech situation, Sen's emphasis on the identification and evaluation of injustices allows to operationalize these insights in regard to the understanding of SHD outlined in section 5.5 (cf. Sen 2005a, p. 157). More specifically: Habermas (1998, p. 44) states that an ideal speech situation is characterized by four conditions (see also Habermas [1984] 2001, pp. 97–99):

> "(i) that nobody who could make a relevant contribution may be excluded; (ii) that all participants are granted an equal opportunity to make contributions; (iii) that the participants must mean what they say; and (iv) that communication must be freed from external and internal coercion so that the 'yes' or 'no' stances that participants adopt on criticizable validity claims are motivated solely by the rational force of the better reasons" (Habermas [1992] 1996, pp. 305–306).

Sen and his discussion of capabilities, which includes the demand to identify capabilities

213. The move of Habermas' research program into the direction of modern law and political theory (cf. Habermas 1986, [1992] 1996, 1992, 1998, [2008] 2009), is partially a response to the criticism put forward by pragmatists (cf. Frega 2013; Habermas [1999] 2003, pp. 213–235, the latter for a response) and a necessity following from the rejection of a meta-discourse to decide in which discourse a given problem needs to be addressed (cf. Habermas [1991] 1994, pp. 16–17).

and specify their importance as well as their relative weighting in discourses, not only spells out the form of the discursive content, but he also suggests an important—seen from the perspective of SHD—qualification of the discourse principle (D) that impinges on the ideal speech situation's first condition: the 'impartial spectator'. The impartial spectator, developed by Smith in his '*The Theory of Moral Sentiments*', is an instrument that not only provides informational enrichment, possibly reducing the scope of incompleteness (cf. Osmani 2010, p. 605), and helps to remove the influence of traditions, ideologies, and dogmatic beliefs (Sen 2009, pp. 45–49, 108, 123, 128), but it also allows to incorporate, at least partially, the 'voiced concerns' of "structurally handicapped" future generations (cf. Hooft 1993, p. 207):

> "The principle by which we naturally either approve or disapprove of our own conduct, seems to be altogether the same with that by which we exercise the like judgments concerning the conduct of other people. We either approve or disapprove of the conduct of another man according as we feel that, when we bring his case home to ourselves, we either can or cannot entirely sympathize with the sentiments and motives which directed it. And, in the same manner, we either approve or disapprove of our own conduct, according as we feel that, when we place ourselves in the situation of another man, and view it, as it were, with his eyes and from his station, we either can or cannot entirely enter into and sympathize with the sentiments and motives which influenced it. We can never survey our own sentiments and motives, we can never form any judgment concerning them; unless we remove ourselves, as it were, from our own natural station, and endeavour to view them as at a certain distance from us. But we can do this in no other way than by endeavouring to view them with the eyes of other people, or as other people are likely to view them [...]. We endeavour to examine our own conduct as we imagine any other fair and impartial spectator [...] would examine it [footnote excluded]" (Smith [1759] 1984, pp. 109–110).

In other words, the impartial spectator—in its function as ideal observer—is an instrument for critical scrutiny from the perspectives of others (Sen 2009, p. 135) that allows to go beyond national boarders, which is a vital prerequisite for Sen's—and arguably other approaches—idea of justice, because the "underlying concept of justice in the human development approach does not recognize any national boundaries [...]" (Sen 2008, p. 340). Furthermore, repeatedly exercising the 'removing ourselves' to view problems with 'the eyes of other people' beyond national identities is also instrumentally important to devise an awareness for and an attachment to humanity as a whole, i.e., to develop a global identity (cf. Phelps et al. 2011, p. 405). Therefore, the impartial spectator is also a technique that provides the basis for counterbalancing the mechanism that generates community incoherence and social fragmentation.

Identification of Intervention Entry Points

The final task in the second step of the design of 'possible worlds' is the identification of intervention entry points through a critical reflection of the 'factual world' from the perspective of a hypothetically existing alternative, that is, from the 'possible world'. In the latter's sketch it was already indicated that both worlds differ in at least two respects (see also footnote 203): (i) a new position, i.e., the community-driven SHD initiative, was added to the action situation and (ii) the outcomes were, from the perspective of SD, rectified. The 'relevance' or more precisely the reason for both these changes is explicated in the following to justify that these changes are indeed desirable and to prepare the basis for the synthesizing design, which aims to demonstrate that these changes are also possible. Both differences [(i)–(ii)] are discussed in turn.

Critical Reflection of Community-Driven Initiatives

The first divergence between the 'factual world' and the 'possible world' concerns the way in which policy options that have reached the political agenda have been designed and are implemented in the 'factual world'. A concept that helps to illustrate both processes are the afore-mentioned 'issue networks' (Heclo 1978), which, in addition to their informal representation, exist also in form of think tanks, trusts, or foundations. These organizations are often closely related to political parties, ideological institutions, or industrial associations that financially support their operation. The first presently relevant argument of Heclo (1978, pp. 105–106, 121–122) is that policy options are not devised within the political system, but within these—democratically not legitimated—organizations that feed created options into all levels of the governmental hierarchy. Democratic arrangements, in this interplay, solely serve as a platform for selecting and legitimating particular proposals (see also Leifeld and Schneider 2012; McGann 2012; Miller-Cribbs et al. 2010; Pautz 2010; Smith, Kay, and Torres 2013; Weidenbaum 2010). Although such a structure has its advantages (e.g., involving field experts), it also has serious limitations—not only from a SHD perspective. For example, these organizations tend, sometimes even under external pressure, to 'correct' results to meet the vested interests of their financiers (see also Morris and Clark 2013):

> "[E]vidence can also be an article of trade, with the livelihoods of research institutes dependent on their capacity to manufacture evidence to meet the needs of inquisitive customers. On a bad day, the ivory tower can look awfully like a shopping mall" (Pawson 2006, p. 3).

This issue underpins those further shortcomings that this division of labor brings from a SHD stance (cf. Brundtland 1991, p. 48): on the one side, the financier-specific design of policy options cannot cope with the crosscutting nature of SHD concerns, which often require trade-offs between different interests, and on the other side, SHD efforts depend, due to their long-term horizon, on broad support in the electorate. The latter, however, is difficult to achieve, because interest-specific marketing campaigns as well as respective counter actions—often even based on 'manufactured' evidence—disperse the electoral base (see section 6.1). Combined with the aspiration of officials to 'survive' the next election (cf. Brundtland 1991, pp. 43–44; Marshall and Toffel 2005, p. 680), unpopular long-term concerns, such as SHD-relevant problems, often do not reach the political agenda. However, if they do, they do it only in a reframed version (see section 5.5) that mainly serves the needs of particular stakeholders. As businesses, in contrast to civil society organizations, are much better coordinated and connected to all levels of the political hierarchy (cf. Blakeley 2005, p. 159; Brunet-Jailly 2008, p. 381; Doberstein 2011, p. 541)[214], their interests, instead of a genuine public opinion, tend to dominate the political system (see section 6.1).

The second relevant argument in the present case refers to the realization of a selected option: the implementation is not done by governmental agencies, but by 'intermediary orga-

214. For example, there are business improvement districts that are comparable to or even larger than local governments in terms of resources and coverage (see Foster 2011, pp. 104–108). The prime example of such a powerful 'business government' within a locality is the Time Square Alliance `http://www.timessquarenyc.org/`, accessed May 25, 2015.

nizations' (Heclo 1978, p. 94). Similar to development agencies (Clark and Carney 2008, p. 2), the governmental administration is merely concerned with regulating implementation and distributing financial resources among intermediaries (Heclo 1978, p. 92). Generally, these intermediary organizations translate options into practice by either employing technocratic top-down or, if legally mandated, participatory bottom-up approaches. The former is often associated with the highly influential contribution of W. A. Lewis (1954, 1955), who, inter alia, suggests that providing incentives and perquisites for elites to invest will eventually generate economic growth and employment opportunities. Therefore, the deliberately created inequality will only be short-lived, because investments and perquisites finally trickle down to the masses. This reasoning gave rise to large scale development projects, often planned in cultural- and locality-insensitive settings, that were imposed on various regions (cf. Kelly, Caputo, and Jamieson 2005, pp. 308–309). However, these efforts have not lived up to their promises, partially because they failed to be realized as planned, i.e., the assumed linear process of continual refinement does not work in the real world (cf. Mann and Absher 2014; Ostrom 2012, p. 129; Uphoff 1986, pp. 192–196, and table 8.2). On the contrary, the realization process is highly complex as figure 10.3 illustrates (see Linder and G. Peters 1987, pp. 468–470; Pawson 2002a; 2006, pp. 24–27; Pawson et al. 2004, pp. 2–12; 2005, pp. 22–24; Stame 2004, pp. 63–65; Weiss 1995, pp. 86–89; 1998, pp. 51–55, for an extensive discussion). It involves numerous actors, i.e., policy makers, practitioners, and subjects, who have divergent interpretations of the program [see also the discussion of the embodiment of artifacts such as (reference) architectures in section 5.2] and who negotiate between refinement phases. Furthermore, programs are introduced into a continually changing environment, which manifests itself in (a) the parallel and interacting interventions carried out in the context [see also the open system perspective discussed in section 7.3] and (b) the feedback of users as well as the newly gained operational knowledge that cause programs to be revised. Finally, the learning of subjects, i.e., the local citizens targeted by the effort, can make programs self-fulfilling or self-defeating endeavors.

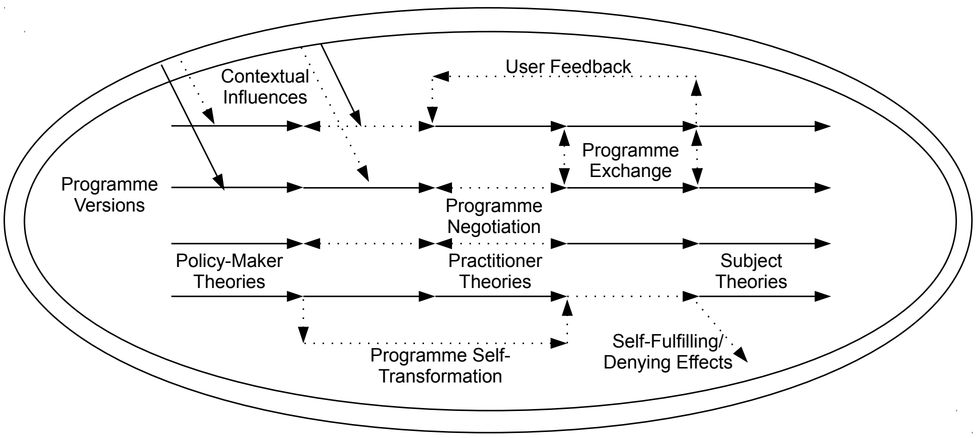

Figure 10.3: Program Complexity, source: Pawson (2006, p. 36)

In addition to the uncertain success of such top-down approaches, mainly evolving from the complexity of the program, the lack of popular support, a consequence of the 'implicit paternalism' (Chambers and Conway 1992, p. 3), moved development practice from the technocratic realm into the domain of participatory approaches (cf. Classen et al. 2008, pp. 2402–2405; DFID 2001a, p. 3; Helling, Serrano, and Warren 2005, pp. 18–19; Mosse 1994,

p. 500; Wong 2012, p. 1). However, these participatory efforts have been criticized for various reasons (cf. Andersson and Ostrom 2008, pp. 75–76; Arnstein 1969; Babajanian 2005, pp. 454–457; Berner and Phillips 2005, p. 18-25; Bhattacharyya 1995, p. 63; Blakeley 2005, p. 162; Chinsinga 2003; Enengel et al. 2011, p. 1259; Helling, Serrano, and Warren 2005, pp. 30–39; Kelly, Caputo, and Jamieson 2005, p. 310; Morrison-Saunders and Therivel 2006, p. 289; Mosse 1994; Ostrom 2012, p. 137; Oettlé et al. 2004, p. 116; Sick 2012, pp. 322–323; Silver, Scott, and Kazepov 2010, pp. 455, 466; Uphoff 1986, p. 197; Vanclay 2004, p. 280, see also the contributions in 2001): they are implicitly top-down, not only because donor organizations have a specific scope, but also because the key aspects of projects are often already decided before the first participatory exercise is carried out; they can result in monopolies that increase community inequalities; they are often not integrated with other projects in the locality; they are usually conducted by remote intermediary organizations that do not have the required context knowledge for involving all relevant stakeholders and, by implication, consider their interests (i.e., they are 'officializing private interests' and/or are prone to elite capture[215]); intra-community disputes are regularly hidden from outsiders; and participation is often 'ticked off' late in projects without any real influence or empowerment, even in legally mandated approaches, because of (omnipresent) resource constraints.

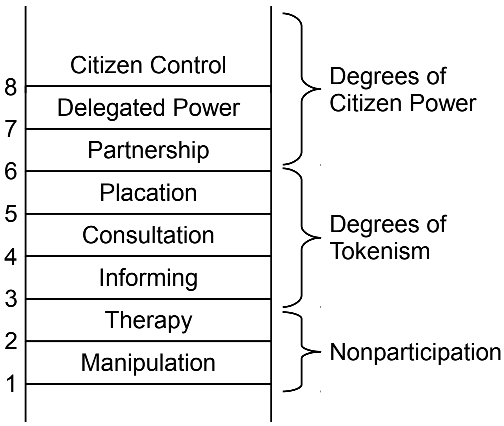

Figure 10.4: Ladder of Participation, source: Arnstein (1969, p. 217)

In short and in reference to the 'ladder of participation' (Arnstein 1969) depicted in figure 10.4, participatory approaches can be criticized for failing to go beyond 'tokenism'[216]. In the best case, efforts reach the level of 'placation', which Arnstein (1969, p. 217) describes as forms of participation in which local citizens are given the opportunity to advise, but still do not have the power to make decisions or even have direct control such as in community-driven endeavors (Mansuri and Rao 2004, pp. 1–2). Such an external, promotional development might be useful and necessary in contexts caught in a locality poverty trap; however, in cases with stronger institutional structures, such as in Western democracies, assistance approaches, i.e., participation beyond level five, tend to be more reasonable (Uphoff 1986, pp. 188–192):

215. Following Dasgupta and Beard (2007, p. 230) elite capture is defined as the "process by which [. . . local elites] dominate and corrupt community-level planning and governance". They further define local elites as "individuals [or groups of individuals] with disproportionate access to social, political or economic power". A detailed and thorough analysis and review of the elite capture phenomenon can be found in the insightful contribution of Lund and Saito-Jensen (2013).

216. See Collins and Ison (2009, pp. 360–363) for a critical reflection of why it tends even to be necessary to 'jump off' Arnstein's ladder of participation.

> "Unless people and communities have the opportunity to articulate their own understandings and priorities, the means by which to express them, and the capabilities to be effectively involved in their realization, they are unlikely to want to partake in any action agenda" (Khagram, Clark, and Raad 2003, p. 300).

However, as Rodríguez-Izquierdo, Gavin, and Macedo-Bravo (2010, pp. 239–240) point out, the degree of participation can vary over the project's lifecycle. Unfortunately, the pursued strategy is usually the reverse of what might be expected: participatory activities are carried out in early stages, mainly to increase—often degenerating into the 'officialization of vested interests'—the endeavor's legitimacy, whereas 'technical experts' take over the program's implementation (cf. Mosse 1994, pp. 508–511; Mumford 1983, pp. 23, 31–35; Uphoff 1986, p. 197). Correspondingly, neither participatory nor technocratic approaches satisfy the peculiarities of SHD in localities: on the one side, top-down approaches fail to incorporate the demands of local citizens and are not flexible enough to adapt to the locality's concrete context, and on the other side, bottom-up approaches are not integrated and aligned with other initiatives and they cannot adequately address, but might even further, inter-community issues. However, this latter aspect does often not fully unfold, because bottom-up approaches tend to be more common in rural areas (Eriksson and Forsberg 2010, p. 326), which are characterized by local citizens who, inter alia and in contrast to the ethnic-, cultural-, and/or religious-based self-categorization of urban local citizens, also strongly identify with their place of residence (cf. Bowen 2009, p. 257; Eriksson and Forsberg 2010, p. 327). In urban localities, the focal point of the present inquiry, this place-based identification as well as the intertwined social capital is, despite the wider post-place networks, largely lacking (Bradshaw 2013, p. 15). This explains why structural interventions or top-down approaches are more common in urban areas (Eriksson and Forsberg 2010, p. 326) and it suggests that solidarity and agency, prerequisites for collective action, need to be created utilizing community development approaches (cf. Bhattacharyya 1995, pp. 60–61). In other words, what is required to overcome the above mentioned challenges, at least partially, is a sort of issue network or think tank specifically concerned with the locality (Heusinger 2013b, p. 37): an initiative that has, inter alia, the intimate knowledge of the locality, required for the adaptation of interventions and their alignment with other activities, and that is capable of scrutinizing the proposals of intermediary organizations as well as holding these organizations accountable for their efforts. Obviously, such initiatives cannot be led by intermediary organizations, but they have to be driven by 'technical experts of the locality', that is, local citizens. This view of 'participation' beyond level five (see figure 10.4), is the guiding idea of the HD approach discussed in section 5.5:

> "The perspective of human development incorporates the need to remove the hindrances that people face through the efforts and initiatives of people themselves. The claim is not only that human lives can go very much better and be much richer in terms of well-being and freedom, but also that human agency can deliberately bring about a radical change through improving societal organization and commitment. These are indeed the two central ideas that give cogency to the focus on human development" (Sen 2005b, p. vii).

Such a view is also proposed by other leading figures in the HD literature such as Fukuda-Parr (2005, pp. 122–123), who argues that more collective action of community organizations and civil society groups is required to determine the course of development efforts (see also

Bailey 2012, p. 33; Kirkpatrick 2007, p. 347; McQuarrie 2013, p. 79; UNDP 1990, p. 6). Although this reasoning might be misused as an argument to cut-back on governmental spending, it also has to be seen as, in contrast to the dependency on governmental support, the increase of agency (cf. Bhattacharyya 1995, p. 63). The need for citizens to supplement public service activities and to direct the political system through a powerful public opinion crystallizes out even in 'developed' countries, in which—in addition to the inadequately addressed SD concerns—a disturbing trend is looming: the number of people 'left behind', measured in unemployment rates and income disparity, is increasing and governmental support is, relatively, declining despite increased spending (see also Bailey 2012, pp. 3, 29; Boucher 2013, p. 215; Leslie and Canwell 2010; OECD 2013, pp. 11–12; 2012, p. 81; Silver, Scott, and Kazepov 2010, p. 468). For example, the unemployed labor force in 'Organisation for Economic Co-operation and Development (OECD) countries' increased, according to OECD (2013, p. 11), between 2007 and 2013 from 16 million to over 48 million. This does not include the decline of income and job quality. Income inequality, the second above-mentioned factor, has risen between the mid-80s and the late 2000s in most 'developed' OECD countries (OECD 2012, chap. Income Equality), e.g., the Gini coefficient of Great Britain rose from 0.286 to 0.345. This increased socio-economic inequality is not only responsible for the steady increase of 'gated communities' (Foster 2011, pp. 75–79), but it is also considered to be one factor contributing to community incoherence (Cantle 2001, p. 9) and social fragmentation (UNDP 2009, p. 8). Some countries, notably Great Britain, have been struggling with these issues, especially the former, for years. The lack of community cohesion manifests itself in parallel existing cultural subsystems, which emerge from the ethnic-, cultural-, and/or religious-based self-categorization of local citizens (cf. Bowen 2009, p. 257; Eriksson and Forsberg 2010, p. 327). As ethnic diversity is a trend that "will increase substantially in virtually all modern societies over the next several decades [. . .]" (Putnam 2007, p. 128), other OECD countries also have to address the problems that jeopardize HD achievements (Cantle 2001, p. 9, see also the 'opportunity competition' discussion in section 5.5). Although participating in the life of the locality is recognized as one of the four 'key capabilities'[217] (Fukuda-Parr 2005, p. 122), this type of capability constraint has received relatively little attention in the HD literature (see section 5.5). A possible explanation is the focus on the worst off (cf. Johnstone 2007, p. 80; Sen 1992, pp. 114–116; 2009, pp. 255-256), which is often illustrated using the 'appear in public without shame' example (cf. Smith [1759] 1984, chap. 2), or the challenges involved in operationalizing this dimension of freedom in a form that it is measurable (Fukuda-Parr 2005, p. 122). However, the effects on well-being are considerable, because ethnic diversity, at least in the short-run, is correlated with reductions in social solidarity as well as the formation of social capital, even within communities (Putnam 2007, pp. 142–151). These concerns, in turn, are closely related to increased violence and social insecurity (UNDP 2009, p. 8), strikingly summarized in the following quote:

> "While, for privileged people in particular, these basic identifiers [of our social identities] may not appear to be of particular importance much of the time, when caught on the wrong side of town at the wrong time of day, they can suddenly become *all* that you are seen to be [emphasis in

217. The other three key capabilities have found their way into the human development index (HDI) that is annually reported in the Human Development Report (HDR). The HDI "measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living" (UNDP 2010, p. 216).

the original]" (S. White 2009, p. 257).

Although it might be argued that there is a primacy of socio-economic inequalities, interventions addressing these issues and those concerned with intra- and inter-community tensions are each necessary but in themselves insufficient; both have to be closely aligned to avoid adverse effects (cf. Gaffikin and Morrissey 2011, pp. 1090–1091; UNDP 2009, p. 14). More specifically: Gaffikin and Morrissey (2011, p. 1105) point out that solely focusing on "resource allocation demanded by the 'community differential' may inadvertently accentuate intercommunal enmity" (see also Clayton 2009, pp. 481–482, 485; Mason 2010, p. 873), which creates the breeding ground for adverse effects on HD achievements through violence. The Geneva Declaration (2010, pp. 10–14), for example, operationalizes violence with homicide rates and, inter alia, observes that homicide rates and HD rankings are inversely proportionally correlated (see also Geneva Declaration 2011, chap. 5). Correspondingly, if the initiative is concerned with the locality's development, then it has to address the 'community cohesion' problem as well. As indicated in section 10.1, the selection of the locality as unit of analysis was guided, inter alia, by this concern: the focal issue emerges if a spatial area is inhabited by numerous, largely separately evolving communities, delineated by different social identities (Teschel and Derobert 2008, p. 126). Nevertheless, Sen (2006, p. 27) points out that human beings have multiple identities (see also Lobo 2010, p. 87–88; Sen 2002, p. 81; Uphoff 1986, pp. 12–13)—some deliberately chosen and some socialized (see section 7.3). Hence, it is unreasonable to link the community cohesion problem to a particular dimension of social identity (Ratcliffe 2012, p. 262; UNDP 2009, p. 14); rather, framing it—more general—as a lack of tolerance for diversity tends to be more plausible (Heusinger 2013b, p. 34). One possible way to counterbalance the lack of tolerance is to create a shared local identity that, by supplementing other identity dimensions (cf. Dovidio, Gaertner, and Saguy 2007, p. 305), provides the basis for solidarity in the locality. Such a local identity can evolve from or out of inter-community exchange and mutual social learning; however, environments that could foster these activities are constantly disappearing in 'developed' countries (cf. Hampton and Wellman 2003, p. 285; Kelly, Caputo, and Jamieson 2005, pp. 310–311; Putnam 2007, p. 164)[218]. Within the 'possible world', in contrast, the initiative provides a space in which this development takes place to enhance local citizens' well-being and to ensure the initiative's durability and continuity (cf. Ibrahim 2006, p. 406; Putnam 2007, pp. 163-164; Soma and Vatn 2010, p. 42; Tiwari and Ibrahim 2012, p. 82).

In sum, the foregoing examination culminates in the following two intervention entry points: whereas the first refers to the creation of organizational structures that allow local citizens to develop a public opinion, which directs local development efforts, as well as to organize complementary development action, the second aims to address the community cohesion problem through the creation of interaction places in which shared identities can be developed. In other words, to distinguish the 'possible world' from a utopia, it has to be justified that (i) local citizens can organize their own development efforts and (ii) that the problems of community incoherence and social fragmentation can, at least partially, be addressed by the envisioned initiative.

218. See also the website `http://bowlingalone.com/?page_id=8`, accessed August 20, 2012, that accompanies Putnam's famous book '*Bowling Alone: The Collapse and Revival of American Community*' for further empirical evidence in this regard.

Critical Reflection of Rectified Scope of Outcomes

If using the concept of SHD as a lens through which the 'factual world' is viewed, there are at least two critical aspects evolving from the economic focus[219] of the 'factual world abstraction'. Firstly, human beings are reduced to 'human resources' or 'human capital', that is, they are treated solely as input factor to the economic production function. This particular view gave rise to the HD approach briefly touched in section 5.5 (see also Fukuda-Parr 2005, p. 118; Sen 1999, chap. 2; UNDP 1990, p. 11):

> "What has to be avoided is seeing human beings as merely the means of production and material prosperity, taking the latter to be the end of the causal analysis—a strange inversion of objects and instruments" (Anand and Sen 2000, p. 2039).

However, this line of reasoning will not be further pursued here, because it is one of the initiative's responsibilities to define the conditions of a valuable living (see section 5.5) and this includes identifying the aspects that contribute to well-being. This is not to discredit the highly interesting and important work of researchers involved in the search of the nature of well-being (e.g., Alkire 2002; ASTM et al. 2007; Cruz 2011; Dodds 1997; Kenrick et al. 2010; Maslow 1981; Max-Neef 1991, 1992; Nussbaum 2000, 2011; Pajak 2000; Reader 2005; Spillemaeckers, Ootegem, and Westerhof 2011), but to recognize that the shared vision has to emerge within and through the interaction of local citizens to be an effective vehicle for the locality's development. This practical reason includes but also goes beyond another argument put forward to be cautious with an universal conceptualization of well-being:

> "My [Sen] own reluctance to join the search for such a canonical list arises partly from my difficulty in seeing how the exact lists and weights would be chosen without appropriate specification of the context of their use (which could vary), but also from a disinclination to accept any substantive diminution of the domain of public reasoning. The framework of capabilities helps, in my judgement, to clarify and illuminate the subject matter of public reasoning, which can involve epistemic issues (including claims of objective importance) as well as ethical and political ones. It cannot, I would argue, sensibly aim at displacing the need for continued public reasoning" (Sen 2005a, p. 157).

Secondly, to remain in the analogy between the 'factual world' and an economic production function, the 'factual world' considers only two input factors to the input-output relation, namely capital in form of infrastructure and labor in form of human resources—both comprised in the service delivery system. A third factor, often excluded in neoclassical economics (e.g., Mill [1848] 1909, chap. 1; J. Robinson 1954; Solow 1957) but increasingly recognized in ecological economics (e.g., Czech 2009), are ecological systems, which, as understood in the following, include land and other ecological resources (cf. Uphoff 1986, p. 3). The neglect of this category is a serious limitation of the 'factual world' as the economic system not only harvests renewable and extracts non-renewable resources from ecological systems, but also stores the waste from manufacturing, use, and discard of products and services in sinks, which, in turn, influences the regenerative capacities of renewable resource as well as the social system in various dimensions such as health or recreation (cf. Ewing et al. 2010, pp. 9–12; Goodland and Daly 1993, pp. 85–90; Hawken 2010, pp. 1–64; Senge et al. 2010, pp. 18–27; UNDP 2011, p. 6; WCED 1987, pp. 18–25). The interlinkages between economic

219. This economic focus is also reflected in the World Bank's adaptation of the Triple Bottom Line (TBL) as SD framework (World Bank 2011, p. 196); see also section 5.5 for a criticism of the TBL.

and ecological systems have been recognized at least since the Brundtland Report (see also Meadows, Randers, and Meadows 2004, and section 5.5):

> "There has been growing realization in national governments and multilateral institutions that it is impossible to separate economic development issues from environment issues; many forms of development erode the environmental resources upon which they must be based, and environmental degradation can undermine economic development" (WCED 1987, p. 19).

One of these long ignored linkages, receiving increased attention, is the effect of energy production on the world's climate, eventually leading to human induced climate change (J. Cook et al. 2013; Rockström et al. 2009; Running 2012). To address this issue, nearly 50% ($ 194 billion) of the more than $ 430 billion spent by world's governments in 2010 to address climate change themes were allocated to clean energy efforts (WEF 2010, pp. 9–10). Not only were improvements partially compensated by rebound effects, e.g., Lin and Liu (2012, p. 871) estimate a rebound effect of approximately 50% in China, the "world's clean energy leader" (Pew Charitable Trust 2013, p. 14), there are also prominent examples of undesirable HD effects. For example, the displacement of rural and indigenous population as a result of the construction of dams to generate hydroelectric power (cf. T. Binns 2009b, p. 35; Sick 2012, pp. 314–315)[220], the side-effects of the biofuel production to replace gasoline (cf. RFA 2008; Ribeiro 2013), the socio-economic effects of nuclear energy as a substitute for energy production based on fossil resources (cf. Chen 2001, p. 251; Ehrlich and Holdren 1971, pp. 1215–1216; Gonzales and Nelson 2001; Gowda and Easterling 2000; Lehmann and Wadsworth 2011), or the physical harm, the reshaped landscape, and the loss of memory by the 'eviction for conservation' (Brockington and Igoe 2006, p. 459; Ribeiro and Srisuwan 2005, p. 182), which disproportionally affects the most vulnerable people (McGranahan et al. 2005, p. 810). Similar side- and rebound effects are experienced in other areas of the climate change fight: the greening of buildings in order to reduce emissions through improved energy efficiency lead to an increase of embodied emissions, which are only partially the result of reduced operational emissions (cf. Ibn-Mohammed et al. 2013); the socio-economic inequality effects through the unequal distribution of the costs of the 'greening of buildings' initiatives (cf. Schaffrin 2013); or the community cohesion problems caused by the 'improvement' of transportation arrangements (cf. Jones and Lucas 2012; Power 2012)[221].

In general, the brief exemplary discussion of climate change illustrates that human beings do not live in a boundless world and that structures and processes within and between social, economic, and ecological systems need to be aligned in respect to these boundaries. This is nowhere near to a new insight; the claim has been made even long before the Brundtland Report (cf. Carson [1962] 1994; Lovelock [1979] 2000):

> "In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such [emphasis in the original]" (Leopold [1949] 1966, p. 240).

It is all the more remarkable that these problems have received, until recently, relatively little attention in international policy circles and that no adequate means to resolve these

220. A recent example of such adverse effects is the Belo Monte Dam that might be built in Brazil. This dam should provide hydroelectric energy for aluminum production. However, building this dam will result in the displacement of 20,000 to 40,000 indigenous people (Amazon Watch 2013).

221. See also Hilty et al. (2006, pp. 1628–1629) for a highly interesting simulation of the potential rebound effects of 'enhancing' different types of transportation through ICT.

issues have been devised. Admittedly, it is not an easy task as Hardin (1968) explicates in his "The Tragedy of the Commons." His core argument is that the cumulative effect of rational, self-interested actors, who maximize private gains from 'common goods' or 'common-pool resources', eventually destroys the latter (see also Ostrom 2007, pp. 40–41; Wunsch 2013, pp. 223-224). More specifically, common-pool resources are resources that exhibit the following two characteristics (cf. Gatzweiler 2006, p. 297–298; Gardner, Ostrom, and Walker 1990, pp. 335–337; Kimber 1981, pp. 179–180; Ostrom 1990, p. 30; 2002, p. 1317; 2005, pp. 24–26; 2010a, p. 644–645; 2010b, pp. 412–413): (i) they provide a finite quantity of resource units, which is often large enough to be used by different users simultaneously, but which decreases if individuals subtract a resource unit (subtractability)[222]; and (ii) they are resources from which it is costly, but not impossible, to exclude potential beneficiaries (excludability). Whereas the latter (ii), leads to the 'free rider problem' (M. Olson 1971), which states that rational actors, due to the unfeasibility of exclusion, have no incentive to contribute to the creation and maintenance of the resource, the combination of both characteristics leads to situations in which it is possible for actors to advance their private gains at the expense of self-restricting others. This eventually leads to the problems of congestion, that is, rivaling groups use the resource for incompatible purposes, and over-exploitation, that is, the extraction of resource units exceeds the resource's capacity (see Colding et al. 2013, pp. 1040–1041; Demsetz 1967, p. 354; Gardner, Ostrom, and Walker 1990, pp. 336–337; Gatzweiler 2006, p. 297–298; Ostrom 2002, p. 1317, and section 10.3). This, in turn, leads Hardin (1968, p. 1244) to his famous conclusion: "Freedom in a commons brings ruin to all". To constrain such destructive behavior, at least partially, the 'freedom in commons' needs to be restricted by devising organizational structures (cf. Dietz, Ostrom, and Stern 2003, p. 1907; Hardin 1968, pp. 1245–1246; M. Olson 1971, pp. 34–35; Runge 1981, 1984; Stern, Dietz, and Ostrom 2002, p. 63). Respective discussions focus, traditionally, on two idealized types of institutional arrangements (cf. Ostrom 1990, pp. 8–15; 2008, pp. 25–27; 2012, pp. 131–133; Ostrom and Cox 2010, pp. 453–454; Plummer and FitzGibbon 2004, p. 878; Vatn 2010, p. 1246): state property, i.e., public sector institutions based on the hierarchical command to maintain social objectives, or private property, i.e., private sector solutions based on voluntary exchange to foster individual competition (see table 10.1 and the left and the right side in figure 10.5 respectively).

Public Sector		Voluntary Sector		Private Sector	
Local Administration	Local Government	Member Organizations	Cooperatives	Service Organizations	Private Businesses
Bureaucratic Institutions	Political Institutions	Local Organizations (based on the Principle of Membership Direction and Control; These can become Institutions)			Profit-oriented Institutions

Figure 10.5: Continuum of Local Institutions by Sector, source: Uphoff (1986, p. 5)

However, not at least through the tireless efforts of Ostrom, the first and to this day only female Nobel Laureate in Economics[223], collective management is recognized as an 'alterna-

222. This characteristic distinguishes common-pool resources from 'public goods'. For a more detailed discussion, which also includes two further types of resources, see the quoted literature.
223. Ostrom received, together with the afore-mentioned O. E. Williamson, the Nobel Prize in 2009.

tive third solution' in the middle of figure 10.5 (cf. Bhattacharyya 1995, p. 64; Dekker et al. 2010, p. 611; Ostrom 1990, pp. 15–21):

> "The widespread existence of organizations in the real world testifies to the interdependence and net benefits of people's decisions to cooperate. This does not mean that free-ridership is no problem but rather that it is not as pervasive or overriding as presumed. The process of 'institutionalization' creates constrains in free riding so that [common and] public goods can be provided by common efforts" (Uphoff 1986, p. 15).

In short, the natural, pre-political, ownerless open-access resources that Hardin (1968) uses in his argument can be, in principle, brought under one of the three idealized types of property-rights regimes described in table 10.1. However, there is no single right solution; the regime has to fit to the socio-historical, economic, and geographic conditions of a concrete context (cf. Colding et al. 2013, p. 1040; Rama and Theesfeld 2011, pp. 372–377, 384; Uphoff 1986, p. 37). However, as indicated by 'in principle', there are very few open-access resources left; in most cases they have already been transformed into state property (cf. Foster 2011, pp. 65–66; Sandberg 2007, p. 614). Nevertheless, even though common-pool resources are under governmental control they are still degrading, that is, the tragedy is not prevented. The most common causes include: declining governmental spending (i.e., regulatory slippage), inflexibility of bureaucratic management to adapt to changing circumstances, inability to deal with the complexity of ecological systems within the boundaries of a sectoral division of labor, and uniformity of management that hampers experimentation (see Andersson, Barthel, and Ahrne 2007, p. 1276; Andersson and Ostrom 2008, pp. 74–76; Berkes 2010, p. 492; Bodin, Crona, and Ernston 2006, p. 3; Carlsson and Berkes 2005, p. 71; Coase 1960; Damodaran 2006, pp. 70–71; Gatzweiler 2006, p. 299; Henocque 2013, p. 68; Murtinho et al. 2013, p. 1110; Ostrom 2008, pp. 25–28; 2010a, pp. 664; 2010b, p. 435; Paavola 2007, p. 98; Plummer and FitzGibbon 2006, pp. 51–52; Rama and Theesfeld 2011, pp. 382–384; Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, pp. 239–240; Schultz, Duit, and Folke 2011, pp. 662–663). Traditionally, two different avenues are pursued to overcome these challenges: decentralization and privatization. Whereas the former does not directly change the existing property-rights regime, the latter transforms state property into private property. Both these options are discussed in turn.

Decentralization[224] refers to the transfer of rights and duties to lower social units, e.g., local governments, in the public sector hierarchy (cf. Berkes 2010, p. 491; Ribot, Agrawal, and Larson 2006, pp. 1865–1866). This process is captured by the subsidiarity principle that states: solve problems or take actions at the lowest possible level (Kooiman 2003, p. 58). However, this approach has to deal with, inter alia, the following difficulties: reduced economics of scale, relatively high costs of operation, vulnerability to elite capture, stagnation at suboptimal social-ecological system states, lacking capacities of local governments, insufficient decentralization of power, and the neglect of local and traditional ecological knowledge (cf. Andersson, Barthel, and Ahrne 2007, p. 1276; Andersson and Ostrom 2008, pp. 74–76; Berkes 2010, p. 492; Bodin, Crona, and Ernston 2006, p. 3; Carlsson and Berkes 2005, p. 71; Damodaran 2006, p. 70; Enengel et al. 2011, p. 1256; Gatzweiler 2006, p. 299; Henocque 2013, p. 68; Larson and Soto 2008; Murtinho et al. 2013, p. 1110; Ostrom 2008,

224. The term 'devolution' is often used interchangeably with the term 'decentralization' (cf. Larson and Soto 2008). However, in the present inquiry both terms are, following Berkes (2010, p. 491), differentiated as follows: decentralization refers to the transfer of rights within the public sector hierarchy, whereas devolution or 'double devolution' refers to the transfer of already decentralized rights and responsibilities to groups located outside of the public sector (see also Bailey 2012, p. 12).

Table 10.1: Idealized Types of Property-Rights Regimes, adapted from: Colding et al. (2013, p. 1040)

Regime Type	Owner	Owner's Rights	Owner's Duties
Private Property	Individual	Socially Acceptable Use; Control of Access	Avoid Socially Unacceptable Uses
Collective Property	Collective	Exclusion of Non-Owners	Maintain Resource; Constrain Usage Rates
State Property	Citizens	Determine Rules	Maintain Socially Desirable Objectives

pp. 25–28; 2010a, pp. 664; 2010b, p. 435; Paavola 2007, p. 98; Plummer and FitzGibbon 2006, pp. 51–52; Rama and Theesfeld 2011, pp. 382–384; Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, pp. 239–240; Schultz, Duit, and Folke 2011, pp. 662–663; Spak 2005, p. 239; Stenseke 2009, p. 215).

The second avenue, that is, privatization, can take two different directions: either the focal ecological system is fully privatized or it is split according to the separation of attributes and partially privatized; whereby revenues are used to finance the maintenance of the non-privatized part (cf. Colding 2012, p. 120; Colding et al. 2013, p. 1041). Although the concrete effects depend on the choice of the owner of the newly created private property, within the literature some general tendencies of adverse effects of privatization are identified: exclusion of otherwise socially marginalized groups and the corresponding decline of traditional and local ecological knowledge due to the lack of interaction possibilities [i.e., the 'extinction of experience' (Pyle 2002; 2003, p. 206)], the 'cascade of small decisions' transforming green areas into build areas, conflicting arrangements of interrelated ecological systems due to the fragmentation of governance, and the neglect of the need to align different aspects of multi-scale social-ecological systems (cf. Colding 2012, p. 120–121; Colding et al. 2013, pp. 1039–1041; Damodaran 2006, pp. 70–71; McGranahan et al. 2005, p. 809; Pilgrim, Smith, and Pretty 2007, p. 1748; Schultz, Duit, and Folke 2011, p. 662; Stenseke 2009, p. 215; Tuschiya, Okuro, and Takeuchi 2013, p. 87). In addition, but more seriously, the assignment of property-rights or the change of an existing property-rights regime is not, as often argued, just an issue of Pareto efficiency; rather, it is an issue of distribution and, by implication, of procedural justice (see also Paavola 2007, pp. 95–96):

> "How to understand the human/environment relationship and, consequently, what a resource is and how it should be managed, can be seen as having less to do with an ultimate truth but as merely *reflecting the way power is organized* in a particular time period [emphasis added]" (Spak 2005, p. 235).

This is also acknowledged by one of the leading figures in economic thought, the Nobel Economic Prize winner of 1991, who is also one of the early thinkers of how to deal with the challenges involved in the management of common-pool resources:

> "As Frank H. Knight [a key figure of the Chicago school of economics] has so often emphasized, problems of welfare economics must ultimately dissolve into a study of aesthetics and morals" (Coase 1960, p. 43).

Therefore, the third or 'alternative solution' proposed by Ostrom (1990) tends to come closer to the underlying value position of the present inquiry. More specifically: she suggests a collective property-rights regime in which a group of individuals holds all, or most, of the property-rights[225] at common-pool resources (Colding et al. 2013, p. 1040). This type of arrangement is considered to be particularly attractive, because local citizens are the ones who have the biggest stake in the locality's ecological systems (Uphoff 1986, p. 23). Therefore, collective property-rights regimes can, in respect to the fact of the governmental control of common-pool resources, be interpreted as an extended version of decentralization: property-rights are not only decentralized but also 'devolved' out of the public sector hierarchy to local user groups (cf. Bailey 2012, p. 12; Berkes 2010, p. 491, see also footnote 224). In other words and in reference to the ladder of participation (Arnstein 1969), power is delegated to local citizens (see also figure 10.4). According to Berkes (2010, pp. 490–491, 497), reforming the governance system by devolving power out of the public sector is not just a passing fad; rather, involving and engaging local citizens in decision-making stands in a democratic tradition to which many of the 'developed' countries with which the present inquiry is concerned subscribe (see also A. Williamson 2009, p. 303). However, the success of such a collective property-rights regime depends on contextual conditions[226] and, more importantly, on local citizens' ability to exercise those governance functions that are vital to sustain any of the three idealized types of property-rights regimes (see table 10.2[227]).

Table 10.2: Design Principles of Local Governance Systems, adapted from: Ostrom (1990, pp. 90–102) and Cox, Arnold, and Tomás (2010, p. 15)

Definition of Resource Boundaries	
	The boundaries that separate a particular ecological system—providing certain resource units—from the larger biophysical environment are clearly defined.
Definition of User Boundaries	
	The boundaries between authorized and non-authorized users are clearly defined, that is, individuals who hold, inter alia, usus and usus fructus rights on the ecological system can be distinguished from those who do not hold these rights.
Congruence with Local Conditions	
	Appropriation rules, delimiting time, place, technology, and/or quantity of resource unit extraction, and provision rules, defining labor and/or material required to maintain the ecological system, are congruent with the local socio-environmental conditions.
Appropriation and Provision	
	The appropriation rule-based benefits that users can obtain from the resource are proportional to the amount of inputs defined by the provision rules.
Existence of Collective-Choice Arrangements	
	Most individuals affected by the operational rules can participate in the collective-choice arrangement that allows to modify and adapt appropriation and provision rules.
Monitoring Users	
	Local citizens monitor others' levels of appropriation and provision to hold each other accountable, to increase the redundancy of the monitoring and the sanctioning system, and to gather information about the rates of voluntary compliance, which individuals incorporate into their strategic decisions in respect to the contingent self-commitment.
Monitoring the Resource	
	Local citizens monitor the state of the ecological system to adapt appropriation and provision rules in accordance with changes of the resource's condition.
Existence of Graduated Sanctions	

Continued on Next Page

225. There are generally five types of rights (Schlager and Ostrom 1992, pp. 250–252): the right to access or enter a resource (usus), the right to withdraw resource units or earn an income from the resource (usus fructus), the right to manage and transform the resource (abusus), the right to exclude and transfer the access right, and the right to alienate the resource (ius abutendi).

226. These external factors include, for example, population growth, immigration, mobility of citizens, and privatization tendencies (Uphoff 1986, pp. 24–25).

227. For a more detailed discussion see Blomquist and Ostrom (1985), Cox, Arnold, and Tomás (2010), Ostrom (1990, pp. 88–102), Ostrom (2002, pp. 1330–1333), Ostrom (2010a, pp. 651–653), Ostrom (2010b, pp. 420–423), Paavola (2007, pp. 99–100), and/or Uphoff (1986, pp. 36–37).

Table 10.2 – Continued from Previous Page

	Local citizens, who violate appropriation and provision rules, are sanctioned in a process that takes the seriousness as well as contextual factors into account.
Existence of Conflict-Resolution Mechanisms	
	Resource users have access to mechanisms that allow to specify what constitutes an infraction and to define adequate compensations for the lack of compliance[228].
Minimal Recognition of the Rights to Organize	
	Locally devised institutions are recognized and supported by extra-local governmental authorities to avoid that users circumvent these rules by appealing against them.
Nested Enterprises	
	Local arrangement needs to complement and to be complemented by rules and activities on other social units, because unintegrated systems do not endure over the long run.

Although the 'alternative option' is, in general, considered to be relatively effective and ordinarily cheap as well as being able to operate in settings where there are no incentives for private sector investments (Bertotti et al. 2012, p. 169), its successful realization is often compromised by the tendency to stop innovating and to stick to traditional, sub-optimal arrangements to avoid being confronted with unexpected results (Andersson and Ostrom 2008, p. 76). In short, this property-rights regime is not a 'panacea' (Ostrom and Cox 2010) or 'one-size-fits-all solution' (Ostrom 2012, p. 139) that can, as a privatization alternative, step in for the public sector if it fails to keep up the governance of common-pool resources in a socially acceptable way (see also Sandberg 2007, p. 614; Stame 2004, p. 67):

> "No perfect governance arrangement exists. All governance institutions are imperfect responses to the challenge of collective-action problems. Because these imperfections may exist at any level of governance, we [Andersson and Ostrom] argue that analysts should consider the extent to which complementary back-up institutions exist at higher or lower levels of governance that can help offset some of the imperfections at any one level" (Andersson and Ostrom 2008, p. 73).

This quote not only indicates that none of the three idealized property-rights regimes is an universally applicable solution, but it also suggests that a specific ecological system is generally governed by an arrangement that is constituted by a vertically stretched array of different combinations of those institutions depicted in figure 10.5 (cf. Andersson and Ostrom 2008, p. 71; Armitage, Marschke, and Plummer 2008, p. 95; Paavola 2007, p. 94; Pigram 2000, p. 223; Uphoff 1986, pp. 40–41, and the 'nested enterprise' condition in table 10.2). This applies even to China, which is or used to be considered to be the prime example of a state property-rights regime[229] (see also section 10.3). In addition to this vertical dimension of governance systems, the situation becomes even more complex if ecological systems are taken into account. McGranahan et al. (2005, pp. 805–818) state that urban areas, the focus of the 'second research project', are related to three analytically distinct ecological systems: (i) the ecological systems within the city, (ii) the ecological systems of peri-urban and rural areas, that is, the systems surrounding the urban center, and (iii) distant ecological systems that are connected to the urban center via regional, national, and global transportation. However, this distinction along administrative boundaries hides that ecological systems are interdependent and interrelated (cf. Andersson, Barthel, and Ahrne 2007, pp. 1274–1275; Bolund and Hunhammar 1999, pp. 299–300; Levin 1998, pp. 432–434; 1999, p. 1; Lovelock

228. These mechanisms are, in general, located on higher social units, because fellow local citizens often do not have the (perceived) authority to make such decisions (cf. Huang et al. 2010, p. 366; Uphoff 1986, pp. 26–27). In other words, these conflict resolution forums are provided by other institutions that have an overlying jurisdictions (cf. Carlsson and Berkes 2005, p. 68; Oakerson and Parks 2011, p. 153; Uphoff 1986, pp. 27–28).

229. The Economist Intelligence Unit Report 2013 classifies China as authoritarian regime (cf. EIU 2013, p. 7).

[1979] 2000, pp. 30–43; McGranahan et al. 2005, p. 798; Strohbach, Lerman, and Warren 2013, p. 70). Although the degree of dependency and interrelatedness decreases with increasing distance, the ecological systems within an urban area and those surrounding it are, despite being fragmented by different property-rights regimes, part of a larger ecological system[230]. From the perspective of this larger system, the governance arrangement takes the form of a mixture of vertically as well as horizontally dispersed actors who hold certain property-rights, make particular decisions, and exercise special governance functions. Within the literature these institutional configurations are discussed under the heading of 'polycentric governance systems'[231] as illustrated in the following description of a metropolitan area:

> "'Polycentric' connotes many centers of decision making that are formally independent of each other. Whether they actually function independently, or instead constitute an interdependent system of relations, is an empirical question in particular cases. To the extent that they take each other into account in competitive relationships, enter into various contractual and cooperative undertakings or have recourse to central mechanisms to resolve conflicts, the various political jurisdictions in a metropolitan area may function in a coherent manner with consistent and predictable patterns of interacting behavior. To the extent that this is so, they may be said to function as a 'system'" (Ostrom, Tiebout, and Warren 1961, p. 831).

In other words, policentricity denotes a governance system in which multiple, independent decision-making centers with overlapping authorities, thereby shifting the administrative to a territorial focus (Andersson and Ostrom 2008, pp. 79–80), form a complex and dynamic network that governs a focal system (see Andersson and Ostrom 2008, p. 71; Gatzweiler 2006, p. 298; Hill et al. 2012, p. 2; Oakerson and Parks 2011, pp. 153–154). Although a pure economic perspective suggests that such an arrangement, which governs a social system, operates at less-than-optimal levels (e.g., Andersson and Ostrom 2008, p. 78; Berkes 2010, p. 493), it is, due to the inevitable division of labor, necessary for the effective and efficient provision of general services in a setting, whose variety of contextual influences and determinants renders every attempt to devise a static, optimal configuration a hopeless effort (Andersson and Ostrom 2008, p. 78; Oakerson and Parks 2011, p. 150). A similar rationale applies to the effective and efficient exercise of governance functions in regard to larger ecological systems. However, these polycentric systems, despite opening up the 'civic space' (Oakerson and Parks 2011, p. 154) in which the envisioned initiative can unfold, make it, due to the involved property-rights-related fragmentation of ecological systems, difficult to coordinate efforts to maintain the larger ecological system's ability to adequately produce ecosystem services (cf. Ernston, Sörlin, and Elmqvist 2008, p. 1). As this is one of the activities the initiative carries out, the 'possible world' therefore presupposes an interaction platform on which a number of horizontally and vertically dispersed actors, each exercising certain governance functions on specific parts of the larger ecological system, align their de-

230. Although urban areas affect all three types of ecological systems, the following discussion focuses on the envisioned initiative's contribution to the mitigation of those problems that unfold in respect to the first two categories. Even though the initiative indirectly strengthens endeavors addressing the set of issues associated with distant ecological systems, respective resolutions tend to belong to higher social units [e.g., global certification systems (e.g., Malandrino, Proto, and Supino 2007) and/or standardized third party-evaluated reports (e.g., GRI 2006)]. As these endeavors are not directly influenceable by ordinary local citizens, an investigation of this realm involves a set of conceptually different and, seen from the present inquiry's focus, independent research problems. Therefore, this avenue is not further pursued; however, possible options to extend and refine the 'second research project' in this direction are briefly explored in chapter 14.

231. Ashby (1960, chap. 13) discusses polystable systems in cybernetics, which exhibit similar characteristics as the one described in the following.

centralized endeavors to improve the larger ecological system's overall health (cf. Ostrom 2012, p. 133; Schultz, Duit, and Folke 2011, p. 662). Participating in this embedding 'co-management arrangement' (cf. Ostrom 2012, pp. 138–139) is important for the initiative to make local public opinion visible to the political system and to infuse the locality's identity with, for example, arguments issued in other localities and general concerns voiced by non-governmental organizations (NGOs) (e.g., ecological systems, future generations).

In short, there are again two issues at stake: firstly, the possibility of collective property-rights regimes in urban localities—an area largely neglected and underdeveloped in research (Foster 2011, p. 62), and secondly, the possibility of creating a co-management arrangement for larger ecological system. However, in contrast to the critical analysis carried out before, the possibility assessments and the syntheses of draft meanings and organizational options for these two intervention entry points can be conflated into one. This simplification is based on the following rationale: although both intervention entry points are located on different levels in the social hierarchy, they not only share the focus on ecological systems, but, more importantly, they are, in essence, both co-management arrangements. The 'alternative option' or the collective property-rights regime is actually a simplified version or special case, which involves one focal ecological system and two sets of actors, i.e., public sector officials and local citizens. Therefore, the respective realist syntheses, or more specifically the keywords used within them, do overlap considerably and can be, at least in respect to the exemplary nature of the 'second research project', confined to the general term as the set of documents will comprise inquiries dealing with both types of co-management arrangements. In other words, the more general realist synthesis will also allow to demonstrate the possibility of the collective governance of common-pool resources in urban areas and to extract respective draft meanings and organizational options. Correspondingly, this realist synthesis, complemented by the insights gained in the assessments and syntheses carried out for the two other intervention entry points, provides sufficient data to mark out the 'possible world' as at least theoretically possible in respect to the studied divergences from the 'factual world'.

10.3 Possibility Assessment & Synthesizing Design

"Our aim is to find the rules and institutions for a true one, not the one and only true one. We confront the problem of an ordered social life among free and equals at many levels and contexts [. . . . T]he problem of global justice is that of developing a variety of justified institutions and conventions [. . .] that allow the participants in our increasingly global social and economic order to treat each other as free and equal while achieving acceptable lives for all."

Gaus (2012, p. 276)

Within the third and final step of the design of 'possible worlds', the three intervention entry points explicated in the preceding section are used to identify programs that, by exploiting these entry points, address the outlined issues in a way that is congruent with the idea of the 'possible world' as well as its underpinning value position. In addition and parallel to this possibility assessment, the second task in this third step is to synthesize the structural elements that result from these interventions to refine the sketched 'possible world', that is, to carve out draft meanings and organizational options, to concretize possible alternatives and to lay the foundation for the design of blueprints that guide the development of technical systems capable of supporting the processes in 'possible world' instantiations. In other words, to distinguish the 'possible world' from a utopia the present section employs the research strategy outlined in section 8.2 for each of the three aspects identified in the preceding critical reflection. More specifically, the following is concerned with justifying that (i) local citizens can create an initiative, comparable to an organized issue network for the respective locality, that directs the local political system through a formed public opinion and organizes as well as carries out complementary development efforts, (ii) that this initiative contributes, by virtue of its communicative nature, to the resolution of the problems of community incoherence and social fragmentation, and (iii) that the initiative can, on the one side, organize and sustain the collective effort required to co-manage an urban common, which contributes to the resolution of concerns captured in the narrow interpretation of SD and that is instrumentally important to (i) and (ii), and on the other side, function as actor in the polycentric system that governs the larger urban ecological system, that is, it can represent the public opinion of local citizens in the embedding co-management arrangement if such an institutional configuration is indeed possible. In other words, the following elaboration is, along the lines of the introductory quote, concerned with social structures and institutions that are aligned with the imperatives of SHD.

However, before turning to this justificatory step a brief discussion of an anticipated counterclaim in regard to the utopian behavioral assumption underpinning the proposal is inserted. Although the possibility assessments would implicitly address this allegation as well, the larger practical implications that can be derived from this discussion are an essential prerequisite for the 'possible world' not only to be theoretically possible, but also to be *realizable* (see section 5.3). Correspondingly, it is worthwhile to include this brief digression before the elaboration dives into the actual possibility assessments and synthesizing designs—the third and final step in the design of 'possible worlds'.

Digression: Assumed Human Behavior

"No one can enjoy freedom alone, or at the cost of the freedom of another. Thus freedom may never be conceived merely negatively, as the absence of compulsion. Freedom conceived intersubjectively distinguishes itself from the arbitrary freedom of the isolated individual. No one is free until we all are free."

Habermas (2002, p. 161)

In respect to the exemplary character of the present part as well as the fact that the inquiry is actually located in ISR and that the discourses about the nature of human behavior—dating back to ancient times—have not resulted in any conclusive answer yet, it tends unrewardingly to reopen another philosophical discussion. Nevertheless, to counter the claim that the behavior implicitly assumed in the foregoing elaboration is unreasonable and utopian, primarily due to the domination of the homo oeconomicus model (cf. Ostrom 2007, pp. 30–32; 2010a, p. 643; 2010b, p. 410; 2011, pp. 12–14; Sen 1977b; H. A. Simon 1996, chap. 2), the author of the present inquiry wants to advert to the highly interesting, partially amusing, and widely quoted studies of Frans B. M. de Waal and his colleagues, which are published in the most prestigious scholarly journals such as *Science* and *Nature*. These studies provide empirical evidence that elements of the implicitly assumed (moral) behavior (e.g., sense of fairness, cooperation, empathy, reciprocity, etc.) are even present in the animal kingdom (cf. Brosnan and Waal 2003; Eppley et al. 2013; Proctor et al. 2013; Proctor, Brosnan, and Waal 2013; Wolkenten, Brosnan, and Waal 2007; Waal 2003)[232]. Correspondingly, it seems not

232. See also his TED talk available at: `http://on.ted.com/deWaal`, accessed May 25, 2015.

too unreasonable to assume that such a behavior, a behavior not solely directed at realizing vested interests, is also possible in human societies.

If granted that such moral behavior is not impossible, these insights are highly relevant to the 'tragedy of the commons' (Hardin 1968) as well as the 'free rider problem' (M. Olson 1971) briefly touched in the preceding section. More specifically: the gathered empirical evidence complements theoretical criticism, for example, that free riding, at least in regard to deliberately created, i.e., not naturally existing, public and common-pool resources, is, following from the implicit assumption that the focal individual is the only rational, self-interest actor, an inconsistent account (Kimber 1981, pp. 192–194). It corroborates that opportunistic behavior such as 'free riding' is just deductively derived from specific, set premises; it is neither an irrefutable empirical fact nor a law of the Medes and Persians (see also Ostrom 1990, chap. 3; Dietz, Ostrom, and Stern 2003; 2002, pp. 1318–1224; 2009; Stern, Dietz, and Ostrom 2002). It is merely an, admittedly appropriate, approximation in relatively simple, competitive, and frequently reoccurring situations (see also Axelrod [1984] 2006, p. 126; Ostrom 2010a, pp. 654–658; 2010b, pp. 423–429; 2011, pp. 13–14):

> In common-pool resource dilemmas "where individuals do not know one another, cannot communicate effectively, and thus cannot develop agreements, norms, and sanctions, aggregate predictions derived from models of rational individuals in a noncooperative environment receive substantial support. These are sparse environments and full rationality appears to be a reasonable assumption in them" (Ostrom, Gardner, and Walker 1994, p. 319).

However, an approximation is not the same as an adequate descriptive account of human behavior; there is at least some room for different views. The conceptualization underpinning the present inquiry can be described as that of a 'fallible learner' (cf. Ostrom 1990, p. 25–26; 2007, pp. 30–32; 2011, pp. 13–14). It is, in contrast to the homo oeconomicus model, based on the concept of 'bounded rationality' (cf. Katz and Kahn 1978, pp. 494–496; Schmid 2004, pp. 28–34; H. A. Simon 1972; 1996, pp. 25–49), i.e., "[t]he meaning of rationality in situations where the complexity of the environment is immensely greater than the computation power of" individuals (H. A. Simon 1996, p. 166). Implicit to this perspective of human thought processes is that individuals can make mistakes, but also, as explicated by the second term, that they can learn from their mistakes[233] by, for example, changing or adapting employed heuristics.

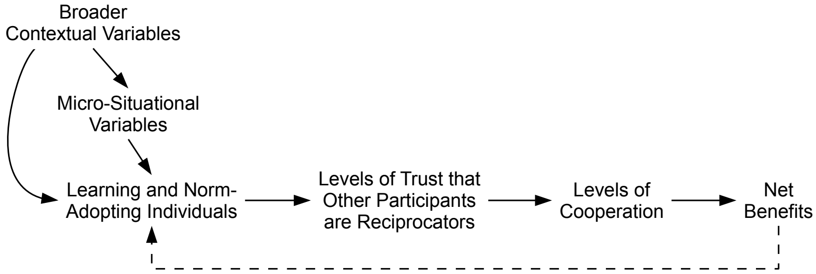

Figure 10.6: Cooperation and Effects of Contextual Variables, source: Poteete, Janssen, and Ostrom (2010, p. 227)

233. Note that this 'violates' the 'internal condition for closure', one of two conditions required for closing open systems as discussed in section 7.3.

Furthermore, fallible learners can also learn to establish norms through communication, i.e., to resolve disputes via communicative action (cf. Habermas 1998, p. 39), and to coordinate their activities, i.e., to adopt cooperative strategies. This leads, as schematically depicted in figure 10.6, to trust[234] between cooperation partners (cf. North 1990, p. 56; Ostrom 2010a, p. 659–661; 2010b, pp. 429–432; 2011, p. 14; Plummer and Fennell 2007, p. 948). However, trust is, on the other side, not only an outcome, but it is also involved in the initiation of cooperative human behavior:

> "Process-based trust entails the incremental process of building trust through gradual accumulation of either direct or indirect knowledge of the social relation present. Typically, the way these trust relations can be developed and maintained, is through various forms of feedback among the participants, or to what extent they give confirmation on each other's initiatives, or approvals of the way the work is conducted" (Hertzberg and Monteiro 2005, p. 382).

In other words, what is assumed in addition to the fallible learner is that trust is, as will be discussed more thoroughly in the following sections, essentially a fragile, process-based outcome that depends on repetition and continuous reaffirmation. Nevertheless, in regard to the focal aspect of the present digression, the foregoing elaboration explicates that although the behavioral assumption differs substantially from the conceptualization prevalent in economics and related disciplines, i.e., seen from the homo oeconomicus model, it is not completely unreasonable. Yet, even if it was and human beings are purely self-interested individuals, then the approach suggested in the present inquiry becomes even more important:

> "[E]ven if it were found to be true that people are aggressive in virtue of their physical nature rather than social conditioning, it would in no way license an abandonment of attempts to use our social powers to override such tendencies" (Sayer 1992, p. 121).

The following discusses interventions that aim to change those social structures and mechanisms, which generate the undesirable tendencies outlined in the preceding section. Although each of the three identified intervention entry points indicates a particular issue that needs to be resolved to bring the 'factual world' closer to the 'possible world', the first of these plays, in reference to the quote that introduced the foregoing examination, a distinct role: it is primarily concerned with the agency of local citizens, that is, with their freedom in an intersubjective sense.

The Possibility of Community-Driven Development

"We gotta make a change ...
It's time for us as a people to start makin' some changes.
Let's change the way we eat, let's change the way we live
and let's change the way we treat each other.
You see the old way wasn't working so it's on us to do what we gotta do, to survive."

Shakur (1998)

Shakur is not only a descendant from important figures of the Black Panther Party, a social rights movement in the USA, he himself was a social activist who was concerned with the improvement of the living conditions of America's black population. As indicated in the above extract, he recognized that such an improvement depends, in more general terms, on

234. For an evolutionary explanation why trust and reciprocal behavior is inevitably a part of human nature see Trivers (1971).

the way local citizens deal with each other and their active involvement in desired changes. In the same vein, the first identified intervention entry point refers to the ability of local citizens to create organizational structures in which they (i) plan and decide about the development of their locality, (ii) assess the interventions of intermediary organizations, and (iii) organize complementary development programs. As indicated in the critical reflection, an intervention fostering such efforts is necessary not only because more and more citizens in 'developed' countries are left behind, but also because governmental spending, for example, to maintain the urban commons is constantly shrinking. This 'regulatory slippage', defined as a situation in which "the level of local government control or oversight of the resource significantly declines" (Foster 2011, p. 59), causes many urban commons, as indicated in the tragedy of the commons, to decay (see also Plummer and FitzGibbon 2004, p. 876). This, in turn, is one of the factors endangering HD achievements as manifested in the growth of the Fourth World. To reverse this vicious cycle leading figures in HD literature (e.g., Fukuda-Parr 2005, pp. 122–123; Sen 2005b, p. vii; UNDP 1990, p. 6) called for more civil society action. In short, what is at stake in this first assessment is the possibility of development driven by local citizens or, as referred to in the literature, 'community-driven development'.

Figure 10.7: Tag Cloud of Background Search 'Community-Driven Development' (The tag cloud was created using `http://www.wordle.net/`, accessed May 25, 2015)

As discussed in section 8.2, the synthesis of justificatory evidence starts with a broad background search, which, in the present case, was conducted using 'community-driven development' as the initial keyword. Further keywords, some of which are shown in figure 10.7, were extracted by screening titles, abstracts, and keywords of retrieved documents. This enlarged set provided the basis for circumscribing desired interventions, that is, those leading to the envisioned context shift, more clearly.

In particular, the present study uses the extracted keywords to create a query string that comprises two categories (see figure 10.8). Firstly, it specifies the goal of the intervention through the four combinations emerging from 'local' or 'community' and 'development' or 'governance'. In other words, articles should deal with the development or governance of communities or localities—the change or governance of social structures in the locality for the benefit of all local citizens (cf. Kelly and Caputo 2006, p. 235). Secondly, it qualifies this relatively broad goal by adding an `AND`-connected second category. The latter defines the preferable attribute of the desired results, that is, the locality's development or governance should be community-driven. As indicated in the introduction to the present inquiry, it is expected that such events unfold primarily within and through a community-based^synonyms organization^synonyms. However, the synthesis includes, by adding an `OR`-connected self-organized^synonyms, the more general processes as well. The underpinning rationale is as follows: whereas the former, actually sufficient to demonstrate the hypothesized possibility, leans more towards the draft meanings and organizational options of a stabilized and mature program realization, the latter, due to its process perspective, has the potential to include studies that deal with earlier development stages. In respect to the design of the reference architecture supporting the processes of the resulting social system, insights into the emergence and development of initiatives can provide hints that allow to design the technical system in a way that it can evolve with the initiative.

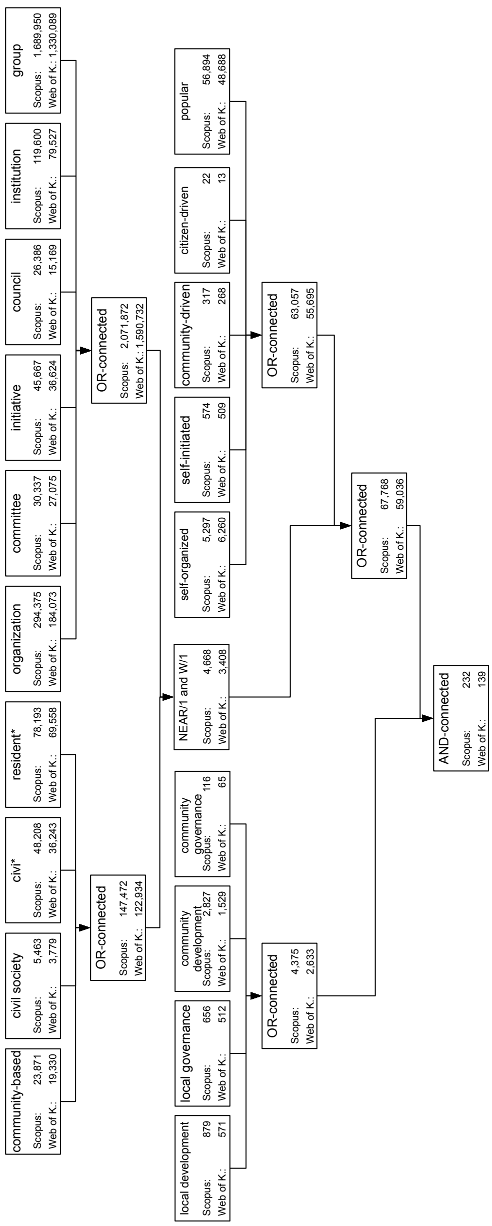

Figure 10.8: ‘Community-Driven Development’ Query String [The results were obtained on October 13, 2013, using the following query constraints: English journal articles published between 2004 and 2013. The query string for the selected database differed in one minor respect: whereas Scopus uses `W/<distance>` as proximity operator, the Web of Knowledge (Web of K.) substitute is `NEAR/<distance>`]

As can be seen in figure 10.8, querying the two selected databases (see section 8.2) yields an initial set of 371 documents. After 100 duplicates were removed from this set, the metadata of the remaining 271 documents were retrieved and filtered using the following four inclusion/exclusion criteria: only those studies (i) that address—the key selection criterion—a problem similar to the issues outlined in the preceding section, (ii) that have an urban unit of analysis (see sections 6.1 and 10.1), (iii) that are either itself case studies or summarize the results of multiple primary studies[235], and (iv) that report results of interventions in 'developed', democratic countries[236] (see sections 6.1 and 10.1) are included. 228 studies comprised in the duplicate-free list have been, based on the information provided by title, abstract, and keywords, excluded because they deal with a presently unrelated problem and/or do not meet the remaining, above-specified conditions (see annex A.1). However, some studies have been included in a second iteration, although they do not meet one of the latter four criteria, because they illustrate certain facets discussed in the following. This entails, for example, two documents that, despite their violation of (iv), have been analyzed, because they represent rather extreme cases: the Pronatura Yucátan (Mexico) (Andrews 2006) and the Dagongzhe (China) (Chan 2013) case study. Both inquiries serve to illustrate, in reference to the sequence of contexts shifts discussed in section 8.1, that community-driven development is possible even in contexts that are less favorable than the one in 'developed', democratic countries; yet a detailed exploration of the creation of initiatives in such circumstances is out of the present inquiry's scope. Nevertheless, within the more detailed screening described in 8.2, ten additional documents were identified as those that explicitly describe initiatives, which resemble the community-driven initiative envisioned for the 'possible world'. Table 10.3[237] summarizes the core aspects of these ten and the two additional case studies using the data extraction template introduced in section 8.2. After a brief discussion of these 12 studies, which indicate that it is indeed possible that local citizens take up the responsibility for the development of their locality, the draft meanings and organizational options extracted from the larger set of documents are presented to enrich this elaboration.

Table 10.3: Reviewed Community-Driven Development Case Studies

Andrews (2006): Pronatura Peninsula de Yucátan[238], a civil society organization in Yucátan, Mexico.	
Original Context:	The initiative was funded in an area with virtually no existing civil society—except for some Catholic charities and the Red Cross. Furthermore, it emerged at a time in which ecological system conservation, the initiative's initial concern, was not a priority in Mexico.

Continued on Next Page

235. This also includes studies in which experienced and knowledgeable field experts synthesize their know-how. The underpinning rationale is as follows: as the design of 'possible worlds' aims to inform practitioners, the knowledge of other practitioners is a valuable source of insights to this audience.

236. The two attributes are operationalized as follows: whereas developed refers to, as specified in the HDR 2013 (UNDP 2013), a very high level of HD, a democratic country is one that is, according to the Democracy Index 2012 (EIU 2013), categorized as full or partially flawed democracy.

237. As indicated in section 8.2, journal articles often exclude insights that might be relevant to the explication of the mechanisms-intervention interplay. To get an, as far as possible, comprehensive overview of the described context shift, the present inquiry examines the websites, if available, of community-driven projects to complement missing elements in the data extraction template (see section 8.2). Links to investigated websites are added to the respective case study description.

238. The website is available at: `http://www.pronatura-ppy.org.mx/`, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Intervention:	Pronatura Peninsula de Yucátan, having neither a prescribed mission nor resources, was created because one of Pronatura's[239] board members asked the later founder to become the organization's Yucátan representative. The funder used her private contacts to start small scale projects (e.g., providing food baskets for the guards of natural sanctuaries) and later expanded the initial network to include as well as to connect separately working, regional private, public, and scientific organizations. The financial resources gathered by using the established track record to apply for outside funding allowed the initiative later to move from the funder's home into a dedicated office as well as to tackle larger projects.
Resulting Context:	Although the initiative is primarily dedicated to ecological system conservation, it has extended its scope to include social concerns such sustainable tourism and other community development models to create and strengthen the regional civil society. It functions as a node or an intermediary that connects various regional NGOs to cooperatively conduct conservation and community development projects.
Side-effects:	[not mentioned]
Bailey (2012)[240]: The Westway Development Trust[241], a social enterprise in Kensington, London, UK.	
Original Context:	Within the locality, characterized by poor health and housing conditions as well as a high percentage of immigrants, a strong civil society emerged in response to the negative effects of the construction of the A40 Westway flyover in London.
Intervention:	The Westway Development Trust was initiated by the local Council, granting £ 25,000 for the startup phase, to revitalize North Kensington. The Trust is a company limited by guarantee and a charity (i.e., a social enterprise), which manages the public land under the Westway flyover as well as the created buildings on the behalf of local citizens. It is a coalition of civil society organizations, which are represented by seven trustees elected from the 36 member organizations, and the public sector, which is represented by seven trustees nominated by the local Council. The organization is headed by an independent chair elected from the board's members, which, in addition to the 14 trustees, includes two honorary trustees.
Resulting Context:	The Trust mainly operates two sport facilities, i.e., the Westway Sports Centre and the Portobello Green Fitness Club, which were created on the public land under the Westway flyover. Overall, the trust manages assets worth more than £ 25 MM, generates an annual income of more than £ 2 MM, and finances various community development programs, environmental work, as well as health and education projects from its annual surplus.
Side-Effects:	[not mentioned]
Blakeley (2005): The Advisory Councils, a participatory governance platform in Barcelona, Spain.	
Original Context:	Barcelona faced a complex of challenges during the transition from an authoritarian to a decentralized, democratic governance system after the death of the military dictator Francisco Franco. This comprises a lack of democratically experienced civil servants, tight financial resources, and significant socio-political problems bequeathed by the former centralized government.
Intervention:	Political elites, recognizing that the complexity of the challenges goes beyond their capacity, put forward a participatory, co-operative governance model to involve civil society organizations in addition to well-organized and connected business elites. This resulted in the creation of advisory councils, i.e., a sort of platform on which public sector and civil society actors can interact with each other. These councils were devised as means to counterbalance powerful economic lobbying by integrating citizens' social welfare considerations into the municipality's policy making process.

Continued on Next Page

239. The website is available at: `http://www.pronatura.org.mx/`, accessed May 25, 2015.
240. Within the following only one of the case studies discussed in the paper is presented.
241. The website is available at: `http://www.westway.org`, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Resulting Context:	Various sectoral and territorial advisory councils were created to institutionalize civil society participation. The goal of these advisory councils is to make proposals for the design and adaptation of municipal policies. On the other side, the city council, the central public sector instance in Barcelona, informs each of the advisory councils in which way its suggestions were incorporated into the final policy. This way of showing responsiveness is seen as vital to keep up voluntary participation in advisory councils.
Side-effects:	Blakeley (2005, pp. 160–162) points out that organizations concentrating solely on funded projects, without having their own volunteer-driven projects, are merely an extension of public sector structures. The dependency on external funding is a form of control that leads to a professionalization of participation. In other words, by establishing clear interaction procedures between the public sector and civil society organizations, the linkages between civil society organizations and local citizens degenerate.
Chan (2013): Dagongzhe, a migrant worker center in the Pearl River Delta, Guangdong, China.	
Original Context:	The Pearl River Delta in the Guangdong province of China is an area with more than 80 million migrant workers (i.e., rural Chinese)[242], which are, due to the social organization in China, politically and economically marginalized. Generally, China provides a relatively unstable environment for NGOs, because the authoritarian central government established very restrictive requirements for the creation of civil society organizations and has, in addition, reserved the right to withdraw any granted operating licenses.
Intervention:	Dagongzhe is a migrant worker center created by an intellectual activist, supported by NGOs located in Hong Kong, in response to the general conditions of migrant workers in the region. To cope with the unstable institutional environment, worker centers in China often pursue a 'guerrilla strategy', that is, they organize small events in changing locations to avoid attracting suspicion from corporations or local governments. However, if they have attracted too much attention and their operating license is withdrawn, they need to move and re-register their organization with other authorities.
Resulting Context:	The initiative aims to build awareness of general working conditions among the working poor and offers a wide range of relevant services. This includes, for example, information about legal rights, health support, as well as recreational and education services. Due to the environment these organizations often have no networks with locally existing public sector or private sector organizations; instead they work with multi-national NGOs, which are located in remote areas.
Side-Effects:	Initiatives try to avoid confrontations with local and central authorities by de-politicizing themselves.
Dale and Newman (2006): United We Can[243], a social enterprise in Vancouver, British Columbia, Canada.	
Original Context:	The Eastside of Vancouver is characterized by low levels of economic capital, high rates of addiction as well as destitution, and, compared to other localities in the city, high levels of health issues.

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242. By 2012 more than 260 million rural Chinese have migrated to urban areas such as the Pearl River Delta (Yang 2013, p. 310).
243. The website is available at: `http://www.unitedwecan.ca/`, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Intervention:	United We Can is a social enterprise, which evolved from an event a 'dumpster diver' organized, using the $ C 150 donated by the First United Church, in the Victoria Square Park. The aim of this meeting was to raise awareness for the binners' contribution to recycling by paying the latter to delivering their non-refundable containers. In response to the public attention this event attracted, the public sector organized workshops and paid binners as consultants to understand the challenges this 'hidden way' group was facing. Out of these workshops a regularly meeting network of approximately 15 binners emerged. This loosely formed group developed the idea of a binner-managed deposit center, which was later realized using a loan from the VanCity Community Loan Fund.
Resulting Context:	The self-sustaining social enterprise now functions as employer for more than 120 local citizens who face various employment barriers. The center processes approximately 50,000 containers per day and refunds more than $ C 2 MM to its more than 600 daily customers. The initiative cooperates with Vancouver's administration to provide services such as lane cleaning and it operates BikeWorks, a small business, in which ordinary citizens can repair as well as rent bikes and where binners can repair their container collection carts.
Side-Effects:	[not mentioned]
Foster (2011)[244]: Urban Park friends[245], civil society organizations in the USA.	
Original Context:	Many green spaces, parks, and other recreational areas became, due to the reduction of governmental spending for cleaning and supervision, unsafe and dirty public places. Reinforced by the decline of traditional usage scenarios, these areas turned into central places for criminal activities and illegal garbage disposal.
Intervention:	Local citizens, not only those living near decaying areas, spontaneously formed neighborhood park 'friends' groups to revitalize and maintain parks such as Central Park in New York City.
Resulting Context:	Many formal and informal 'Friends of [Park X]' groups are formed by volunteers who provide labor, donate money and/or infrastructure, raise funds, and organize park clean ups or other community events. These initiatives are often encouraged as well as financially and technically supported by local governments, but they do, in general, not assume any formal responsibility in regard to focal commons.
Side-Effects:	[not mentioned]
Kelly and Caputo (2006): The Resiliency Center[246], a civil society organization in Saint Johns, New Brunswick, Canada.	
Original Context:	Saint Johns is a city that has successfully managed to, at least partially, overcome its industrial past, but which is characterized by a high degree of gentrification and social exclusion of the approximately 3,400 adult offenders who are released—each year—from the nearby correctional facility into the local community.
Intervention:	The Resiliency Center (hereinafter: Center) emerged out of a community workshop organized by the John Howard Society (hereinafter: Society) to identify its priorities for the following year. The participants suggested that youth and families should be the focus of the organization. However, instead of extending the Society's portfolio, which is mainly concerned with crime prevention, it was decided to create a separate organization, which is formally embedded in the Society and administratively supported by it, but which is in fact an independently working NGO. The Center identifies service gaps, allocates and mobilizes resources to devise potential solutions, and builds community capacity to close the identified gaps.

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244. Within the following only one of several case studies discussed in the paper is presented.
245. For example, the New York City's Park department website lists dozens of such partner organizations: `http://www.nycgovparks.org/about/partners`, accessed May 25, 2015.
246. The website is available at: `http://saintjohn.johnhoward.ca/services/social-development-services/`, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Resulting Context:	The Center functions as a network intermediary that includes various public service providers and other local NGOs. It serves as anchor point for local organizations as well as marginalized and/or socially excluded local citizens that face problems they cannot solve on their own. The Center addresses the reported issues by working out, sometimes using extra-local sources and experts, dedicated programs and it organizes selected local citizens to be coached to deliver the program as well as enable them to instruct other local citizens in the same way. This approach of implementing programs not only reduces costs substantially[247], it also ensures that the respective capacity is built locally as well as redundantly.
Side-Effects:	Kelly and Caputo (2006, p. 244) argue that the Center is, by focusing solely on identifying service gaps and delivering cost-effective programs, unsuitable to address deeper structural inequalities.
Kelly, Caputo, and Jamieson (2005): Community A, a civil society organization in western Canada.	
Original Context:	Community A, i.e., a composite locality that represents the common features of six high-density urban localities in western Canada, is beset with, inter alia, problems such as high crime rates, vandalism, unsupervised youth, decayed urban commons, and resident fear.
Intervention:	The civil society organizations in the six localities, all set up in a similar way, evolved from an externally funded crime prevention program. Initially, up to five local public servants came together to discuss the respective locality's focal issues and problems. The original groups soon realized that sustainable solutions required activities beyond the official mandates and therefore involved local citizens by organizing participatory partnership committees.
Resulting Context:	The monthly meeting partnership committees involve up to 26 members, who aim to identify solutions to local issues. The complementary executive committees, dealing with day-to-day operations, support the partnership committees by mobilizing resources and realizing selected measures. The latter include, for example, neighborhood foot patrols, a local chapter of the Boys and Girls Club, or annual clean up park events. Within these programs representatives of the local administration cooperate with local citizens to deliver the respective services. In other words, the partnership committee can be understood as an organization that spans from the public to the voluntary sector (see figure 10.5), i.e., the local administration extends or supplements its service delivery by engaging organizations of the voluntary sector.
Side-Effects:	Kelly, Caputo, and Jamieson (2005, pp. 316–317) point out three challenges that were identified during the creation of the public sector-civil society partnerships: (i) projects, which involve different public service providers with overlapping mandates and jurisdictions, require that conflicts of competencies are negotiated and resolved within the local administration to be successful; (ii) the dominance of professional service providers needs to be balanced by implementing mechanisms that allow local citizens to influence the process; and (iii) local citizens, who often expect immediate results, need to be aware that public servants often have to struggle with bureaucratic procedures, which prolong processes.
Kirkpatrick (2007)[248]: The Unity Council[249], a social enterprise in Fruitvale, Oakland, California, USA	
Original Context:	Fruitvale, in Oakland California, is an area that is characterized by high ethnic segregation, political marginalization, and low economic capital. The locality has a long history of civil society organizations, which organized, for example, foot patrols to protect the predominantly black population against policy brutality.

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247. It is estimated that this way of delivering programs reduces the costs from $C 111,369 to $C,4,613 p.a. for delivering programs (Kelly and Caputo 2006, p. 239).
248. Within the following only one of several case studies discussed in the paper is presented.
249. The website is available at: http://www.unitycouncil.org/, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Intervention:	The Unity Council (hereinafter: Council), initially a political action group, was formed through the association of various civil society organizations, which joined forces in response to the discrimination of blacks in the 1960s. However, the Council complemented, as indicated in the introduction to the discussion of the current intervention entry point, its political activities by providing services to local citizens in Fruitvale, because this area had, at least at this time, virtually no public service provisioning infrastructure.
Resulting Context:	The Council, actually a non-profit community development corporation, is headed by a board of 13 members, which includes representatives of the public sector, political activism, and local businesses. The organization provides a variety of services to local citizens such as building physical assets, business development schemes, family and youth services, literacy programs, and a 'land bank', which caps property taxes for long term residents to counterbalance the indirect replacement of local citizens due to rising property prices.
Side-Effects:	Kirkpatrick (2007, p. 332) points out that successful place-based NGOs, which are run by paid staff and non-residential stakeholders, often alienate themselves from their 'constituency'. However, the Council, although being a quite successful community development NGO of scale, keeps up the dialogue with local citizens by regularly organizing meetings, public hearings, and workshops.
Mathews (2013)[250]: Suggsville, a composite city in the USA[251]	
Original Context:	Suggsville is, similar to Community A, a composite locality that combines the insights of more than 50 projects the Kettering Foundation has carried out accross the USA. Suggsville, having no civil society infrastructure, faces several serious challenges that the local government alone cannot adequately address, i.e., Suggsville is captured in a community poverty trap (see section 10.2). High unemployment caused by economic restructuring, high rates of children born to single teenagers, decaying urban commons, and alcoholism are among the most serious problems that beset the locality.
Intervention:	The local development organization emerged out of a series of meetings that were organized and facilitated by an extra-local association: within the first meeting local citizens were brought together to 'name' the locality's problems, i.e., they should identify in which way Suggsville differs from a livable locality. Based on these insights successive meetings carved out options that could contribute to the resolution of the identified issues. After several of such preparatory activities the meetings advanced to a deliberation phase in which local citizens discussed the effects and possible side-effects of the gathered alternatives. This reflective practice was accompanied by the identification and committing of resources, which are two important tasks to determine the feasibility or realizability of options. These activities, in turn, provide the basis for translating the identified programs into practice, that is, local citizens started to work out projects with the local administration and to organize complementary action. The extra-local association, which was not involved in these practical efforts, complemented these endeavors through the arrangement of further meetings that aimed to create a platform on which local citizens can share and exchange their experiences. These discussions, in turn, melted over into the afore-mentioned phases, which created, as intended, an ongoing process.

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250. This article was found during the background search, therefore, it is not contained in the list of articles provided in annex A.1.
251. See Mathews (2002) and http://mathewscenter.org/, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Resulting Context:	After several iterations the meetings became institutionalized, that is, they evolved into a dialogue platform that functioned as an anchor or point of contact for local citizens who required help. The institution was, eventually, transformed into a formal civil society organization that took over the responsibility of the disengaging extra-local association and since then has arranged meetings and facilitated the organization of collective action to address local issues.
Side-Effects:	Mathews (2013, p. 144) points out that it not only takes several years to build the capacity required to operate self-reliant local development organizations, but also that extra-local actors need to be non-interfering so that the competencies can be created locally.
Silver, Scott, and Kazepov (2010)[252]: Community Gardens, civil society organizations in Berlin, Germany.	
Original Context:	Berlin, the capital of the reunified Germany, is a city that can be characterized as having a high degree of active civil society organizations and in which, due to the withdrawal of subsidies after the reunification, occurred a 'regulatory slippage' that resulted in the privatization of some and the decay of other urban commons as well as the reduction of public service provisioning levels in general.
Intervention:	In response to the decay of the city's green spaces several formal and informal grassroots formed to create community gardens on empty land—similar to the Friends of Park X-groups discussed above.
Resulting Context:	The created, formal as well as informal, NGOs established greening areas in formerly open, empty spaces to increase green areas in the locality and to improve the living conditions of local citizens.
Side-Effects:	Silver, Scott, and Kazepov (2010, pp. 468–469), in reference to Rosol (2010), argue that despite the often claimed inclusive nature, these initiatives tend to involve only middle-class residents, that is, they neither involve senior citizens or less educated groups nor do they cross ethnic boundaries. Furthermore, they also point out that the public sector is off-loading responsibilities to local citizens and that the competition for funding between initiatives leads to a co-option and de-politicization of initiatives, which hampers the formation of coalitions between civil society organizations.
Urbigkit (2007): PlanCheyenne[253], a community-driven planning committee in Cheyenne, Wyoming, USA.	
Original Context:	Cheyenne, the capital of Wyoming, was a city that suffered from an unvarying economic sector. In fact, the local government and the nearby Air Force base were the largest employers in the city.
Intervention:	In 2002 the Greater Cheyenne Chamber of Commerce initiated the Vision 2020 project, that is, a 'community-driven' planning process in which local citizens created a holistic plan for the development of Cheyenne. Although the project is termed 'community-driven', this does only partially include the implementation of the plan; local citizens were mainly involved in mobilizing other local citizens to participate in the planning of how Cheyenne's economic sector could be diversified. Nevertheless, within this planning exercise local citizens had a high degree of control and influence, which, at least to some degree, justifies the label 'community-driven'.

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252. The case study discussion is based on the article of Rosol (2010).
253. The website is available at: `http://www.plancheyenne.com/`, accessed May 25, 2015.

Table 10.3 — Continued from Previous Page

Resulting Context:	Cheyenne's civil society infrastructure was enriched by a regularly meeting, community-driven planning committee that created the city's development plan using, inter alia, a SimCity[254] exercise and that was responsible for organizing the participatory processes (i.e., festivals, workshops, etc.). The main goal of this steering committee, which included representatives of the public sector and more than 40 local citizens, was to develop a holistic development plan that integrates a transportation, a community, and a recreational plan. Each of these integrated plans comprised four parts: an inventory analysis of the status quo, a physical representation of the current state, a future vision, and a list of actions and techniques required to realize the vision. The integrated plan functioned as a basis for the urban development projects that were initiated in 2006.
Side-effects:	[not mentioned]

The variety of contexts represented by the above described case studies indicates that there are various paths for establishing the envisioned initiatives; indeed, it might even be argued that creating a civil society organization is path-dependent, i.e., unique to a particular context (Bailey 2012, p. 7), which makes a duplication or replication in different settings difficult (cf. Bailey 2012, p. 7; T. Binns 2009a, pp. 104–105). However, these are challenges faced by social system designers. Within the present inquiry only the theoretical possibility as well as the resulting draft meanings and organizational options that the reference architecture need to support are of interest (see section 8.2). Correspondingly, for the current purpose the 12 case studies summarized in table 10.3 provide justificatory evidence that the creation of community-driven initiatives in a locality as characterized in section 10.1 is indeed possible. Furthermore, the Pronatura Yucátan (Andrews 2006) and the Dagongzhe (Chan 2013) case studies illustrate that such initiatives might even emerge in 'developing' localities (see the sequence of interventions depicted in figure 8.4): in the former case a civil society infrastructure, rendering the creation of initiatives more likely (cf. Jun 2007, p. 116), is completely missing; the latter case goes even further and provides evidence that such an initiative can evolve not only without such an infrastructure, but also despite an authoritarian state, which makes it hard for civil society to emerge (see also Babajanian 2005, pp. 453-454). In other words, civil society organizations generally evolve if citizens make use of their freedom to associate (Dekker et al. 2010, p. 611)—specified in article 20 of 'The Universal Declaration of Human Rights'[255]. The latter case illustrates that initiatives can be formed even if this human right is granted only partially.

In sum, whereas these two case studies indicate that initiatives can evolve even in less favorable circumstances as assumed in the present inquiry (see section 10.1), the remaining case studies suggest that within 'developed' localities initiatives are formed either in response to a service gap caused by a regulatory slippage or to an anticipated threat such as externally imposed projects [e.g., the planned expansion of the Port of Charleston (Wilson, Rice, and Fraser-Rahim 2011)]. The former entails three different cases: initiatives are either, as Eriksson and Forsberg (2010, p. 325) put it, formed 'spontaneously' (e.g., Dale and Newman 2006; Foster 2011; Mathews 2013; Silver, Scott, and Kazepov 2010), are (proactively) initiated by public sector organizations (e.g., Bailey 2012; Blakeley 2005; Kelly, Caputo, and Jamieson 2005; Urbigkit 2007), or evolve from the existing civil society infrastructure (e.g., Kelly and

254. SimCity is a video game developed by Maxis which allows the user to build and manage cities, see `http://www.simcity.com/`, accessed May 25, 2015.

255. The Universal Declaration of Human Rights is available at: `http://www.un.org/en/documents/udhr/index.shtml`, accessed May 25, 2015.

Caputo 2006; Kirkpatrick 2007; Richardson, Nichols, and Henry 2012). In other words, an initiative can be created if an 'initiative window'[256] opens up (see also Bailey 2012, pp. 26–27; Dekker et al. 2010, p. 611): the initiative window denotes a situation in which a certain state of affairs, which local citizens perceive to be problematic, requires organizing collective action to take up the slack for local authorities or to complement the latter's efforts to resolve the issue to the satisfaction of local residents. If such an initiative window is given, the formation of an initiative tackling this specific problem is possible as illustrated by the aforementioned case studies. In addition and further elaborated in the following, the inquiries also indicate that, once an initiative has been formed in response to a particular concern, it can extend its activities over a period of time to cover a broader range of issues. Therefore, it is indeed possible to establish a community-driven SHD initiative in an urban locality. This, however, requires that the right 'organizational crash barriers' are implemented to avoid that the initiative is captured and used as a vehicle to advance vested interests, i.e., to prevent that the initiative evolves in an inappropriate way, and that, in regard to the fact that the initiative evolves out of an organization that was formed in response to a much narrower issue, enough time is devoted to build trust among local citizens and to create the capacities required for such an endeavor (see also chapter 9).

Within the following, the draft meanings and organizational options extracted from the 41 documents that passed the screening process are presented. This discussion is organized around the six[257] success criteria of community-driven civil society organizations suggested by T. Binns (2009b, 2009a): adapted to the locality, foster community spirit and cooperation, engage and disengage extra-local facilitators, create a transparent governance structure, focus on sustainability, and learn from experience.

The first criterion suggests to take stock of the locality's physical assets, local capabilities, natural environment, etc. (T. Binns 2009b, pp. 31–32). Such an inventory analysis, for example, explicitly mentioned in the PlanCheyenne case study (Urbigkit 2007), is important because civil society organizations are path-dependent and context-specific (Bailey 2012, p. 7). However, such an investigation of the status quo presupposes that the boundaries of the locality in which the initiative is based are already established. Unfortunately, the discussion in section 10.1 provides only a vague definition of 'locality' and how it can be identified; in fact, it only provides some negative criteria such as large enough to comprise multiple communities or cultural subsystems, but not larger than the lowest level of the political system. In respect to the 'underdesign principle' (Fischer and Herrmann 2011, pp. 15–17) it can be argued that the definition is deliberatively vague to be applicable in multiple contexts. Nevertheless, there is a need to, at least initially, delimit the initiative's scope to define, inter alia, its 'constituency' (Jun 2007, p. 108). However, as illustrated by the Resiliency Center case study (Kelly and Caputo 2006), this spatial area is not fixed but can be extended if the initiative matures. As the identification of the spatial coverage is specific to the respective context, delving deeper into this criterion is not particular rewarding within the present inquiry (see Foster 2011, pp. 120–124, for some thoughts in this direction).

The second criterion, foster community spirit and cooperation, emphasizes that the creation of a common vision is crucial to the success of initiatives (T. Binns 2009b, p. 34). A vision does not have to be a concrete plan of the locality's future as in the PlanCheyenne case

256. This term is used in reference to what Kingdon (1995, pp. 166–172) calls the 'policy window'.
257. The seventh criterion, i.e., the path-dependency of initiatives, is excluded from the enumeration, because it has already been discussed.

study (Urbigkit 2007); agreeing on how the current situation affects valuable living conditions, as indicated in the Suggsville case study (Mathews 2013) and the underpinning value position (see section 10.2), as well as recognizing a shared interest in and commitment to the locality (Eriksson and Forsberg 2010, p. 333; Foster 2011, p. 129; Hustedde and Ganowicz 2013, pp. 171–172; Kelly, Caputo, and Jamieson 2005, p. 314; Richardson, Nichols, and Henry 2012, p. 985; Saegert 2006, pp. 275–276) are the minimal but sufficient conditions to form a basis for effective cooperation and collective action:

> "Collective efficacy exists where there is the social cohesion, working trust, and a shared willingness of residents to intervene on behalf of the common good, including to maintain effective social controls [.... A] group's capacity for action thus depends on a certain level of social capital, as well as on informally shared expectations or norms for cooperative action [...]" (Foster 2011, p. 86).

In other words, the initial agreement provides the foundational bonding capital, a form of justificatory reference point, from which legitimate rules and norms can be derived (cf. Connelly 2011, p. 932). These shared rules and norms are one of the two constitutive elements of solidarity, the essence and ultimate goal of community development (Bradshaw 2013, p. 16). A common identity, the second constitutive element, will be further elaborated in the next intervention entry point's assessment and synthesizing design. In anticipation of this discussion, it can be argued that agreeing on negatively affected valuable living conditions is the basis for forming loosely coupled networks in urban areas and that such networks are, in turn, the platform from which the collective action required to address specific issues originates. Creating this initial bonding capital is particularly relevant in urban areas, because cities are, in comparison to rural areas, relatively small geographical areas in which large groups of 'strangers', who need to be willing to cooperate, live together (cf. Clayton 2009, p. 489; Jacobs 1961, p. 30; H.-D. Meyer 2012, p. 10; Wiesel, Bigby, and Carling-Jenkis 2013, p. 2391). This is in fact the key criterion that distinguishes the two types of affiliations already mentioned in the critical reflection: rural citizens tend to be closely related to their place of residence; in contrast, the identity of mobile, urban citizens is mainly a matter of belonging to post-place communities such as ethnic or religious groups. Correspondingly, in rural areas, where local citizens are more acquainted (Jacobs 1961, p. 30), agreements have a certain tradition, i.e., they have evolved over prolonged time spans. In urban areas, achieving an initial agreement in a spatial area is a more intricate problem, because the values and norms of multiple, differently socialized strangers need to be reconciled. This observation is compatible with the results of Eriksson and Forsberg (2010, p. 330), who compared civil society organizations in urban and rural areas of Sweden: whereas initiatives in the latter tend to have a more holistic perspective, networks in urban areas concentrate on specific problems. This might be attributed to the emergence of an issue opening up the initiative window. However, the existence of an initiative window does not automatically lead to the creation of an initial agreement. A particularly useful approach facilitating this process can be derived from the procedure Cameron, Ghosh, and Eaton (2011) suggest for the development of a community health impact assessment tool. The core aspect of this narrative-based technique is that local citizens learn to see particular issues from the perspective of other participants. To achieve this goal Cameron, Ghosh, and Eaton (2011, pp. 434–435) suggest to hold a workshop during which each of the participating local citizens shares a personal story concerned with a particular issue. Afterwards, the participants select one of the stories for a more thorough investigation. Within this detailed analysis local citizens determine all relevant factors and their relationships by (i) describing the undesirable event occurring in the story, (ii) explaining why the event occurs, (iii) synthesizing the factors contributing to the event's occurrence, and (iv) devising options for actions that need to be taken to prevent the event to occur[258]. Whereas the first three steps create the initial agreement, the constructive fourth step, which might lead to further iterations, assists in creating collective action. This transformative element is pivotal for extending the agreement, because successfully conducted projects increase trust among and self-confidence of urban citizens as well as their appreciation of collective action (cf. Babajanian 2005, pp. 451–452; Bailey 2012, p. 33; Booyabancha and Mitlin 2012, p. 419; Bowen 2009, p. 259; Kirkpatrick 2007, p. 336; Peel and Bailey 2003, p. 50; Wilson, Rice, and Fraser-Rahim 2011, p. 151). This is coupled with the urban citizens' pride in their locality (Mathews 2013, p. 146), a key aspect of the holistic, spatially anchored rural development perspective (Eriksson and Forsberg 2010, p. 332). In sum, initiatives concerned with the development of urban localities are formed if an initiative window opens up, i.e., if there is a situation that allows estranged local residents to reconcile their different values and norms by agreeing that the current situation negatively affects something that is commonly valued. This initial agreement is the germing bonding capital required for collective action. The latter, if successfully carried out, increases the bonding capital and the willingness to cooperate, which, in turn, allows the group to tackle a broader range of issues, i.e., to expand the initiative's scope of concern by extending the agreement of valuable living conditions.

Within some contexts such a process might not occur despite an initiative window, because the required capacity to organize collective action to address specific issues is missing. In other localities, which have the required capacities, forming such a network and extending its scope is a difficult as well as lengthy process. However, the process can be enabled or accelerated by existing civil society organizations or extra-local actors that support local citizens in their efforts, as indicated in the above-mentioned case studies (e.g., Bailey 2012; Kelly, Caputo, and Jamieson 2005; Kelly and Caputo 2006), by providing administrative and coordinative experience (Kelly and Caputo 2006, p. 241). This involvement is summarized under the heading of the third criterion: engaging and disengaging. In its core the principle suggests that if extra-local actors engage in building local capacity and support ad hoc networks by, for example, connecting them to other actors (e.g., funding or product marketing), this involvement should result in a self-reliant initiative before extra-local actors withdraw their support, i.e., before they disengage themselves (T. Binns 2009a, pp. 101–104). The most explicit description of an approach to foster the formation of an initiative by local citizens is provided in the Suggsville case study (Mathews 2013, pp. 141–156); the process is similar to, but substantially extends the afore-mentioned approach proposed by Cameron, Ghosh, and Eaton (2011). Within the Suggsville case study an extra-local actor initiated the process summarized in table 10.4 by engaging local citizens to participate in a planned kick-off meeting. Besides organizing further meetings to institutionalize the process in the locality,

258. Oettlé et al. describe a particular interesting approach to facilitate learning between different localities. The Community Exchange and Training Programme "brings together local communities, governments, donors and NGOs for exchanges of experience and sound practice through a process of exchange visits, training and information sharing. It is not the intention to solve the problems that people experience, but rather to enable them to broaden their horizons, learn about alternative ways of addressing issues of concern, validate their own knowledge, skills and resourcefulness and develop new visions for a better future" (Oettlé et al. 2004, p. 117). The suggested approach comprises the following steps: develop a vision of the locality's future; design an exchange concept; create a funding proposal with the United Nations (UN); hold a team building workshop; identify suitable partern-localities; organize the exchange, and prepare a final report (pp. 119–123). Oettlé et al. (2004, p. 125) argue that an exchange "provides an appropriate tool for sharing, broadening and applying indigenous knowledge" (cf. Henocque 2013, p. 68).

the extra-local actor played an active part only by cautiously supervising the meetings and by providing information, including contacts, to facilitate discussions about effects, side-effects, resources, and trade-offs. This deliberatively cautious involvement of the actor did not only enhance local citizens' sense of ownership, critical to self-reliance (see also Bhattacharyya 1995, p. 63), but it also fostered capacity building, that is, the enhancement of commitment, resources, and skills of as well as within the locality (cf. Aspen Institute 1996, p. 17; Carlsson and Berkes 2005, p. 73; Raymond and Cleary 2013, p. 1).

Table 10.4: Approach to Community-Driven Development, adapted from: Mathews (2013, pp. 141–156)

Phase	Within this phase local citizens ...
Naming	identify and describe problems they are facing in their own terminology[259].
Framing	gather potential problem solutions. They further identify side-effects of actions and resources, including other actors, that are required to implement solutions.
Deliberative Decision Making	discuss trade-offs inherent to options, possibly informed by external information, and decide upon a set of actions that is feasible to implement.
Identifying and Committing Resources	identify and commit resources required to realize the selected options.
Organize Complementary Action	coordinate and organize the realization of selected alternatives.
Public Learning	reflect collective action experiences and assess the effectiveness, which includes the identification of side-effects, of the selected and realized interventions.

Establishing ownership is mainly achieved within the first two phases within which local citizens create a common vision by naming the most important problems and by discussing potential solutions that are acceptable to participants. This is essentially an agreement, which is further strengthened by selecting feasible options in the deliberative decision making phase. It has to be noted that selection in this case does not imply consensus about a specific preferred option; rather, it refers to the identification of pros and cons of alternatives, which eventually leads to the exclusion or rejection of proposed programs based on reasonable arguments. In other words, the decision making process results in a set of non-opposed options[260], each of which can be refined in particular sub-groups (cf. Bowen 2009, p. 256; Mathews 2013, pp. 147–148). Although this relatively elegant approach provides a workable solution to the 'collective choice challenge' all civil society organizations have to face (cf. Wunsch 2013, p. 224) and is generally compatible with the value position underpinning the design of 'possible worlds', it nevertheless confines the arguments considered to the ones issued by participants. However, to fully meet the demands suggested by the value position (see section 10.2), the process needs, as discussed more thoroughly later, to be extended to take into account even the insights of 'distant observers' (see section 10.2). Nevertheless, within the next phase resources, including people's skills, required for the realization of proposed options are identified and committed. This is a vital step for creating a self-reliant initiative,

259. This is vital for engaging local citizens, because technical terms and professional names are often too remote, which, in turn, hampers local citizens' involvement.

260. It might be argued, as Di Nucci does in his unpublished manuscript "Consent ain't anything", that local citizens express a form of consent if they have the opportunity to oppose a particular action but deliberately refrain from exercising this option.

because in the early stages of the process there are no collectively owned resources. Thus, committing a resource is merely a promise of the resource's owner. This is decisive for enhancing bonding capital: a successful project increases trust as the involved local citizens are perceived as reliable partners. In this way local citizens insure themselves that they can trust each other, because they are devoted to a similar goal. Correspondingly, this approach differs from the technocratic top-down and the consultative bottom-up approaches, briefly discussed in section 10.2, because local citizens are not only involved in the identification of problems, but they are also actively engaged in the organization and realization of solutions as indicated in this and the next phase. Extra-local actors pursuing this or similar approaches aim to exit the process by trying to institutionalize the learning phase, which is the key phase to keep up collective action and to further strengthen the common vision through the initiation of new process iterations. Institutionalizing this phase manifests itself in the creation of formal organizational structures, i.e., the setup of a non-profit charity, which actors support by giving advice in respect to legislation, required operating licenses, accreditation demands, etc. (cf. Bailey 2012, p. 15; Carman 2007, p. 65).

As the analysis of Ireland's civil society by Geoghegan and Powell (2006, p. 858) and the case studies in table 10.3 indicate this is the most common exit strategy: a more formal organization not only allows the initiative to be recognized as civil society actor, which can, for example, apply for funding, but it also creates a dedicated point of contact for local citizens [e.g., the Resiliency Center case study (Kelly and Caputo 2006)]. Whereas the latter aspect will be further elaborated in the next intervention entry point's assessment and synthesizing design, the former, often discussed under the heading of 'external legitimacy' (Connelly 2011, p. 938), is not only required to apply for funding, but also to cooperate with other organizations. Such 'project partnerships' provide access to lacking competencies, resources, and/or information (cf. Dale and Newman 2006, p. 24, and table 10.5). However, Williams points out that extra-local actors need to consider the context when planning their disengagement (see also Babajanian 2005, pp. 453–454; Williams 2004, pp. 730–735): creating formal organizations might be a viable option in affluent localities, but less affluent localities tend to rely on the fourth sector, i.e., "informal aid provided on a one-to-one basis to members of households other than one's own" (Williams 2011, p. 215). In other words, imposing formal organizations on less affluent localities might be an unsuccessful exit strategy (see Bailey 2012, pp. 18–26, for counter examples). Nevertheless, the creation of time banks[261], defined as "community-based volunteering schemes whereby participants give *and receive* services in exchange for time credits [emphasis in the original]" (Seyfang 2004, p. 63), are considered to be an adequate compromise. They are in fact a way to establish formal organizations in less affluent localities and still support the fourth sector (Williams 2004, pp. 737–738). However, realizing such a mixed strategy requires a prolonged commitment.

As this time span is merely an aspect of the transient structures of social system design, this avenue will not be further explored; instead, within the following the two mentioned aspects of external legitimacy are dissected more thoroughly to explicate emerging organizational options: (i) the formation of inter-organizational networks and (ii) the funding strategy as well as its eligibility requirements.

As indicated above, the primary reason for forming inter-organizational networks is to

261. As the very act of involving local citizens in collective action builds social capital (Bowen 2009, p. 258), time banks are also a useful approach to socially integrate asylum seekers, who are often not allowed to work for money, into the locality's social structure (Seyfang 2004, p. 65).

Table 10.5: Inter-Organizational Structures, adapted from: Purdue, Diani, and Lindsay (2004, pp. 279–280)

	Few Partners	Many Partners
Similar Interests	**Interlocking Core Membership** Board members represent the initiative in steering committees of other organizations[a].	**Stable Forums** Civil society organizations form an umbrella organization to bundle and exchange resources.
Complementary Skills	**Project Partnership** Initiatives with different orientations and complementary skills cooperate in (funded) projects[b].	**Rapid Exchange** Initiatives cooperate without developing intimate relationships (e.g., referring clients).

[a] This in implies that board members do not represent themselves and their values, but an initiative and its values (Dekker et al. 2010, p. 610).

[b] Such a cooperation is excluded between initiatives having similar orientations, because they are competing for funds as discussed more thoroughly below.

compensate for the lack of competencies and resources, required to address more complex problems and/or a broader range of issues (Dekker et al. 2010, p. 611, see also 'project partnership' in table 10.5). A key prerequisite for building networks is that the initiative is recognized as a reliable partner. This, in turn, is based on the initiative's track record or record of achievements (Connelly 2011, p. 940). Therefore, before an organization can engage in short-term, cooperative projects, which might even evolve into long-term relationships on personal and organizational levels, characteristics of initiatives addressing welfare issues (Dekker et al. 2010, p. 620), the initiative has to establish a record of achievements as autonomous organization (Purdue, Diani, and Lindsay 2004, pp. 280–282). In other words, establishing a well-functioning organizational structure is the first step for an ad hoc network to evolve into an accepted part of the civil society infrastructure. This provides the basis for cooperating with other organizations to tackle a wider range of objects and to apply for larger funds. Successfully carried out projects might then evolve into long term collaborations between different actors (e.g. public sector-civil society partnerships). However, this development, especially the selection of cooperation partners, depends on the initiative's orientation, which manifests itself in the pursued funding strategy.

Based on Stoecker (1997), Kirkpatrick (2007, pp. 329–331, 343) distinguishes two directions into which an initiative can move (see also Foster 2011, p. 119): on the one side, there are market-oriented initiatives that understand development as the increase of economic exchange value, and on the other side, there are community-oriented initiatives that concentrate their efforts on enhancing the locality's capacity as well as its use value. Whereas the former pursues a sort of profit maximization strategy, which often involves private capital organizations as partners, the latter operates in settings that do not necessarily provide an incentive for private capital investments (cf. Bertotti et al. 2012, p. 169), which often goes hand in hand with smaller grants from different sources [e.g., the Unity Council received grants from more than 30 disparate sources (see also the St. Clair Superior Coalition in McQuarrie 2013, pp. 88–89)]. As community-oriented initiatives exhibit more similarities to the envisioned community-driven SHD initiative sketched in the 'possible world' (see section 10.2), market-oriented initiatives, solely focusing on economic exchange value, are not considered in the remaining discussion. However, it has to be noted that this neither implies that community-oriented initiatives cannot incorporate economic exchange values as one factor into their decision making process nor that private sector funding is necessarily eschewed. For example, in the before-mentioned Unity Council case study (Kirkpatrick 2007), the initiative received a $ 27 MM credit from the CitiBank. However, the difference lies in the interaction's quality (see also Barney 1991, p. 115; Gruca and Rego 2005, pp. 127–129; Hillman and Keim 2001, pp. 127–128): whereas market-oriented housing associations often involve banks as equity partners in their urban revitalization projects, i.e., they set on a relational exchange, the relationship between the Unity Council and the CitiBank was transactional, that is, the bank functioned as traditional lender (Kirkpatrick 2007, p. 345). Although cooperation with private capital organizations might thus still be an option for community-oriented initiatives, the primary source of financial support is the public sector:

> "[C]ommunity development in Ireland is almost completely dependent on the state for funds. This is significant because community development in Ireland originally emerged as a self-activated response of marginalized communities to poverty and social exclusion" (Geoghegan and Powell 2006, p. 850).

This dependency on public sector funding[262], however, is not Ireland-specific; rather, it is a general phenomenon. Unfortunately, depending on public sector funding fosters competition between civil society organizations with similar objectives, which, in turn, hinders their collaboration (see table 10.5). On the other side, to manage this competition for funds the public sector, or more precisely the bureaucratic administration (see section 10.2), applies authoritative criteria, thereby rationalizing civil society, to distribute funds to 'professional community development' projects (cf. McQuarrie 2013, pp. 80–81; Silver, Scott, and Kazepov 2010, p. 454). Rationalization, in this case, means that initiatives have to orient themselves along a "monochrome programmatic palette" of funding opportunities; organizations that fail to adapt do not receive funding and, by implication, eventually starve out (McQuarrie 2013, p. 83). As these palettes are "concentrated on [. . .] those associations which are perceived to have the greatest potential for disruption" (Blakeley 2005, p. 160), disruptive civil society organizations become contractors scrutinized and controlled by the state (Geoghegan and Powell 2006, pp. 857–858). This contradicts the very idea of community-driven development, which Booyabancha and Mitlin circumscribe as follows:

> "[P]rogressive urban development, including the strengthening of local organizations and hence social capital, is not a result of state action but emerges from the civil society process itself" (Booyabancha and Mitlin 2012, p. 419).

Furthermore, local citizens who voluntarily participate in an initiative often do not have the formal training required to fulfill eligibility requirements of donor organizations, such as competencies in program evaluation, record reviews, financial audits, accreditation, and reporting (Carman 2007, p. 61). The seriousness of this educational deficit is reinforced by the high degree of complexity, emerging from the need to manage and coordinate the eligibility requirements of different donors that each provide a small portion of the total funding, community-oriented initiatives have to face. Both facets culminate in the need to involve paid professionals. However, this development transforms civil society activism into a paid

262. This, however, does not imply that funding is solely confined to direct state funding (Blakeley 2005, p. 155). One of the largest organizations funding community development projects is the World Bank group, which has established various decentralized, demand-driven, participatory, and country-specific social funds (cf. Babajanian 2005, pp. 450–452). The European Union (EU) provides similar funding opportunities, for example, through the European Social Fund (2007 to 2013), which had a budget of €75 billion (for more details see: `http://www.ec.europa.eu/esf/`, accessed May 25, 2015).

profession (McQuarrie 2013, pp. 77, 84): civil society is becoming an 'industry system' in which technocrats are extolled as representatives of local citizens' interests (see also Blakeley 2005, pp. 160–162). This runs contrary to the very idea and foundation of community-driven development, because it creates another form of dependency (see section 10.2), instead of increasing localities' resilience. This leads McQuarrie (2013, p. 73, 75) to conclude that 'the voluntary nature of civil society organizations' has been transformed into a 'civic monoculture' that makes the locality prone to external shocks as the foreclosure crisis in Cleveland strikingly demonstrates. Although it might be argued that the professionalization and contracting tendencies corrupt the inclusive and empowering nature of community-driven development (cf. Geoghegan and Powell 2006, pp. 857–858; McQuarrie 2013, p. 75), there is also another side of the coin:

> "[D]elegitimising the role of paid staff as 'community leaders' is both potentially damaging in practice and weak in principle. Although professionalisation has its dangers, it is not inevitably a problem [...]" (Connelly 2011, p. 943).

The critical bias is damaging and weak, because paid staff plays a major role in motivating and engaging local citizens, building capacity within initiatives as well as localities, proactively identifying potential committee members as well as persuading them to stand for, often uncontested, elections, and motivating local citizens to participate in elections (cf. Connelly 2011, p. 937; Wilson, Rice, and Fraser-Rahim 2011, p. 151). Furthermore, the 'not inevitably a problem' indicates that there are mechanisms to overcome the principal-agent challenge between paid staff and local citizens (cf. Wunsch 2013, p. 224) such as the diversity of the initiative's project portfolio:

> "[W]ithout their own autonomous projects, associations [civil society organizations] cannot participate on equal terms with the administration. They end up simply shadowing the local administration rather than offering constructive alternatives. In this sense, associations run the risk of becoming a mere extension of the municipal structure" (Blakeley 2005, p. 160).

The core argument of the above external legitimacy discussion runs as follows: initiatives need a record of collective achievements to demonstrate professionalism, solidarity, and capacity, which, inter alia, indicates that the initiative is not driven by individual rent-seeking behavior, a behavior that often emerges if initiatives are funded too early in their genesis (cf. Bailey 2012, p. 31; Classen et al. 2008, p. 2414). The rival of this perspective is, as indicated in the above quote, the demand for internal legitimacy, that is, the perspective of local citizens: it is important that initiatives do not solely depend on public sector funding, they have to have their 'own autonomous' projects driven by voluntary collective action of local citizens. To balance these two, not necessarily mutually exclusive, demands, the initiative needs an appropriate organizational structure that ensures overall legitimacy (Connelly 2011, p. 942). These aspects will be discussed under the umbrella of transparency and governance, the next criterion of successful community-driven initiatives.

In respect to the development of the reference architecture in section 11, the issues discussed in the following are particularly important, because they are concerned with the organizational structure of the social system, i.e., the basis for the design of technical systems. T. Binns (2009b, p. 33) suggests that the governance mechanisms of successful initiatives not only give local citizens a sense of ownership, but they also actively engage them; only those initiatives which consider and appreciate these two aspects demonstrate internal legitimacy, that is, they can be seen as legitimate representatives of local citizens.

> "It is important to recognize that community action structures need internal support as well. Their capacity to function as the local nexus of innovation depends on several internal factors: the ability of their members to work effectively together, available skills and knowledge for defining and addressing local problems, decision-making processes, leadership characteristics, formalized rules and procedures, and member-staff relationships" (Poole 1997, p. 164).

Within this list of 'internal factors' the formalized rules and procedures, including those shaping decision-making processes, capture the essence of the initiative's organizational structure. Other elements such as the ability to 'cooperate effectively' or the 'availability of useful skills and knowledge' in the locality are contingently related elements that are only implicitly considered in the following. Instead, the focus of the succeeding discussion, below complemented by an analysis of leadership characteristics and general capacities, lies on structural elements. However, the starting point of the elaboration is the 'two-edged paid staff sword': on the one hand, professionals are seen as important determinants of external legitimacy, which is pivotal to the initiative's survival, and on the other hand, it is argued that technocrats are "problematic barriers to direct representation of community voices" (Connelly 2011, pp. 940–941). The tension can be resolved by establishing mechanisms that involve local citizens as well as trained specialist in the decision-making process, but simultaneously balance the power relationship between these two groups (Connelly 2011, p. 941; Frandsen, Paton, and Sakariassen 2011, p. 24). The vital element is that local citizens' interests, which are specific to a particular socio-historical context (Johnson, Dowd, and Ridgeway 2006, pp. 72–73), are integrated in the decision-making process, because they constitute the reference point for the justification of legitimate rules and actions in the locality (Connelly 2011, p. 932). Geoghegan and Powell (2006, pp. 858–859) distinguish three types of decision-making processes: (i) a consensus-based participative, (ii) a consultative, management-based, and (iii) a management-led decision-making process. Within the management-led decision-making process the initiative's management board makes all decisions on behalf of local citizens without explicitly taking their views into account. As this approach is irreconcilable with the underpinning value position and tends to be weak in respect to the two afore-mentioned conditions of successful initiatives, this option is not considered in the following. The consensus-based participative alternative suggests that all local citizens should be actively involved in decision-making procedures. Although this process organization tends to be, seen from the 'possible world', the ideal candidate, it is not only difficult to achieve in practice, it is also incompatible with the legislative demands of formal organizations in most countries[263]. Correspondingly, the only practically viable route in the present case is the consultative, management-based decision-making process in which the board makes decisions on behalf of local citizens, but takes, in contrast to the management-led alternative, not only the views of all members, but, following from the underpinning value position, of all interested stakeholders into account. This variation of the consultative decision-making process, discussed more thoroughly later and in chapter 11, is intertwined with the norms and rules governing the board creation process (e.g., election, nomination),

263. In fact, the rationale behind the idea to grant voting rights only to members is a response to the following dilemma: a majority of non-members could vote for an outcome, which is not in the interests of members but for which members are formally responsible. In Germany this legal demand is manifested in the adjudication 15.11.2006-1 U 636/05 of the Higher Regional Court Saarbrücken, see http://www.iww.de/quellenmaterial/id/25152, accessed May 25, 2015.

as well as the board members' profiles, i.e., the standpoint they are going to represent in the board (cf. Connelly 2011, pp. 940–941; Kirkpatrick 2007, p. 340). In respect to the former it is important to consider that not all local citizens have the same starting position:

> "participants enter the process from unequal positions of power: they have asymmetrical social positions, disparate access to economic resources, varying levels of knowledge of political protocols and procedures and different literacy rates" (Dasgupta and Beard 2007, p. 233).

The more powerful local citizens are those with higher socio-economic status and those who belong to the major ethnicity (Dekker et al. 2010, p. 610). Not only are those local citizens more likely to participate in initiatives, but, following from their power position, they become board members more frequently. This constitutes another instance of the aforementioned principal-agent challenge, which was already indicated as 'elite capture' in section 10.2. To overcome this inequality, opportunities for elites to advance vested interests need to be reduced by establishing institutional structures such as participatory budgeting[264] or elections, which ensure accountability, and/or by including conflict resolution intermediaries that monitor and enforce rules of conduct (cf. Classen et al. 2008, pp. 2412–2415; Dasgupta and Beard 2007, p. 233; Fritzen 2007, pp. 1370–1372; Lund and Saito-Jensen 2013, p. 110). Although these mechanisms can reduce the degree of control individuals can exercise to advance vested interests, they cannot completely eliminate the domination of local elites (Bowen 2009, p. 262; Dekker et al. 2010, p. 610; Fritzen 2007, p. 1370). However, this does not inevitably result in an elite capture, because not all local elites obtaining powerful positions within initiatives are inevitably corrupt (Dasgupta and Beard 2007, p. 244, see also the human behavior digression). Therefore, it is necessary, as forcefully argued by Dasgupta and Beard (2007, p. 244), to distinguish between elite control and elite capture—the former also called 'benevolent capture' (Mansuri and Rao 2004, p. 30). Thus, not only because eliminating the domination of elites is unrealistic, but also because a benevolent elite control provides benefits in terms of competencies and resources, it is argued that more attention should be paid to

> "what mechanisms may raise the likelihood that elites will play a constructive role in community development (rather than focusing mostly on means for avoiding elite control altogether, an objective that in many CDD [community-driven development] contexts will be unrealistic)" (Fritzen 2007, p. 1372).

A particularly important mechanism is the promotion of inclusiveness or board heterogeneity, which is considered to be a necessary condition for benevolent elite control to emerge (cf. Classen et al. 2008, p. 2413; Fritzen 2007, p. 1373; Platteau and Abraham 2002, pp. 124–125). However, heterogeneity is a multidimensional space, which in urban localities is spanned, inter alia, along socio-economic and ethnic characteristics. As Jun (2007, p. 116) points out in his analysis of the formation of Neighborhood Councils in Los Angeles (CA, USA), within socio-economic heterogeneous localities the formation of these community-driven Neighborhood Councils was faster than the formation of groups in ethnically diverse localities. In reference to the discussion of the first criterion of successful community-driven initiatives, it might thus be concluded that it is more difficult to achieve an initial agreement

264. Participatory budgeting is a mechanism that public sector organizations implemented to allow local citizens to decide about how and where resources, often only small portions of the total budget, should be spent (Wampler 2007, p. 21). Within the case of civil society organizations the usefulness of this technique is heavily restricted, because funds are usually granted for specific purposes.

within ethnically diverse groups. Nevertheless, bringing about such an agreement provides a huge potential, because multicultural initiatives tend to have larger and denser networks (Dekker et al. 2010, pp. 623–624), which, in turn, are critical success factors of community-driven development. This, on the one side, emphasizes the afore-mentioned importance of building capacity and self-confidence (cf. Classen et al. 2008, pp. 2412–2414), and on the other side, allows to derive an important qualification of the initial agreement's nature. The latter can be illustrated by the description of the value system that makes Vancouver, despite its ethnic diversity, a multicultural society that is characterized by a high degree of tolerance:

> "Vancouver views itself as a multicultural city where large and very diverse groups live in one of the most beautiful areas in the world. Conflicts are tolerated to the extent that they lead to agreeable solutions. And public opinion, and both conservative and progressive values, religions and ideologies, are accepted and respected as long as they contribute to the effective construction of the city" (Brunet-Jailly 2008, p. 382).

This quote suggests that it is not sufficient to recognize the shared commitment to the locality's development and to reach an initial agreement about valuable living conditions as well as negative effects of the status quo, it, in addition, points to the fact that such agreements are in a flux: they are continuously refined by transforming disagreements into constructive agreements, which, if translated into successfully carried out practical solutions, allow participants to reaffirm and reassure each other about their shared commitment (see section 5.5). The key driver of this virtuous circle is tolerance for and appreciation of diversity, because only if the disagreement is respected as antithesis to the initial agreement (i.e., the thesis), a refined agreement (i.e., the synthesis) can follow (see chapter 7). Correspondingly, "[s]hared tolerance for diversity is as important as shared commonalities" (Bradshaw 2013, p. 16). The two essential prerequisites of this dialectic process are (i) the learning receptivity of local citizens in general and the board members in particular (i.e., the appreciation of diversity) and (ii) the heterogeneity of opinions in the decision-making process to ensure disagreement (i.e., the existence of diversity). Whereas the former is discussed more thoroughly in the following, the latter has already been touched by suggesting that one of the central responsibilities of paid staff is to motivate local citizens to stand for elections, which is a key element to ensure the board's diversity. Another important element to guarantee the variety of perspectives is to nominate representatives of civil society organizations and of closely related localities as board members (see the interlocking core membership in table 10.5). This allows to incorporate even more distant perspectives, i.e., of indirectly affected stakeholders, into the initiative's decision-making process (cf. Bailey 2012, pp. 17, 33).

The second afore-mentioned institutional mechanism, i.e., the monitoring and enforcement of rules of conduct, is intended to ensure that the common good is not endangered by the 'double devolution'[265] (cf. Bailey 2012, p. 12; Hilder 2006, p. 239):

> "[O]ne reason that modern states have traditionally resisted decentralization and local self-government is that small jurisdictions can abuse their power, pursue narrow interests, exclude outsiders, express parochial identities and impose externalities on their neighbours contrary to the greater good" (Silver, Scott, and Kazepov 2010, p. 455).

A prominent example of such an excess is Orania, a town in the South African province Northern Cape, established on privately owned land. The 'local authorities' allow only white

265. For a critical reflection of 'double devolution' see also the contribution of Jordan (2007).

citizens who identify with the Afrikaan 'culture' to become residents of the locality by restricting who can buy shares, which, in turn, is a prerequisite to settle in Orania, of the company that owns the land. This rather extreme example emphasizes the importance of involving the public sector, inter alia, as protector of universal human rights (Platteau and Abraham 2002, pp. 124–125)—an un-decentralizable responsibility (cf. Foster 2011, p. 122, and section 10.2). Furthermore, engaging public sector representatives as board members provides additional benefits. In respect to the afore-mentioned decaying or overexploited[266] urban commons (see also pp. 68–70), the involvement of public sector officials might, for example, increase the understanding of the local administration's situation (cf. Frandsen, Paton, and Sakariassen 2011, p. 25) and facilitate the development of public sector-civil society partnerships. However, such collaborations transform governance systems into structures that resemble the ones of the afore-mentioned co-management arrangements (see section 10.2). Within such a newly emerging regime the initiative's character undergoes a fundamental change (cf. Silver, Scott, and Kazepov 2010, p. 461): it becomes a provider of, admittedly qualitatively different, public services. As this could, on the one side, further the withdrawal of the public sector (cf. Kelly, Caputo, and Jamieson 2005, p. 320; Poole 1997, p. 164), it is important that collaborative actions supplement—not supplant—public service provisioning (Foster 2011, p. 64). That is, these partnerships can be established for services that entail a 'shared responsibility'. This includes, for example, the preparedness for emergency events (Frandsen, Paton, and Sakariassen 2011, p. 23) or the governing of urban commons (Foster 2011, p. 71). In such cases, the technical, social, and economic support of the public sector (see also Dekker et al. 2010, p. 628; Foster 2011, pp. 62, 83) can fruitfully be complemented by the efforts of local citizens. However, on the other side, such partnerships might provide the breeding ground for inter-locality tensions:

> "The more that sublocal communities are able to manage their own commons, and provide for their own public goods, and pay for them directly, the less likely they are to be supportive of citywide services (and taxes) that provide those goods and services to other communities" (Foster 2011, p. 125).

To mitigate and alleviate this side-effect or risk, the board should, as indicated above, also involve representatives of spatially close and possibly affected neighboring localities. In other words, the board needs to be diverse in multiple dimensions: it has to involve a variety of local elites as well as representatives of other civil society organizations, of other localities, and of the public sector. Such a mixture of elected and nominated board members ensures that the initiative maintains its internal legitimacy and at the same time is strategically managed to protect the common good:

> "Formal structures and processes combining representative and participatory elements gave democratic legitimacy [to an initiative in a not-named northern English city], but were strategically managed in order to protect a general community good against the perils of 'too much democracy' " (Connelly 2011, p. 942).

Sustainability, the fifth criterion, is defined as the mid-/long-term survival of civil society organizations, i.e., it suggests that initiatives should be self-reliant and not solely depend on

266. Foster (2011, pp. 68–70) introduces the term 'overexploitation of urban commons' to refer to situations in which one group is excluded from using a common, because another group uses the same common for a different, irreconcilable purpose (i.e., rivalry of uses). For example, families and their children will not use a park for their recreational activities if this very park is frequently used for criminal activities such as drug dealing.

external support (T. Binns 2009a, p. 100). The key capacity of self-reliant initiatives is their ability to mobilize volunteers to carry out non-funded, self-organized projects. As indicated before, such projects are vital for initiatives to deal with donor organizations on equal terms. A prerequisite to be able to mobilize voluntary collective action is to stay in touch with local citizens, which is itself a labor-intensive process (Blakeley 2005, p. 161) that is further complicated by the demand to demonstrate external legitimacy through professionalism.

Before exploring the draft meanings and organizational options to mobilize voluntary action, a complementary strategy to sustain initiatives highlighted in the literature is discussed: social enterprises. Social enterprises are civil society organizations that carry out income generating projects, either alone or in collaboration with the public sector (Bailey 2012, p. 4). They differ from economic enterprises by managing commonly owned resources on behalf of local citizens and by ensuring that revenues are directed back into the locality, for example, through 'jointly managed community development funds' (Booyabancha and Mitlin 2012), and not, as in the other case, appropriated by extra-local investments entities (Kirkpatrick 2007, p. 335). Within the case studies summarized in table 10.3, two evolution paths of social enterprises can be identified: on the one side, there are the United We Can (Dale and Newman 2006) and the Unity Council (Kirkpatrick 2007) case studies, and on the other side, there is the Westway Development Trust (Bailey 2012) example. The former cases resemble conventional enterprises, which received donations or applied for loans respectively. Therefore, the following will focus on the, currently more interesting, second category. The Westway Development Trust can be characterized as a public sector-civil society partnership in which the public sector transferred three of the five property-rights (cf. Demsetz 1967; Schlager and Ostrom 1992, pp. 250–251; Sandberg 2007, p. 613, and footnote 225 in section 10.2) to the civil society association. Traditionally, only the right to use, access, and enter a public resource (usus) as well as the right to manage, change, and exclude (abusus) are transferred to initiatives [e.g., the community gardens (Silver, Scott, and Kazepov 2010)[267]]. However, in this case the initiative also holds the right to earn income from the resource (usus fructus). Consequently, the public sector retains only the right to alienate the resource (ius abutendi) as well as the right to enforce property-rights. It is not uncommon that the regulatory and policy-making power stays with the public sector (Foster 2011, p. 64), but this case is special as regards the usus fructus right. It allows to carry out income generating activities, which can be used either for cross-financing unfunded projects (cf. Bertotti et al. 2012, p. 173) or, by demonstrating external legitimacy to private capital organizations (Connelly 2011, p. 938; Dale and Newman 2006, p. 23), to acquire assets on behalf of local citizens [e.g., the Unity Council case study (Kirkpatrick 2007)]. There are obvious similarities between social enterprises and market-oriented initiatives, but the strategic direction differs substantially: whereas market-oriented organizations are mainly interested in increasing the economic-exchange value of owned property and in attracting private capital investment (see, for example, the discussion of 'Business Improvement Districts' in Foster 2011, pp. 104–108), social enterprises aim to increase the use value by renting out real estates, for example, to medical and senior centers, child care facilities, or bilingual public libraries (Kirkpatrick 2007, p. 336). In addition, they also try to promote local businesses and 'self-development' (Crowe 2006, p. 576) by declining requests of multi-national enterprises

267. It has to be noted that not all community gardens have the right to exclude certain activities. In fact, those gardens created using the 'guerilla gardening' technique have no official rights and, in addition, are constantly threatened by the danger of being evicted (see Bendt, Barthel, and Colding 2013; Colding et al. 2013; Rosol 2010; Silver, Scott, and Kazepov 2010, for detailed discussions).

as illustrated in the Unity Council case study (Kirkpatrick 2007, p. 353). Although fostering economic self-development is a lengthy process and creates less (directly) visible effects, it brings along several benefits in comparison to its counterparts such as industrial recruitment (Crowe 2006, p. 576): it requires less financial resources (e.g., tax reductions) and it is more reliable, because enterprises do not leave if financial support expires. A prominent example of this 'predator mentality' is Nokia. Its production facility in Bochum (Germany), subsidized with approximately 90 MM €, was moved to Jucu (Romania) in 2008 for financial reasons. Although the company was supported with more than 20 MM €, the facility was relocated to China at the end of 2012—again, for financial reasons[268]. Nevertheless, another feature of local economic development is, from the perspective of social enterprises and community-oriented initiatives, presently more important: local businesses tend to be more amenable to provide small amounts of financial support for civil society projects as indicated in, for example, the Resiliency Center case study (Kelly and Caputo 2006). In other words, this approach not only fosters local economic development, but it also strengthens civil society by making it less dependent on external support. Unfortunately, community-driven initiatives usually do not get access to physical assets for pursuing such a strategy.

This 'deficit' needs to be compensated, as Dale and Newman (2006, p. 19) point out, through the formation of social capital—both bridging and bonding capital. The former refers to, for example, public sector-civil society partnerships as illustrated by the partnership committee in the Community A case study (Kelly, Caputo, and Jamieson 2005). However, to avoid the danger of becoming merely a 'shadow of the local administration' (cf. Blakeley 2005, p. 160), initiatives need to utilize their bonding capital to carry out projects based on voluntary work by local citizens. As figure 10.9 indicates, although the number of adults, that is, persons older than 15 years, volunteering for various civil society organizations in selected EU countries varies considerably, in average almost a third of the adult population volunteers. In England, admittedly a country with a rate above the average, volunteers spend in average 110.5 hours p.a. (cf. Williams 2004, p. 731).

Although hours p.a. might be lower in other countries, the numbers in figure 10.9 substantiate, at least partially, the assumed cooperative behavior indicated in the excursion that preceded the current discussion. Furthermore, they are relatively promising and mitigate the claim that civil society organizations are fundamentally endangered by the free rider or collective action problem (Wunsch 2013, p. 223).

However, there are other contingently related obstacles that need to be overcome to facilitate participation and voluntarism (cf. Enengel et al. 2011, pp. 1259, 1262; Geoghegan and Powell 2006, p. 852; Goven et al. 2012, pp. 159–160, 162; Plummer and FitzGibbon 2006, p. 58; Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, pp. 240–241, 246–247; Schultz, Duit, and Folke 2011, p. 669; Stenseke 2009, p. 220; Williams 2004, pp. 731, 736–737; A. Williamson 2009, pp. 301–302): (i) pre-decided plans or outcomes and the associated unwillingness of the public sector to devolve decision-making power—a key determinant to motivate participation; (ii) the inherent tension between the length an opportunity window is open and the time required to roll out participatory approaches; (iii) the chronic lack of resources required to organize collective action and develop local capacities; (iv) the danger that an initial agreement might not be reached due to the plurality of values and that individuals follow only their vested interests; (v) the resistance of local citizens to participate because negative experiences have destroyed trust; (vi) the disinterest of local citizens, who perceive

268. See `http://spon.de/adtte`, accessed May 25, 2015 (German).

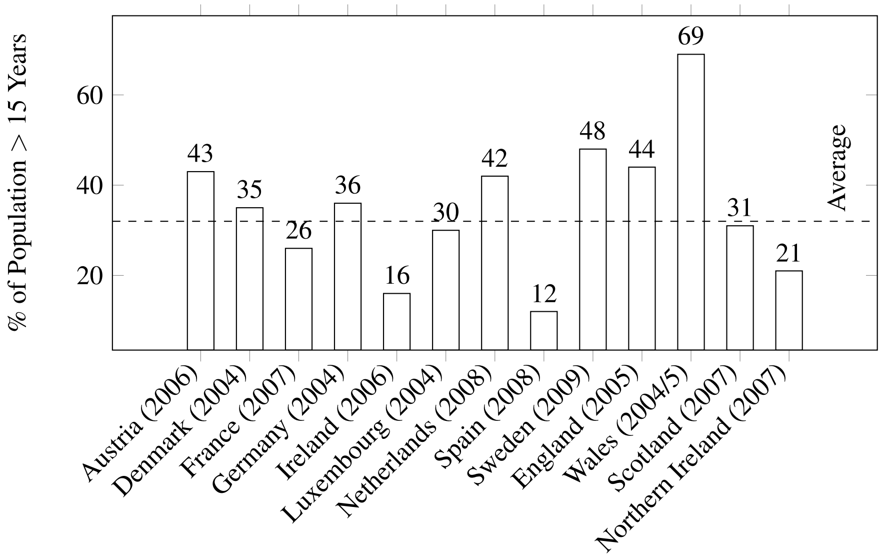

Figure 10.9: Percentage of Adult Population of Selected EU Countries Volunteering, data source: European Commission (2010, pp. 60–63) (The year in brackets indicates in which year the respective survey was carried out)

particular issues as technical problems for which other actors are responsible[269]; (vii) the involved opportunity and transaction costs; and (viii) the treatment of volunteers as periphery actors in a professionalized civil society organization. Whereas (i) requires an, as indicated above, already ongoing shift of thinking of public officials, resolutions to issues (iii) and (iv) as well as (ii) and (vi) are discussed more thoroughly in the possibility assessment and synthesizing design of the second and third intervention entry point respectively. However, before the following explores draft meanings and organizational options to overcome the two latter obstacles, it has to be emphasized that it is important to continuously monitor the effort-benefit-relation as perceived by local citizens in all these dimensions to identify and improve those facets that do not, from the perspective of potential volunteers, pay off (cf. Enengel et al. 2011, p. 1265). Institutionalizing this form of learning through, for example, regular surveys and informal chats as indicated in the afore-mentioned case studies is critical for any initiative to sustain participation, mobilize new volunteers, and help to avoid that individuals make bad experiences and lose trust in participatory approaches.

In respect to the first of the two presently relevant challenges, that is, the existence of transactions and opportunity costs, the initiative itself as well as the afore-mentioned time banks (Seyfang 2004) are mechanisms that can address this problem at least partially. Whereas the initiative constitutes, as indicated in the Resiliency Center case study (Kelly and Caputo 2006), a point of contact that lowers transaction costs for local citizens, time banks are suitable means to lower opportunity costs. They not only have the ability to bridge the gap between the third and fourth sector as well as to integrate socially excluded individuals (see section 10.2), but they also incentivize volunteering by reducing those opportunity costs (Williams 2004, pp. 736–737) that emerge because there is no directly visible compensation for invested (private) time. As this imbalance is considered to be one of the central factors

269. For example, Enengel et al. (2011, p. 1265) point out, based on their interviews with several participants who dropped out of the investigated landscape development initiatives, that some local citizens are actively engaged only as long as they perceive certain outcomes as personally endangering and that they stop participating if they have prevented or changed the course of action. As this behavior indicates a lack of solidarity, there is a considerable overlap between this and issue (iv).

that discourage individuals to volunteer (cf. Goven et al. 2012, p. 162; Huang et al. 2010, p. 363; Stenseke 2009, p. 220), the introduction of time credits as direct, personal rewards has the potential to reduce this participation barrier. However, besides establishing such a local 'currency' to increase participation, there are other factors that can serve as a lever to motivate individuals to participate in collective action (cf. Andersson and Ostrom 2008, p. 81; Enengel et al. 2011, pp. 1258–1259, 1265; Höpner, Frick, and Buchecker 2008, pp. 616–618): the perceived risk of those external aspects that open up an opportunity window; the sense of social belonging and attachment to the place; personal reasons and beliefs about 'the right things to do'; the wish to influence and to change something in the locality; prestige, contact to fellow local citizens, the feeling of being appreciated, and other social incentives; the willingness to increase the legitimacy and acceptance of decisions from an individual as well as from a process perspective; the desire to widen one's knowledge and capacities; and the enhancement of one's self-confidence. As these aspects are closely related to the second above-mentioned challenge, the corresponding techniques are treated together.

The second obstacle is a direct consequence of the need to demonstrate external legitimacy by doing things professionally. It is a highly critical problem, because treating volunteers as periphery actors leads to dissatisfaction and disillusion, which, in turn, endangers initiatives' internal legitimacy. Traditionally, mechanisms such as, for example, meetings, public hearings, answer sessions, or workshops (cf. Frandsen, Paton, and Sakariassen 2011, p. 24; Kirkpatrick 2007, p. 341) are employed to engage local citizens and create dialogues within localities. An important success factor of these efforts is the type of language that is used (cf. Bhattacharyya 1995, pp. 63–64; Dasgupta and Beard 2007, p. 233; Enengel et al. 2011, p. 1259; Jun 2007, p. 116; Silver, Scott, and Kazepov 2010, pp. 455–456, 469): a too formal communication style excludes many socially marginalized groups (e.g., less educated, long-term unemployed, senior citizens, and immigrants). However, even if the consulting techniques are embellished more inclusionary, they still need to be complemented by informal gatherings and conversations (cf. Bailey 2012, pp. 17–18; Bertotti et al. 2012, p. 176; Connelly 2011, p. 939); not only to maintain internal legitimacy (cf. Blakeley 2005, p. 155; Bowen 2009, pp. 261–262), but also to engage local citizens in voluntary work:

> "[P]eople cannot be coerced into participating but must be encouraged and supported over a long period of time. Information is crucial to this process, but, ultimately, existing networks must be used and individuals need to be encouraged into roles and responsibilities which they initially feel ill-equipped to perform. Word of mouth, talking with people in their own homes, persuading and cajoling, extolling the personal and social benefits of involvement may be more effective than more traditional methods of meetings and leaflet drops. The experience seems to be that identifying motivated individuals with their own networks of friends, relations and contacts within the locality works best, and then giving them the support to develop their confidence and capabilities in the tasks they perform" (Peel and Bailey 2003, pp. 50–51).

This quote carves out another factor implied in the numbers of figure 10.9, i.e., that there is an untapped potential in localities. In other words, an initiative can increase its collective action capacity by mobilizing those local citizens that feel 'ill-equipped' to actively participate. Such endeavors involve, firstly, the identification of potential candidates in informal situations, and secondly, the provision of training to overcome educational 'deficits' and to enhance candidates' self-confidence. The skills that respective instructional programs should offer can be derived from those abilities that characterize individuals literature refers to as 'participative residents' (Matarrita-Cascante and Luloff 2008, p. 56), complemented by those of 'social entrepreneurs':

> A social entrepreneur "needs the skills of the entrepreneur to identify opportunities and ways of exploiting them, they need a clear vision about the social, economic and environmental objectives of the organisation, and an ability to motivate staff, the directors and the wider community in order to sustain the organisation and to ensure it prospers. The style of working can often be seen as pragmatic, opportunistic and relying heavily on personal contacts and local networks but with an underlying strategic vision as to where the organisation is going" (Bailey 2012, pp. 14–15).

In addition to its instrumental relevance for collective action, such capacity building efforts are important for civil society organizations to act as representatives of their respective constituencies as well as to ensure their long-term survival (T. Binns 2009a, p. 100). The latter interplay is particularly relevant in urban localities where local citizens are, in contrast to their rural counterparts, relatively mobile, e.g., they might move for work reasons, and, especially the new economy workers, mainly interested in global rather than local issues (cf. Gibbs and Krueger 2012, pp. 375–376). An additional factor that underlines the significance of training local citizens, is the tendency that successful activists and, by implication, their skills often get lost if these individuals leave civil society organizations to occupy leadership positions in the public sector (McQuarrie 2013, p. 79) as, for example, indicated in the Community A case study (Kelly, Caputo, and Jamieson 2005). Although such a change of position might improve the relationship with local authorities, it nevertheless reduces the contact-based, inter-organizational networks that are important for initiatives (Purdue, Diani, and Lindsay 2004, pp. 285–286). However, capacity building is not only a necessity to replace leaving personnel, it is even more important to offset the influence exerted by founding activists. They, even if not occupying any positions, often govern initiatives from the sidelines (cf. Bailey 2012, p. 30; English and Peters 2011, p. 164), which, in turn, jeopardizes the initiative's claim to represent the locality. Correspondingly, the above mentioned techniques to ensure the initiative's internal legitimacy need to be complemented by mechanisms that mitigate these and comparable issues.

The final characteristic of successful community-driven initiatives is their ability to learn from experience, i.e., to reflect about the initiative's successes and failures to strengthen its effectiveness (cf. Babajanian 2005, p. 451; T. Binns 2009b, p. 36, and the discussion of the public learning phase in table 10.4). Furthermore, the ability to learn is also required to cope with external pressures such as the need to increase external legitimacy (Connelly 2011, p. 938), to avoid the loss of competencies and networks caused by member turnover (T. Binns 2009a, p. 100; Kelly, Caputo, and Jamieson 2005, p. 318), and to counterbalance the negative effects of becoming too professionalized, i.e., to scare off volunteers by changing the qualitative nature of volunteering (Geoghegan and Powell 2006, p. 852). Laverack and Thangphet (2009, pp. 175–179), based on an earlier work of the first author, provide a comprehensive framework that structures this conglomeration of important issues more clearly (see also Nathan et al. 2010, pp. 2–3). They suggest that successful community-driven initiatives need to develop capacities in nine domains. This includes the abilities to (i) foster participation of local citizens; (ii) develop new and strengthen existing leadership; (iii) devise effective organizational structures in which local citizens can jointly address local issues;

(iv) mobilize local resources to carry out projects that meet their local needs (cf. Kelly and Caputo 2006, p. 236); (v) establish and manage inter-organizational networks to supplement lacking skills; (vi) identify problems, develop solutions, and organize collective action; (vii) set up and manage transient structures as well as projects effectively; (viii) perform analyses and critical assessments of those causes that underpin existing inequalities; and (ix) deal with donor organizations and other outside agents to mobilize extra-local resources. Some of these competencies require special training such as the communicative abilities to adequately integrated people with special needs and challenges as discussed in the next intervention entry point's possibility assessment and synthesizing design. Although it is often difficult to develop this expertise without external support, efforts in this direction are seldom funded by external actors; partially because they are a prerequisite to apply for grants[270], and partially because achievements are not sufficiently measureable. This latter aspect procures that endeavors fall out of the afore-mentioned palettes of funding opportunities, which are, in general, organized around quantifiable criteria. A possible solution, drawing on Eriksson and Forsberg (2010, p. 324), might be to provide required training services via organizations of popular, non-formal, state subsidized education, i.e., adult education classes and study associations. These organizations do not only have economies of scale, but they are also able to promote network building between initiatives within and across localities (see also Townsend 2008, p. 88). This facilitating role of the public sector is also recognized within the SHD conceptualization (see section 5.5) and the underpinning value position (see section 10.2):

> "The people have to be seen [...] as being actively involved—given the opportunity—in shaping their own destiny, and not just as passive recipients of the fruits of cunning development programs. The state and the society have extensive roles in strengthening and safeguarding human capabilities. This is a supporting role, rather than one of ready-made delivery" (Sen 1999, p. 53).

Within this call, Sen not only demands that people themselves have to be active in changing their situation, he also emphasizes the supportive role or character of the public sector: instead of paternalistically imposing what is expected to be in people's interest, the public sector's primary function should be the empowerment of local citizens, that is, it has to enable them to 'shape their own destiny' through the change of those social structures that restrict their freedom (see also Laverack and Thangphet 2009, p. 183). As indicated in section 5.5, this is a collective effort, which, in turn, suggests that the envisioned initiatives have to go beyond just identifying service gaps; instead, they also need to engage in the change of what North (1990, p. 3) termed the 'rules of the game' (see also Ostrom 2007, pp. 44–46). Even though such endeavors are challenging, successful community-driven initiatives are those that take the difficult path (cf. Wunsch 2013, p. 225). Within the discussion of the third intervention entry point an example in regard to ecological systems is presented. However, before turning to this facet the next elaboration focuses on the contribution of community-driven development efforts to community cohesion and social inclusion.

270. This includes, for example, the ability to campaign and to write formal proposals. However, in later stages of an initiative's evolution, discussed more thoroughly in the possibility assessment and synthesizing design of the third identified intervention entry point, these more formal avenues are complemented—often even replaced—by more undemocratic, informal communication channels that connect civil society organizations and extra-local actors (Muir 2011, pp. 971–972).

The Possibility of Community Cohesion

"It is hardly possible to overrate the value [. . .] of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar [. . .]. Such communication has always been, and is peculiarly in the present age, one of the primary sources of progress."

Mill ([1848] 1909, p. 581)

Riots such as the ones in the United Kingdom (UK) (2001 and 2011) as well as those in French Banlieus (2005) are the prime examples to illustrate the tension that socially excluded communities have built up, that is, they demonstrate the consequences a lack of community cohesion, which manifests itself in segregated cultural subsystems, brings along. Furthermore, as migration is expected to increase in the coming decades, other societies, especially those in 'developed' countries, will have to face similar challenges. This, in turn, endangers already made HD achievements (see sections 5.5 and 10.2). Correspondingly, a holistic SHD concept has to incorporate the issues of community incoherence and social exclusion as central elements. Within the sketched 'possible world' it is envisioned that the initiative can, in its function as an interaction platform on which local citizens organize collective action, contribute, at least partially, to the resolution of these challenges. Therefore, what is at stake in this second possibility assessment and synthesizing design is the claim that the initiative exhibits those features that are considered to be important for mitigating the mechanisms that cause community incoherence and social exclusion as well as avoids those that reinforce these mechanisms. In other words, the following elaboration will, as already indicated in section 10.2, extend or refine the preceding discussion and therefore does not make use of the data extraction form outlined in section 8.2; instead, fragments of evidence are extracted, collated, and reported to specify the key components of the initiative's inner processes.

Figure 10.10: Tag Cloud of Background Search 'Community Cohesion' (The tag cloud was created using `http://www.wordle.net/`, accessed May 25, 2015)

The structure of the remainder is again organized around the process outlined in section 8.2. Figure 10.10 depicts, similar to the presentation in the preceding section, some of the keywords that were extracted from the documents screened in the background search, which used the term 'community cohesion' as initial keyword. Out of this set a query string comprising three categories was created: the intervention, that is, an initiative$^{\text{synonyms}}$ comparable to the one described in the preceding section, contributes to the emergence, as indicated in section 10.2 and the introductory quote, of a more cohesive and socially inclusive locality (i.e., the outcome) by fostering interaction and contact between local citizens (i.e., the initiative's inner processes). In addition, the initiative facilitates, by virtue of its nature as a platform for organizing collective action, the creation of a shared identity, which, if appropriately aligned, manifests itself in the development of social capital across cultural subsystems. The latter is, as indicated in section 5.5, vital to develop a global identity, which, in turn, is an essential element in the endeavor to make progress in terms of SHD. In short, the query string associates the initiative and some of the features of its inner working with those outcomes that are desirable from a SHD perspective. Executing this query string against the databases specified in section 8.2 yielded an initial set of 326 documents (see figure 10.11). The 28 documents that passed the removal of 90 duplicates and the exclusion of, in regard to the initiative described in the preceding section, 208 unrelated documents (see annex A.2) were subjected to a more detailed screening.

However, before diving into the discussion of the extracted fragments of evidence the understanding of the terms 'community cohesion' and 'social inclusion' are explicated more thoroughly—by demarcating them from closely related terms—to locate the following synthesis more clearly in the encompassing, overarching dialogue.

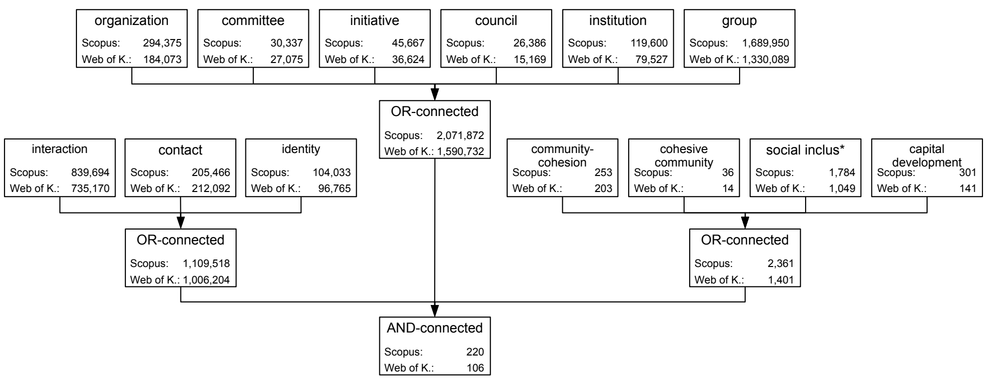

Figure 10.11: 'Community Cohesion' Query String [The results were obtained on October 13, 2013, using the following query constraints: English journal articles published between 2004 and 2013]

Although the term 'community cohesion' is used as an umbrella term to bundle strategies that cover a broad range of issues (Bannister and O'Sullivan 2013, p. 100), its original meaning was much narrower. As indicated in section 10.2, initially the concept evolved to address the problems accompanying ethnic and/or religious (hereinafter: cultural) 'separatism' (Dovidio, Gaertner, and Saguy 2007, p. 306) or the 'pluralism of monocultures' (Sen 2006, pp. 28–29). At the surface value separated localities might exhibit the characteristics of harmonious places to live in. This is, unfortunately, only true if, and only if, one stays on the 'right side of the town' (see section 10.2). For example, Clayton, who studies the everyday life of teenagers with a migratory background in Leicester (UK), a city that earned a reputation as interethnic role model[271], makes, inter alia, the following observation:

> "As with the other young people in this group Adam's [one of the observed participants] mobility across the neighbourhoods of the city was noticeably limited. This was based upon a combination of a lack of need to visit other areas beyond his own, a lack of ability and oppor-

271. Clayton (2009, p. 485) describes the city as follows: "Leicester has in recent decades established itself as a model of harmonious inter-ethnic relations. This is largely based on the relative absence of visible inter-ethnic tension and formal racist activity, despite being predicted to become the first non-white majority city in the UK [footnote omitted]".

> tunity to do so in form of economic and cultural capital, fear of neighbouring 'white' territories and anxieties around racial difference. Given such constraints it is clear why for some young people the neighbourhood remains a central aspect of their identity and why some areas and opportunities for inter-cultural engagement remain beyond their reach" (Clayton 2009, p. 491).

This tends to be in sharp contrast to the freedom of movement—one of the recognized universal human rights (see footnote 255). Nevertheless, such an undesirable state is maintained to ensure, what can, in reference to the human need literature briefly mentioned in section 10.2, be called the need for protection. For example, the culturally independent need matrix of Max-Neef (1991, p. 33) states that the need for protection comprises individual (e.g., avoiding physical and mental pain) as well as collective aspects (e.g., order, stability, and security) (see also ASTM et al. 2007, pp. 51–53; Maslow 1981, pp. 62–87; Max-Neef 1992, pp. 204–211). This is closely related to the sense of belonging, another basic human need (Bernstein et al. 2010, p. 999), which is in the above case confined to specific ethnic territories, i.e., spatial areas in which only particular 'types' of individuals feel protected[272]. The goal of endeavors summarized under the heading of community cohesion is to ensure that local citizens do not only have this sense of belonging in regard to their neighborhood, but, irrespective of their cultural background, in regard to the whole city in which they live. However, nowadays the meaning is much broader; in fact, it has been extended to refer to a spatial area, which provides a secure living space for individuals in all their diversity. Civil behavior has been recognized as the core component to achieve such a peaceful living together:

> "[C]ivility is a code of *superficial* behaviours necessary to enable diverse populations to coexist in harmony, yet the enactment of civility depends upon an awareness of others informed by more meaningful social interaction. These interactions need to be underpinned by recognition of the equality of all citizens. In the absence of these conditions, incivility may take hold. Whether through repeated disregard or institutionalised inequality of status, social groups foster negative feelings toward one another that may develop into hostility and conflict" (Bannister and O'Sullivan 2013, p. 95).

This reframed conceptualization extends the range of issues to, for example, the relationship between different socio-economic groups (e.g., citizens of the Fourth World), and the social inclusion of people with special needs and challenges. Such a broadening is plausible because, as illustrated more thoroughly below, the strategies to address the variety of challenges have a common core. Therefore, the discussion following the clarification will mainly focus on the creation of a multicultural locality; where necessary and appropriate, the argument is extended to cover additional, more specific facets. Further pursuing the clarificatory vein, the discourse of building multicultural societies is characterized by two opposing camps (cf. Allport 1954, pp. 238–240; Dovidio, Gaertner, and Saguy 2007, pp. 306): on the one side, there are the proponents of the assimilation strategy, who demand that minorities adapt to the values and norms laid out by the majority (cf. Clayton 2009, p. 494); on the other side, there are integrationists who advocate a process of mutual adjustment (cf. Habermas 1998, pp. 143–146, 203–236, for a detailed argument). The latter is often understood as a middle way between the 'plurality of monocultures' and a single monoculture, because it implies bidirectional assimilation, which, in turn, indicates that the differentiation is not as

272. As Allport (1954, p. 269) points out, such a "[s]egregation [manifested in ethnic territories] markedly enhances the visibility of a group; it makes it seem larger and more menacing than it is".

clear cut as suggested (cf. Habermas 1998, p. 146; Mason 2010, pp. 860–861). Despite this overlap the dichotomic view is, due to its usage in literature and practice, kept up within the following. Research indicates that individuals belonging to the majority tend to favor the assimilation strategy, whereas minorities endorse the integrative variant (cf. Dovidio, Gaertner, and Saguy 2007, pp. 307, 312; Gaertner and Dovidio 2000, pp. 163, 166; Zagefka et al. 2012, p. 658). However, this is not a law of the Medes and Persians (cf. Bernstein et al. 2010, p. 1006). Nevertheless, in respect to the value position outlined in section 10.2 and implied by the introductory quote of Mill, there are normative as well as practical arguments why the integrative strategy tends to be preferable: from a normative perspective it is expected that there are different, equally valid positions that cannot be reasonably rejected, which renders the assumption that one cultural position dominates another in each and every aspect unreasonable; from a more practical perspective, integration is not only a driver of progress, but cultural diversity is also a key component of an adaptive and flexible, that is, more resilient locality (cf. Dale and Newman 2006, p. 21; Ostrom 2012, pp. 129–130). A necessary, but in itself not sufficient condition for pursuing the integration strategy, is the existence of tolerance, which can be defined as the "neutral (passive) midpoint between prejudiced attitudes on the one hand, and positive attitudes entailing a willingness to proactively include immigrant outgroups on the other" (Phelps et al. 2011, p. 404). Although merely a passive attitude, tolerance is the first step on a way toward an inclusive locality; however, to be truly inclusive a more active stance of local citizens is urgently needed:

> "Turning negative identities into positive ones requires challenging stereotypes and structural biases through group mobilization, dialogue, mutual learning, negotiations, accommodation, structural reform, and so on. The dynamic, without *a priori* and fixed identities, will consist in and develop through political struggle, participation, interaction and adjustments, and so clearly involves collective and not just individual agency [emphasis in the original]" (Modood 2008, p. 552).

Antisocial behavior, another closely related term, has been added more recently to the community cohesion agenda (Bannister and O'Sullivan 2013, p. 104, and section 5.5). Although it is recognized that antisocial behavior and poor cohesiveness in the boarder sense are correlated[273] (Taylor, Twigg, and Mohan 2010, p. 71), both issues rest on substantially different premises (Bannister and O'Sullivan 2013, p. 103): whereas cohesion highlights the equality of all citizens, the latter is based on the valuation of the behavior of particular individuals as violating accepted social norms. However, the core component of both are social norms. A particular useful concept to frame this discussion more clearly is the social capital framework commonly associated with Putnam (1993, 2000)[274]. Putnam (1993, p. 167) defines social capital as the "features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions [...]". The more recent and most prominent definition entails essentially the same elements, but further distinguishes it from other capital types (see also section 10.2):

> "Whereas physical capital refers to physical objects and human capital

273. In fact, it is argued that antisocial behavior (ASB) "contributes to poor social cohesion, because it can make people afraid to go out or visit certain places, and because the public resentment caused by the experience of ASB can lead some people to make scapegoats of social groups from which the perpetrators of ASB are perceived to be drawn" (Bannister and O'Sullivan 2013, p. 100).

274. Although the concept of social capital was developed much earlier, see for example Bourdieu (1983, pp. 190–195) or Coleman (1988), the normative re-interpretation of Putnam (1993, 2000) tends to be the most commonly used interpretation nowadays (Bridger and Alter 2006, p. 7).

> to properties of individuals, social capital refers to connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them. In that sense, social capital is closely related to what some have called 'civic virtue'. The difference is that 'social capital' calls attention to the fact that civic virtue is most powerful when embedded in a sense network of reciprocal social relations. A society of many virtuous but isolated individuals is not necessarily rich in social capital" (Putnam 2000, p. 19).

In other words, social capital is used to describe the networks that are constituted by mutually trusting individuals, who share formal as well as informal rules of behavior and a sense of belonging and commitment to the group of individuals comprised by the network (see also Beard and Dasgupta 2006, pp. 1454–1455; Bertotti et al. 2012, pp. 170–172; Bowen 2009, pp. 246–247; Kay 2006, p. 163; Muir 2011, p. 962). The identification with shared values is important for individuals to categorize themselves and others as being part of the so-called ingroup, i.e., the group of individuals that shares norms, which, in turn, also defines the outgroup, that is, the group of all 'non-compliant' individuals. Besides those chosen and mutable aspects, individuals also use more fundamental, essentialist features for social categorization: essentialist features are those aspects that are "viewed as having an underlying structure that is immutable, inborn, deeply rooted, natural, discrete, and informative about people" (Bernstein et al. 2010, p. 1001). Although it depends on the context which of the various inborn, socialized, and chosen identities individuals use for social categorization (see Dovidio, Gaertner, and Saguy 2007, p. 298, and section 10.2), the inclusion or exclusion by a, from the individual's perspective, perceived ingroup affects the well-being of the individual in a positive or negative way respectively. This effect is even accelerated if the ingroup is based on essentialist features:

> "In two studies, we [Bernstein et al.] found support for the hypothesis that the effect of social exclusion and inclusion on individuals' basic needs is moderated by the ingroup and outgroup relationship between the interacting parties, but only for groups considered essentialized. Inclusion is more fulfilling to one's basic belongingness needs when it comes from an ingroup as opposed to an outgroup member, and exclusion by an ingroup feels worse than exclusion by an outgroup" (Bernstein et al. 2010, p. 1005).

Given that ethnic and/or religious identities tend to be the most prominent criteria involved in the emergence of community incoherence, the connections within ethnic or religious groups are referred to as bonding and those across these groups as bridging social capital (cf. Bertotti et al. 2012, pp. 170–172; Bowen 2009, pp. 246–247; Muir 2011, p. 962; Putnam 2000, pp. 22–24)[275]. Based on this terminological specification, the lack of community cohesion can be construed as a situation where the strength of the bonding social capital inhibits the development of bridging social capital (cf. Bertotti et al. 2012, pp. 171–172, 177–178; Kay 2006, pp. 170–171). Combined with the inward direction of benefits emerging from interactions, such an overbonding can, depending on the size and the group's status, measured in political, economic, and social power (Dovidio, Gaertner, and Saguy 2007, p.

275. A third type of social capital frequently mentioned in literature is linking social capital. It refers to the relationship of individuals who are located on different levels of the social hierarchy (cf. Bertotti et al. 2012, pp. 170–172; Bowen 2009, pp. 246–247; Muir 2011, p. 962; Kay 2006, pp. 164–167). In contrast to the discussion of the preceding intervention entry point, where the creation of informal communication channels through linking social capital supplemented or even supplanted, for example, democratic campaigning to raise issues (see Muir 2011, p. 969), this capital type is presently less relevant.

304), create serious inequalities and racial tensions (Bertotti et al. 2012, p. 177). In very extreme cases unbalanced bonding and bridging social capital might even lead to a 'hyperbonding', i.e., a situation in which an individual's identity completely blends into a particular group identity. Such a development is often accompanied by antisocial behavior (Clopton and Finch 2011, p. 72), because connections to other groups are completely lost. Although social capital is mainly created in and through local citizens' interactions, these two downsides, i.e., overbonding and hyperbonding, emphasize the importance of the public sector within its formation (Muir 2011, p. 961). This is, for example, recognized in the establishment of the initiative's board by the recommendation to nominate public sector officials as advocates of the common good. In addition, it has been suggested to create the initiative at a level of the social hierarchy that comprises more than one cultural community (see section 10.1) to avoid the challenges evolving from too homogeneous civil society organizations. The accompanying adverse effects of the latter can be anticipated from those summarized in the following quote. It is the conclusion drawn from the study of 5 panels of freshmen (N = 2,132) at the University of California (Los Angeles, CA, USA) who were interviewed about their campus activities and expectations in joining the larger campus society:

> "[A]lthough the decision to join ethnic organizations was associated with a positive sense of belonging to the larger university, there was no indication that the experiences in these ethnically oriented student organizations increased the students' sense of common identity with members of other groups or their sense of belonging to the wider university community. Furthermore, [...] among minority students the evidence suggested that membership in ethnically oriented student organizations actually *increased* the perception that ethnic groups are locked into zero-sum competition with one another and the feeling of victimization by virtue of one's ethnicity [emphasis in the original]" (Sidanius et al. 2004, p. 106).

Even though there are substantial differences between a campus and a locality (e.g., the fostered contact between cultural diverse students within course collaborations), there are similarities that can be exploited to frame the following discussion more clearly. Particularly important in this regard are (i) the cultural diversity of a campus and that of a locality and (ii) the fact that not all individuals participate in student or civil society organizations. Therefore, the cohesiveness of cultural diverse individuals within a particular initiative needs to be distinguished from, what in reference to Clayton (2009, pp. 483–484) might be called, the cohesiveness of the 'everyday', i.e., the normalization of multiculturalism in the temporal and spatial dynamics of interaction patterns to create a safe environment build upon anti-essentialism (cf. Modood 2008, p. 550). Within the 'possible world' the community-driven SHD initiative is one of the keys to create the cohesiveness of the everyday, because it carries out projects that enhance the civility within the locality. However, this presupposes that it is possible to create cohesiveness within the heterogeneous board. In respect to the design of the reference architecture for the decision-making processes of the initiative in the next chapter, the organizational structures and processes ensuring the cohesiveness of the board are the main focus of the following. In other words, the elaboration concentrates on identifying and refining these draft meanings and organizational options extracted in the preceding section that facilitate the creation of cohesiveness within the initiative. Nevertheless, to indicate that the cohesiveness of the everyday is also possible, the report of the synthesized fragments of evidence is followed by some illustrative examples of projects that have been and can be carried out to contribute to the realization of the ambitious goal of a cohesive locality.

Starting from the premise that the focal locality can be characterized by a lack of civility or community cohesion the following insight, drawn from the investigation[276] of several civil society organizations in Northern Ireland, is a first indicator that allows to locate the envisioned initiative more clearly in the overall context:

> "As a result of the high levels of residential segregation [...] area-based community associations almost invariably reflect the ethno-sectarian make-up of the area in which they are based; they have few opportunities to develop internal heterogeneity in respect to community affiliation and may be constrained in the number and types of networks that they participate in. In contrast, associations that address social problems that in principle have an impact on people whatever their communal attribution are in principle more open to internal heterogeneity of community affiliation [...]. In Northern Ireland these associations are to be found predominantly in the health and welfare fields [...]" (Acheson 2011, pp. 211–212).

In other words, more heterogeneous initiatives, such as the one envisioned for the 'possible world', tend to be created in response to particular kinds of problems (e.g., health) or to address the needs of certain categories of persons (e.g., senior citizens) (p. 212). Whereas the latter is excluded from the following discussion, because it facilitates and strengthens, as indicated above, the formation of groups, which, in turn, contributes to the lack of community cohesion, the former reason corresponds closely to the afore-mentioned initiative window, that is, the event that allows to reach a cross-cultural, initial agreement about negative effects on something commonly valued, which, if built upon, can function as foundation for the creation of a civil society organization. However, Acheson suggests that within the investigated initiatives the reached initial agreement is highly fragile, because only

> "[b]y deliberately avoiding the [Catholic-Protestant] issue, organisations were opening up a civic space in which people from widely differing political and religious backgrounds could meet and share concerns" (p. 213).

Not only did respondents and interview participants express considerable discomfort with questions about how the difficult Catholic-Protestant relationship was handled within the initiative, but they also stated that they avoid addressing this issue[277] by, using the above terminology of Dovidio, Gaertner, and Saguy (2007, p. 298), deliberately invoking another social identity to create bonding social capital:

> "The evidence provided by the participants in the two senior citizens' forums studied suggests that for those involved there is a powerful unspoken assumption that the identity of 'senior citizen' will remain a source of solidarity provided that ethno-sectarian identities are kept at bay [...]. These hints point to normative boundaries that echo those found in Northern Ireland in that they may reflect a concern to contain the in-group identities within boundaries set by more fundamental identities that participants do not wish to have challenged" (Acheson 2011, pp. 214–216).

Swan (2013) in his Artspace[278] case study makes a similar observation. Artspace is a

276. Acheson (2011) performed a two-stage investigation: firstly, a postal questionnaire was sent out to several hundred civil society organizations in Northern Ireland (N = 535; response rate = 67%), a highly fragmented region in the UK; and secondly, he conducted semi-structured interviews with the leaders (N = 38) of different, purposively selected civil society organizations in six localities.

277. As indicated in the discussion of the first intervention entry point, this tactic also impinges on the pursuable funding strategy (p. 213).

278. Artspace is a pseudonym that is used to ensure the anonymity of the real civil society organization in a locality in North West England (UK) where the case study was carried out.

civil society organization that offers different courses such as writing, gardening, etc., to improve the health and well-being of people with special needs and challenges. One of the interviewees stated that a key success factor of this initiative is that

> "classes fostered positive self-image, illness and disability as 'not the main descriptor' of people being there, and it was felt that there was no pressure on anyone to explain the reasons for their attendance: ...the important thing was focusing in writing rather than being a person with depressions [...] so you are a writer, irrespective of what else is going on ...(Sandra (participant))" (Swan 2013, p. 21).

However, the avoidance to engage in confrontational issues and differences in understanding does not help to overcome estrangement (Nagda 2006, p. 556) and it hinders that created social capital 'spills-over' (Acheson 2011, p. 216) to the everyday context, especially if 'essentialized groups' are involved. In other words, there are identities that are not able to precede essentialized identities except within purposively created contexts, within which the essentialism is deliberately and actively avoided. Although this approach is useful in certain circumstances, more thoroughly discussed later, it is presently not an option. Therefore, the initiative not only requires a heterogeneous board, but it also needs to create a way to establish a new identity, similar to the vision of Vancouver outlined above, that is able to cope with the cultural diversity of the locality. This demand resembles what in the 'common ingroup identity model' (Gaertner et al. 1993) is called a 'dual identity': "With a dual identity group distinctiveness is maintained while a positive connection to the other group is established through the superordinate identity" (Dovidio, Gaertner, and Saguy 2007, p. 305). However, such a development requires not only substantial amounts of time, but also genuine and meaningful intergroup interaction and learning to reduce prejudices and disconfirm stereotypes (Gaertner et al. 1993, pp. 1–2). Recent research provides initial evidence that the realization of these goals can be supported, at least to some degree, using ICT applications (cf. Davenport and Daellenbach 2011; Walther 2009, pp. 227–228) and even techniques that do not require direct interaction:

> "Mentally simulating a positive interaction with a person with schizophrenia resulted in greater intentions to engage in contact with people with schizophrenia and reduced endorsement of stereotypes. Further analysis shows that *imagined contact lead to greater intentions for real contact* via reducing intergroup anxiety. In other words, after a mental rehearsal of a contact experience with a person with schizophrenia, people were more affectively favorable toward people with schizophrenia [emphasis added]" (Stathi and Crisp 2012, p. 752).

Although these results tend to be promising and might even be fruitfully applied in extreme cases such as Northern Ireland or as a preparatory training for potential initiative members, it can only be seen as a complement to interactions in naturalistic settings, because the approach's applicability is limited: reducing prejudices and disconfirming stereotypes does not automatically lead to proactive attitudes (Phelps et al. 2011, p. 408), which are essential for the integrationist strategy. A useful technique that can foster the development of these facets is the 'intergroup dialogue' (Nagda 2006, p. 558), which resembles what Armitage, Marschke, and Plummer (2008, p. 88) describe as 'transformative' or 'social learning'[279].

279. Social learning can be, following Krasny, Tidball, and Sriskandarajah (2009, p. 3), defined as the "learning that occurs when people engage one another, sharing diverse perspectives and experiences to develop a common framework of understanding and basis for joint action" (see also Armitage, Marschke, and Plummer 2008, p. 88; Armitage et al. 2011, p. 995; Collins and Ison 2009; Goven et al. 2012, p. 156). W. M. Cook et al. (2004, p. 468)

Nagda (2006, p. 563, 568) synthesizes the following four sub-processes involved in the communicative process from the successful work of four panels of students enrolled in an American university (N = 211) (see also Pettigrew 1998, pp. 70–74, and the 'community health impact assessment tool' discussed in the preceding intervention entry point): (i) be open to others by listening to their narratives, which provide different perspectives on the focal issue (i.e., appreciating difference), (ii) open up to others by asking questions and sharing personal stories and ideas (i.e., engaging self), (iii) critically reflect worldviews for prejudices and biases (i.e., critical self-reflection), and (iv) collaborate with others to remove entrenched inequalities by changing the status quo (i.e., alliance building). This process emphasizes, as indicated before, the importance of language within intergroup interactions (see also Clayton 2009, p. 486; Mason 2010, p. 865; Vervoort and Dagevos 2011, p. 631). However, it also implicitly presupposes that intergroup exchange occurs, is sustained over prolonged time spans, and satisfies certain quality criteria (cf. Mason 2010, pp. 865, 869). In respect to the former two, the notion of place gains prominence. Within urban contexts, which are characterized as a conglomerate of strangers in a spatial area, two types of places where encounters can take place are distinguishable (cf. Clayton 2009, p. 490): on the one side, there are spaces that facilitate fleeting encounters (e.g., supermarkets or urban commons), and on the other side, there are places in cities that promote more sustained encounters (e.g., schools or workplaces). As indicated in section 2.1, civil society organizations such as the initiative, resemble the latter, because they are based in a particular locality and function as a permanent, belonging strengthening anchor or hub within it (cf. Bailey 2012, p. 30; Burrage 2011, p. 172; Dekker et al. 2010, p. 610; Eriksson and Forsberg 2010, p. 325). It is this feature that allows for intergroup dialogue, which, in turn, is vital to realize the cohesiveness of the board. Nevertheless, although places for fleeting encounters are circumstantial and usually do not support exchange over prolonged time spans, they are still the space where civility and thereby the locality's cohesiveness of the everyday unfolds. The description of a particular illuminating encounter in such a place is the following:

> "*Carla* [a person with moderate intellectual disabilities who requires active levels of support for most types of activities]: Hello.
> *Woman* (early 20s, taken off guard): Hello.
> *Carla*: How are you?
> *Woman*: I'm good. How are you? (Woman is starting visibly to relax, as if she is thinking, this is not so bad)
> *Carla*: Good. What's your name?
> *Woman*: Sonya. What's your name?
> *Carla*: Carla. (Pause for a few seconds.) Can I ask you a question?
> *Sonya*: Yes.
> *Carla*: Do you think I'm stupid?
> *Sonya*: I've never met you before! (Slight look of panic goes over her face as she searches for something to say).
> (*Carla*: continues to look at Sonya waiting for an answer.)
> *Sonya*: No, I don't think that.
> [(]*Carla*: smiles, looking relieved.[)]
> *Sonya*: (hurriedly, uncomfortable): Time to get back to shopping.
> *Carla*: (happy, content): OK (smiles and moves on).
> [emphasis in the original]"(Wiesel, Bigby, and Carling-Jenkis 2013, pp. 2041–2402).

provide an overview of 'experimental approaches' that can be used to facilitate this type of learning.

This description of an interaction in the lifeworld illustrates at least three important aspects (cf. Wiesel, Bigby, and Carling-Jenkis 2013, p. 2402): (i) it demonstrates that fleeting encounters are instrumentally important because they can have a positive impact on well-being (i.e., Carla is happy and leaves smiling); (ii) it exhibits the afore-mentioned re-categorization (i.e., the common identity as shoppers who have to complete a task conveys a sense of belonging to the grocery store); and (iii) it indicates the importance of tactfulness and respect, which Sonya radiates, despite her obvious discomfort, in a natural way. Wiesel, Bigby, and Carling-Jenkis (2013, p. 2401) describe such situations as 'convivial encounter', that is, a brief, causal, and superficial encounter in which participants transiently replace an otherwise salient exclusionary identity by another identity that, by virtue of its inclusive nature, contributes to well-being (see also Lobo 2010, p. 93; Wise 2005, pp. 182–183). However, as indicated above, such re-categorizations tend to be bound to specific settings; they do not spill over to other contexts and they do not always translate into long-term social relations or progression in terms of attitude (Clayton 2009, p. 489; Daley 2009, p. 163). What is instead required is a local identity that generates a sense of belonging or 'intimate emotional attachment' (Andersson, Barthel, and Ahrne 2007, p. 1268) to the locality, i.e., to the place in which most of the interactions of individuals take place (see section 10.1), and that conceives all individuals—irrespective of backgrounds—as local citizens:

> "[C]itizenship is not a monistic identity that is completely apart from or transcends other identities important to citizens. These group identities are ever present and each group has a right to be part of the civic whole and to speak up for itself and for its vision of the whole" (Modood 2008, p. 449).

To develop such a sense of unity within a locality requires interaction, probably facilitated by external parties, of local citizens (Hustedde and Ganowicz 2013, p. 171). However, as the afore-mentioned example demonstrates, not all types of interactions are eligible to create a shared vision (Allport 1954, p. 262). An important research contribution that investigates the conditions or quality attributes that need to be met is the 'contact hypothesis' proposed by Allport (1954). Over the years his seminal work received considerable amount of attention, which not only corroborates the involved claims, but, at least to some extent, refines the initial analysis. Based on an extensive review of the existing body of knowledge, Novak, Feyes, and Christensen (2011, pp. 212–213) synthesize the following five conditions an action situation needs to satisfy to smooth the way for developing a common identity (see also Allport 1954, chap. 16; Gaertner and Dovidio 2000, pp. 82–96; Muir 2011, p. 970; Nagda 2006, pp. 553–554; Pettigrew 1998, pp. 66–67, 75–77; Swan 2013, p. 23): it should ensure that (i) the interaction conveys personal and intimate elements (i.e., opportunity to interact); (ii) the interaction eventually leads to a reduction of prejudices and the disconfirmation of stereotypes (i.e., stereotype disconfirmation); (iii) the interacting individuals have equal power positions or status (i.e., equal group status); (iv) authoritative actors encourage inter-group acceptance (i.e., authority sanction and support); and (v) outcomes depend on the cooperation of individuals who belong to different cultural groups (i.e., intergroup cooperation).

In respect to the elaboration of draft meanings and organizational options of community-driven development, complemented by the refining communicative process described above, the initiative tends to fulfill all of these demands: the process of creating the initial agreement is based on the narratives of participants, i.e., it is a sharing of personal stories about the problems in the locality perceived by individuals. Furthermore, as an organizational setting it also provides the opportunity for sustained interaction over prolonged time spans (cf. Allport 1954, p. 268–274; Pettigrew 1998, p. 76). Secondly, organizing the decision-making processes within the initiative around the four phases of the intergroup dialogue leads to a reduction of prejudices and the disconfirmation of stereotypes. This tends to be possible even in the assumed less cohesive localities, which are, inter alia, characterized by a lack of trust, because trust is, as indicated in the discussion of the preceding intervention entry point and the human behavior excursion, an outcome of intergroup dialogues and cooperation:

> "In essence, the integration of appreciating difference, engaging self, critical self-reflection, and alliance building in intergroup dialogue fosters the realization of connections that are both dialogic and critical. Such connectivity, not estrangement, entails a process of building trust and alliances that can unfold from breaking down the walls of separation, isolation, and silence. Arising out of a critical, dialogic process, bridging differences is not predicated on trust, but fosters trust through personal and political intimacy involving conjoint dialogue, and experimentations in collaborations for action" (Nagda 2006, p. 570).

Thirdly, the status of board members is determined by the distribution of decision-making power, which, in case of the envisioned initiative, refers to the equal allocation of the opportunity to dissent or veto. Fourthly, nominating public sector officials for board positions and giving them equal voting power helps, ideally, to prevent the violation of the common good. Finally, as indicated above and discussed more thoroughly below, the initiative carries out projects that aim to enhance the cohesiveness of the everyday. As these efforts often require cooperating with other local as well as extra-local actors, the association has, as indicated in the discussion of the preceding intervention entry point, to demonstrate its external legitimacy by an established track record of successful intra-organizational cooperation. Pivotal in respect to the present concern is that such efforts have been and will be successful; otherwise the failure is ascribed to one of the attributes associated with particular stereotypes that should be disconfirmed. For example, Novak, Feyes, and Christensen (2011, pp. 220–222) state that people with special needs and challenges, who were integrated into workplaces, had to overcome stereotypic attributes such as childlike, incompetent, or dangerous by being at least as productive as other employees. In settings that are not solely ridden by instrumental rationality (cf. Habermas [1981] 1987a, pp. 244–245) other yardsticks need to be employed. Within community-driven civil society organizations the gauge is usually a reputation as a trustworthy, competent, and committed member, a position that has to be earned and demonstrated in and through successful participation in collective efforts. Combined with the ever present danger of failure, this, in turn, suggests that collective efforts should start with relatively simple and 'standardized' projects to build an initial basis of trust that functions as a barrier against the tendency to attribute failures to features of stereotypes.

However, to form alliances and carry out cooperative projects presupposes that at least the following two barriers have already been overcome: on the one side, the capacities required for carrying out intergroup dialogues need to be present at least to some extent. This includes competencies such as the ability to listen to other viewpoints, to actively present one's own perspective, to have a sensitivity for the proper use of language (Novak, Feyes, and Christensen 2011, pp. 221–222)[280], and, more importantly, to critically reflect and revise one's

280. One example of the improper use of language Novak, Feyes, and Christensen (2011, pp. 221–222) present is the 'our man' a supervisor uses to refer to the employee with special needs and challenges. Although this term tends to be innocuous and the supervisor might have good intentions, 'our man' creates a hierarchical structure and associates the employee with special needs and challenges with a level below the other employees. It, therefore 'violates' the equal status condition.

own position in response to the arguments put forward by others (Nagda 2006, pp. 563, 568). All these skills are vital to disconfirm stereotypes, to reduce prejudices, and to develop an awareness of the 'generalized cultural other' (Bannister and O'Sullivan 2013, p. 94). On the other side, cooperation depends on an initial set of shared objectives that provide a common anchor point (Muir 2011, p. 970), that is, cooperating actors can devise rules of conduct and resolve disputes in reference to the shared agreement. However, shared in this case does not necessarily mean fixed and completely overlapping but rather the contrary: the agreement is a set of similar and negotiated values, a set which is open to further extension through intergroup dialogue (cf. Nathan et al. 2010, p. 3). Having such an agreement in place is pivotal to create an inclusive and safe environment that inhibits self-stigmatization, ostracization, and mass confrontation along established boundaries (cf. Swan 2013, pp. 23–24; Wiesel, Bigby, and Carling-Jenkis 2013, p. 2403). Lobo, who observed the everyday negotiation of ethnic differences in Dandenong, a culturally diverse[281] suburban area close to Melbourne (Victoria, Australia), illustrates that such states are realizable in naturalistic settings:

> "[A]lthough residents initially use national heritage to mark interethnic boundaries, this enables them to include rather than exclude others. Such moments when difference rather than sameness is welcomed rather than stereotyped and stigmatised, destabilise essentialist understandings of ethnicity, reify understanding of culture and contribute to feelings of being 'at home' [. . .]. Therefore, although the presence of difference may sometimes produce feelings of alienation, isolation and threat, suspicion and a yearning to belong, it is the temporal moments of curiosity, surprise, joy and laughter that contribute to feelings of being 'at home'. Such positive feelings have the potential to radiate to the wider neighbourhood through gestures of care [. . .]. Recalling moments when residents showed or received care enables them to *develop or maintain a strong emotional attachment to Dandenong even though the neighbourhood is constantly changing* with the arrival of new settlers [emphasis added]" (Lobo 2010, p. 96).

What is particularly interesting about this conclusion is that local citizens can create a sense of belonging to a certain locality, a locality in which they feel at home (see also Mason 2010, p. 871), and that this sense of belonging is maintained even in a constantly changing environment. Bradshaw (2013, p. 21) put the former as follows: "[c]ommunity identity and norms can be built around place, and place can be built around a common gathering place for people who share common identities and norms". The term 'community', in contrast to the convention made in section 10.1, transcends the rural or cultural meaning and refers to solidarity, which, in turn, is defined as "a shared identity and a code for conduct, both deep enough that a rupture in them entails affective consequences for the members" (Bhattacharyya 1995, p. 61). However, both these elements are not independent: local citizens feel at home in a locality if, and only if, they perceive local institutions as valuable, fair, inclusive, and reflecting their concerns (cf. Bühlmann and Hänni 2012, p. 330; Uphoff 1986, pp. 9, 14). Correspondingly, the envisioned initiative, viewed as an interaction platform for citizens of a spatially confined area, that is, of a 'gathering place', builds an identity by changing the locality's social structure in a way that allows local citizens to identify with it. However, as implied by 'changing' and indicated in the above quote, the locality and, by implication, its identity are in a constant flux. Therefore, the local identity has to be perceived as an ongoing 'work in progress local citizenship':

281. Almost 50 % of local citizens were born in non-English speaking countries (Lobo 2010, p. 91).

> "partly constituted, and certainly extended, by contestatory dialogues and novel demands for identity recognition, as circumstances shift, [that is,] citizenship can be understood as conversation and re-negotiation, not just about who is to be recognized but about what is recognition, about the terms of citizenship itself" (Modood 2008, p. 449).

Conversation and re-negotiation do not, as the terms might indicate, advise that different identities need to be reconciled as, for example, Ibrahim (2006, p. 406) suggests (see section 5.5); rather, they refer to the continuous adaption of the newly created, complementary, local identity. In terms of the afore-mentioned dual identity, this local identity provides a sense of belonging without the need to abandon other identities. Such an integrative approach is expected to be a suitable strategy to tackle the issues associated with the lack of civility or community cohesion in localities:

> "[M]y [Putnam] hunch is that at the end we shall see that the *challenge is best met not by making 'them' like 'us', but rather by creating a new, more capacious sense of 'we'*, a reconstruction of diversity that does not bleach out ethnic specificities, but creates overarching identities that ensure that those specificities do not trigger the allergic, 'hunker down' reaction [. . .] [emphasis added]" (Putnam 2007, pp. 163–164).

That the creation of such an identity within and through a civil society organization is, at least to a certain degree, possible, given the appropriate framing of the constitutive meeting and the adequate socialization of new members, is demonstrated in the highly interesting case study of Soma and Vatn. For example, they found that fostering participants to think imaginatively, i.e., local citizens should take a 'community' or social value perspective, leads to a delegitimization of personal values and interests (Soma and Vatn 2010, pp. 33–34). Nevertheless, what is presently more important is that by eschewing de-culturalization the creation of a dual identity avoids the resentments of individuals, who are, otherwise, negatively affected by removing and devaluing cultural traces, that is, of constitutive aspects of their identities (cf. Ricatti and Klugman 2013, p. 478). The local identity achieves this aim by extending the multi-dimensional space that spans an individual's identity. This, in turn, allows individuals to relate to each other, i.e., to categorize themselves as members of the same ingroup, on a common axis (cf. Daley 2009, p. 162). Converging with the requirements of the SHD conceptualization as outlined in section 5.5, this suggests that the local identity needs to exhibit traits of a global identity, which is a characteristic of a local citizen who is (see also Lobo 2010, pp. 94–95)

> "assumed to have a strong attachment to a global community beyond one's nation or culture and to show responsibility, directing him/her self outwards from local obligations, emphasizing obligations to distant others" (Phelps et al. 2011, p. 405).

Following Allport (1954, pp. 44–46), who refers to the psychological principle that "concentric loyalties need not clash", it is recognized that the identification with humanity as ingroup is difficult to achieve, but nevertheless possible. This 'oxymoronic' conceptualization of the suggested identity requires to reframe it as 'glocal identity', whereby "'glocalization' means the simultaneity—the co-presence—of both universalizing and particularizing tendencies" (Robertson 1997)[282] (see also Ger 1999, pp. 72–73, 75; Hertzberg and Monteiro 2005,

282. Although Robertson is considered to be the name giver, the need to reconcile global and local tendencies can also be found in the work of Geddes (1915, pp. 396–397), who writes: "[T]rue Town Planning, true City Design [. . .] should and must embody the full utilisation of its local and regional conditions, and be the expression of local and regional personality. '*Local character*' [. . .] is attained only in course of adequate grasp and treatment of *the*

p. 376; Mayo, Gaventa, and Rooke 2009; Myers and Macnaghten 1998, p. 338). In respect to the initiative sketched in the preceding section this identity evolves out of the initial agreement that culturally diverse local citizens achieve in an organizationalized and, in accordance with the demands of the underpinning value position, refined version of the intergroup dialogue. That is, the communicatively reached, initial agreement allows to organize collective action that aims to remove entrenched inequalities[283]. Through and within the carried out project a first sign of the 'we' feeling, which is connected to the initial agreement, manifests itself as trust between local citizens. If the project is successful, this, in turn, provides the basis for the extension of the agreement, because the involved learning enhances trust, confidence, and capacities, which, as indicated before, allow to tackle further, more intricate issues. Within weak institutional contexts this mutual reinforcing, virtuous interplay between collective action and identity might degenerate into normatively questionable endeavors such as Orania; however, the 'developed' localities assumed in the present inquiry have to face the re-emerging lack of community cohesion if they fail to create a glocal identity: given the freedom of movement in 'developed' contexts and the success of the initiative's collective action, the enhanced HD of the locality will attract more outsiders (cf. Pearson, Pearce, and Kingham 2013, pp. 243–244), which, in turn, increases the locality's heterogeneity. If such a development cannot be absorbed by the diversity-appreciating glocal identity, the afore-mentioned issues turn up again (see section 10.2). Although creating a glocal identity is by no means free of conflict nor does it guarantee higher levels of HD, it is nevertheless a necessary prerequisite to pass a certain level of HD—the 'HD threshold'. Given the vital importance of successful collective action that enhances the cohesiveness of the everyday, the following will present some noteworthy projects extracted from the reviewed literature. These excerpts not only indicate that such endeavors are indeed possible, but they can also be seen as an initial attempt to support the working of the initiative. This discussion is, due to the second research project's focus, by no means an exhaustive list of programs that can be undertaken.

Nevertheless, before diving into this elaboration, the elements of the foregoing discussion are used to explicate the relationship between the cohesiveness of the board and the cohesiveness of the everyday as well as the initiative's role in this interplay more clearly. This excursion takes two assumptions as given: (i) as postulated in the 'contact hypothesis' (Allport 1954), the negative attitude of ingroup members toward outgroup members can lessen through contact (e.g., Valentova and Berzosa 2012, p. 353), and (ii) as postulated in the 'minimalist [contact] hypothesis', the focal contact can occur in any of the several domains of an individual's live (e.g., Mason 2010, p. 870). From (i) follows that the process within the initiative not only contributes to the cohesiveness of the board, but the initiative itself can be seen as an endeavor that increases the cohesiveness of the everyday—at least in regard to involved members. However, the extraction of draft meanings and organizational options in the preceding discussion indicates that usually only a limited number of boards positions is available. Fortunately, not all local citizens are equally attracted to such development activities; in fact, attracted individuals usually exhibit certain characteristics:

"*Participative residents* were more educated, grew up in smaller towns,

whole environment [...] [emphasis added]".

283. From this perspective the initial agreement and the glocal identity emerging from it exhibit the characteristics of an ideology, which Coleman (1990, p. 320) describes as follows: "An ideology can create social capital by imposing on an individual who holds it the demand that he [or she] act in the interests of something or someone other than himself [or herself]".

had lived longer in the community, were affiliated with non-LDS churches [The Church of Jesus Christ of Latter-day Saints], were more involved in local specialized activities or groups, [...] belonged to more local specialized organizations, and interacted more frequently with their neighbors than residents with lower participation levels [emphasis in the original]" (Matarrita-Cascante and Luloff 2008, p. 56).

While not problematic per se, there is nevertheless a need to bring more, ideally all, local citizens from different cultural and socio-economic backgrounds in contact to achieve the cohesiveness of the everyday. Unfortunately, localities that are not also solidary communities lack the social capital for appropriate collective action (Bradshaw 2013, p. 15). The initiative tries, by implication a pivotal prerequisite for the cohesiveness of the everyday, to narrow precisely this gap through its activities. Similar to the afore-mentioned participative residents, only particular types of individuals will be attracted to each endeavor. According to (ii) this will not present any difficulties, but it indicates that a diverse portfolio of activities is required to reach the entire local population. However, it is important to carry out these projects in spaces that are equally accessible to all local citizens. In the assumed localities there are, generalizing the following, only a few urban commons, e.g., public green spaces, which fulfill this requirement for people of all ages (see also Burrage 2011, p. 171):

> "To [...] develop friendships that cross the boundaries of ethnicity, nationality and creed, youths must meet their peers in surroundings that are accessible to members of all communities, without formal, financial or symbolic restrictions" (Seeland, Dübendorfer, and Hansmann 2009, p. 11).

The survey of pupils in Zurich (Switzerland (CH)) (N = 437) about the places where they make new friends, carried out by Seeland, Dübendorfer, and Hansmann (2009, pp. 12–13), shows that pupils mentioned urban commons (i.e., parks, playgrounds, and lakeside locations), in contrast to cultural events (16%) and sport clubs (14%), more frequently (43%). These areas are particularly important for those pupils who have recently moved to CH and those of lower socio-economic status groups, despite the fact that these areas are in closer proximity to wealthier native citizens. Therefore, they summarize the insights of their inquiry by drawing the following conclusion:

> "Outdoor contacts can be regarded as a major way for pupils to bridge the peer group divide. For both Swiss and immigrant youngsters, outdoor locations like forests, parks and playgrounds are important places for making new friends. Whereas the forest seems to be visited more frequently by Swiss pupils, parks and playgrounds are visited by foreign and Swiss pupils to the same extent. This suggests that these latter places have considerable potential for fostering the social inclusion of immigrants" (p. 16).

Another presently important observation Seeland, Dübendorfer, and Hansmann (2009, p. 14) point out in their study is the differentiation between age and preferred activity: whereas younger pupils tend to use urban green spaces for sportive and other gaming activities, the older the pupils are the higher the degree of using public places for meeting friends and socializing becomes. This overlapping usage of urban commons is an important element for what in reference to Jacobs (1961, p. 35) can be called the 'fairly continuous use', which, if not resulting in a congestion (see Foster 2011, pp. 68–70, and section 10.2), increases 'eyes on the street', which, in turn, prevents their decay (see also H.-D. Meyer 2012, pp. 72–73). Furthermore, it indicates that some local citizens, youth but also (socially excluded) adults, can be reached by organizing sport projects. In fact, sport is one of the most prominent and successfully applied types of projects to increase contact between individuals who have different cultural and/or socio-economic backgrounds. Its popularity rests on three pillars: (i) it is a pervasive, global phenomenon that is attractive to (almost) all cultures (Sherry and Strybosch 2012, p. 498); (ii) it has, at least if referring to team sports and their cooperative nature, a "playful dimension [. . . that] allows for a positive outcome of otherwise often contradictory feelings" (Ricatti and Klugman 2013, p. 476); and (iii) it can, due to tangible achievements, create self-esteem and competencies that can be applied in other non-sportive domains (see also Sherry and Strybosch 2012, p. 501):

> "Findings of this [their] study seem to suggest that organized sport participation of ethnic minorities can result in acquiring knowledge and skills that can be applied in other (non-sport) contexts which, in turn, can benefit their integration into society" (Theeboom, Schailée, and Nols 2011, p. 15).

However, the study of youth in Leicester (UK) indicates that in self-organized sportive encounters the "racial distinctions remain largely intact through the separation of teams into established and competitive groups of 'us' and 'them'" (Clayton 2009, p. 489). Correspondingly, facilitating collective action to overcome this segregation is needed. Similar insights can be drawn from the Community Street Soccer Program case study carried out by Sherry and Strybosch. They conducted several semi-structured interviews and made site visits to explore the potential of soccer as a measure to socially included marginalized adults in various localities in Australia. Besides providing additional empirical evidence for the aforementioned relationship building, they extracted the following four key success factors from the gathered data (Sherry and Strybosch 2012, pp. 500, 504): participants (i) valued the sense of responsibility they had as a part of the team (i.e., the dependency of outcomes/intergroup cooperation); (ii) emphasized that the 'safe environment', organizers created through the banning of drugs and alcohol from the training site, was important for them to engage in activities; (iii) cherished that they increased their support network through the additional services the program offered (i.e., the 'rapid exchange' partnership described in table 10.5); and (iv) appreciated the flexibility of the program to cater to the needs of specific groups (e.g., the creation of women football teams).

Although the role of facilitators in (ii) is different from that in the inter-cultural case, both examples suggest that there are situations where a third party is needed: whereas in the youth case a nudge to build cross-cultural teams, for example, through organized tournaments, might be sufficient, the creation of a safe environment in other contexts is often more difficult. In the above-mentioned Artspace case study a welcoming atmosphere, another instance of a 'safe environment', was established through the articulation of the organization's vision and the 'meet and greet' institution:

> "The 'meet and greet' was seen as an essential way in which new or vulnerable participants could slowly be introduced into the organisation. This was done by both participants and by the 'facilitator', a dedicated employee of Artspace who talks with participants about how they could get involved. As well as working within Artspace, the facilitator spends one day a month at the local doctor's surgery. This was seen as an important way that Artspace could connect with potential participants who may be daunted by the prospect of walking in off the street" (Swan 2013, p. 25).

Even though the latter part of the quote indicates that inter-organizational networks, in this case with a local doctor, are important to purposively recruit new participants and, seen from the perspective of (iii), work in both directions, the presently relevant facet is that facilitators are instrumentally important to introduce potential candidates to initiatives—another contribution of paid professionals. Their main task is to explore options of how these people, who might, as indicated above, feel ill-equipped, can get actively involved in the initiative and ongoing projects to enhance self-confidence and to create a sense of belonging. This activity can be supported by employing the scale developed by Phelps et al. (2011). Facilitators can use it to measure candidates' attitudes and involve them in adequate endeavors (cf. Novak, Feyes, and Christensen 2011, p. 223). The fourth key factor, that is, the adaption of the project portfolio to cater to the needs of specific groups, is an intricate balancing act: on the one hand, it can undermine inter-group contact, and on the other hand, it is critical to avoid that particular groups retreat and socially exclude themselves by creating different, parallel organizational structures in which they can meet their specific needs (see Townsend 2008, p. 81, and his case study of adult education services in Australian localities). As additional and more specialized interest groups increase the already existing competition for resources and attention, such a development, instead of creating a solidary identity, further fragments the locality (cf. Matarrita-Cascante and Luloff 2008, p. 57).

Another possible strategy the initiative can pursue to foster contact between heterogeneous groups is the organization of cultural events. Similar to sport-related endeavors, carrying out such projects is not only important to foster contact and, as indicated above, to increase the initiative's internal legitimacy as well as to establish inter-organizational networks, but, presently even more relevant, to create a place-related identity and radiate it to a boarder audience. Whereas sport and gaming activities contribute only partially to the latter, cultural events are predestinated to do so (see also Allport 1954, pp. 265–267, for the contribution of 'social travels'):

> "Photographs, slide shows, verbal accounts, guided walks and study visits have been used as concrete ways in which to create a common history of the suburbs and a relationship to place where people live. This creation of shared experience in time and space is something that we [Eriksson and Forsberg] interpret as an attempt to *create local identity and a feeling for the place* [emphasis added]" (Eriksson and Forsberg 2010, p. 333).

As indicated by the emphasized part of the quote, such cultural events accomplish more than just contact. In reference to the life history of individuals (cf. Habermas [1981] 1987b, p. 167) their contribution can be described as creating the locality's life history; they integrate and continue the locality's past identities and thereby create an 'ego-identity'. This makes the locality distinguishable, which is, in turn, an essential prerequisite to enable local citizens to relate to and identify with it (see also p. 206). In anticipation of the discussion of the next intervention entry point, such a place-based identity is relatively strong with indigenous populations. In one of the case studies reviewed for the co-management of ecological systems, one of the Jawoyn elder, explained the following relationship to place:

> "You know the concern (and resources and interest) in the park when an animal is endanger? Well the same attention needs to be paid to here ... if this place becomes too dirty we won't come here to hunt, fish, bring family, share stories about this place—and if this happens for too long ... the place will die ... our country will die" (Robinson and Wallington 2012, p. 6).

A further approach to capture and explicate how historical identities go over into the 'here and now', especially in continuously changing urban areas, is another type of cultural event: collaborative exhibitions. Schultz, who conducts a case study at the Museum of Anthropology at the University of British Columbia (Vancouver, British Columbia, Canada), describes the goal of these exhibitions as providing

> "the opportunity for visitors to gain insights into the cultures of those around them and new perspectives as told to them from other viewpoints. In allowing visitors to hear the voice of marginalized communities, museums can demonstrate the active engagement of these peoples with the larger world" (Schultz 2011, p. 3).

Schultz (2011, p. 1) states that in order to realize this aim, the museum has to fulfill two roles simultaneously: on the one side, it needs to function as a point of contact and information disseminator that mediates between different voices within the locality, and on the other side, it needs to balance the resource provision in order to give otherwise marginalized voices an equal opportunity to be heard. The former is particular challenging for museums, because visitors are usually passive recipients who are not used to active encounters (p. 8). In addition to the challenge evolving from visitors' expectations, the involvement of marginalized local citizens creates an emotional momentum, which, as indicated above, requires a safe environment in which the individuals can open up (p. 5). Therefore, such a project presupposes an initial, diversity-appreciating glocal identity, which Vancouver, as indicated in the preceding intervention entry's elaboration, already possess (see also Brunet-Jailly 2008, p. 382). However, within other localities such a foundation needs to be developed before comparable endeavors can be undertaken. Without this groundwork the fleeting encounters in the museum might provide a nudge in the right direction for many local citizens, but in terms of the contact hypothesis' conditions only those who are actively involved in the project have the right frequency and quality of contact. Nevertheless, the case study again illustrates the role of inter-organizational networks, that is, project partnerships that are created to supplement lacking capacities (see table 10.5). Whereas the museum provides access to a larger audience and space, the initiative can contribute by establishing the required points of contact:

> "[P]ersonal interactions do allow for unique encounters that can aid people in their own learning process. This suggests that increased opportunities for personal interactions within the museum may assist visitors in receiving specific messages intended by collaboration" (Schultz 2011, p. 4).

Another way to enhance the sense of belonging through recognition and trust building are the afore-mentioned festivals. In contrast to the former rather informative orientation (see also Mayo, Gaventa, and Rooke 2009, pp. 168–173, and the public sector sponsored global identity adult education program), such projects increasingly set on social interaction that is based on joy and humor; powerful mechanisms to destabilize intergroup boundaries and to experience a shared sense of belonging (Lobo 2010, pp. 94–95). Within the reviewed literature R. Edwards (2012) describes a particularly successful civil society-organized, charity fund raising festival in Gympie (Queensland, Australia). Originally a small country music festival organized by three local enthusiasts, the Muster now attracts tens of thousands of people each year. From the conducted interviews R. Edwards (2012, p. 520) carves out that the festival not only fosters the exchange and sharing of competencies and skills, but it also enhances the sense of belonging through the creation of trust between and recognition of the various involved civil society organizations and local citizens. In addition to the festival itself,

R. Edwards (2012, pp. 524–525) describes several ‘spin-off events’ such as, for example, the Pre-Muster Party or the Muster Race Day. Therefore, the case study not only suggests a way for civil society organizations to raise funds, but more importantly, it indicates that an event organized by an initiative can arouse enthusiasm in the locality and that this, in turn, might create a momentum, which allows the initiative’s vision to reach a much wider audience. In other words, a formal initiative, evolving from a loosely coupled network, can acquire a special status in the locality, i.e., it can be ‘institutionalized’ (Uphoff 1986, p. 8). In literature this is referred to as becoming a social anchor, which denotes, based on the conceptualization of community as solidarity (cf. Bhattacharyya 1995, pp. 61–62), those organizations that

> “allow for social capital development [...], provide a point of connection for various members of the community across racial, gender and other demographic boundaries, and provide some form of uniqueness or identity for community members. Anchors must enhance or construct a sense of community, trust, or reciprocation within social networks” (Clopton and Finch 2011, p. 70).

Compatible with the afore-mentioned creation of a glocal identity as part of a dual identity as suggested by the ‘common ingroup identity model’ (Dovidio, Gaertner, and Saguy 2007; Gaertner et al. 1993; Gaertner and Dovidio 2000), social anchors “are able to tap into each level of identity formation, thereby creating a connection [...] to the specific community context” (Clopton and Finch 2011, p. 74) that manifests itself in a sense of belonging to a particular place—the locality in the initiative’s case.

However, as indicated in the introduction to the present discussion, it would be presumptuous to expect the initiative to resolve the lack of community cohesion single-handedly. There are numerous factors, which influence the cohesiveness of the everyday, that cannot be directly controlled by local citizens. For example, Vervoort and Dagevos (2011, p. 630) found that the level of education and the socio-economic position are correlated with intergroup contacts (see also Valentova and Berzosa 2012, pp. 344–345). Complementary, Valentova and Berzosa (2012, p. 351) found that children of immigrants[284], who were born and socialized in Luxembourg, tend to have the same negative attitude toward immigrants as natives. Although youths in general tend to be more open toward other groups, this case is particularly puzzling, because these children already have, due to their parents, intimate contact to immigrants (pp. 357–358). This not only illustrates the unprogressive problem shift inherent to strict assimilation strategies, it also puts more emphasis, in addition to the previously quoted study, on extra-local factors (i.e., education policy). Similarly, a federated system with power-sharing mechanism is an example of a structural, extra-local, and non-influencable aspect that contributes to an inclusive attitude (cf. Bühlmann and Hänni 2012, pp. 341–347). However, there are also counteracting factors in ‘developed’ countries. For example, Vliegenthart (2007, p. 133) paints an alarming picture of inter-group relations in the Netherlands, a disturbance that is observable in many other EU countries as well (see also Mayo, Gaventa, and Rooke 2009, pp. 165, 168; Vervoort and Dagevos 2011, p. 630): in response to the 9/11 tragedy immigration issues received more attention in the press, which is correlated with the emergence of xenophobia, increased support of anti-immigration parties in the EU, and a significant stagnation or decline of inter-group contacts (see also section 2.1 for the staging of public opinions through the press). These effects as well as their political

284. Valentova and Berzosa (2012, p. 349) point out that in contrast to other countries in the EU, immigration to Luxembourg is mainly from other European countries, whereas other countries in the EU mainly have to deal with immigrants from developing countries.

response can adversely affect a group's sense of belonging or identity (see also Bühlmann and Hänni 2012, p. 327):

> "A group's sense of belonging to the polity may also be affected by foreign policy decisions: the way in which British foreign policy has adversely affected Muslims beyond British borders surely has a key role to play in explaining why so many young Muslims find it hard to identify with the British polity and feel at home in it" (Mason 2010, p. 873).

However, the key concern is not the abstract national identity or the 'collective we' itself, but its operationalization, i.e., the experienced everyday interactions (cf. Clayton 2009, p. 487). If such high level identities are used as criteria to define and frame everyday interactions, then high level issues, as tragic as they might be, are bounded to occur at lower levels. This affects the interactions of individuals even though they were neither involved in these decisions nor do they automatically agree or disagree with actions taken just because they are categorized as belonging to a particular group. Correspondingly, the present inquiry follows the call of Clayton (2009, p. 494), who argues for shifting "attention from identities conceived in an abstract manner at the national scale, toward those experienced through the everyday". Only by having an identity that exhibits a local character to which individuals can and do relate, there is a basis that can mitigate the effects of discord at other social levels. Nevertheless, as the above discussion explicates, there are instrumental reasons as well as a moral obligation to incorporate global or universal aspects in the desirable form of civility (see also Bannister and O'Sullivan 2013, pp. 94–95):

> "Civility is not just a formality to which people must subscribe in order to be taken seriously or to cultivate the appearance of manners or refinement. It is a positive moral obligation that we owe to others in our everyday interactions. We have an obligation to be civil to others out of a deference to the respect in which we are no better than they" (Boyd 2006, p. 873).

In sum, the foregoing discussion indicates that the initiative, that is, the central element of the sketched 'possible world', can contribute to the enhancement of community cohesion and social inclusion if the devising of development alternatives is organized along the communicative process outlined above. The virtuous outcomes of these inner processes are, in turn, reinforced if planned collective actions are translated into successfully carried out projects. In regard to the latter, the above elaboration further suggests that the complexity and scope involved in these collective endeavors needs to be aligned with the trust and the strength of identity present in the civil society organization. In addition to this intra-organizational perspective, the reported fragments of evidence also give a glimpse of the way the initiative and its efforts can contribute to the cohesiveness of the everyday. Although the discussion of the next intervention entry point can also be interpreted as carving out draft meanings and organizational options that constitute an additional endeavor in this direction, the primary role of this exercise, however, is to incorporate the SD dimension.

The Possibility of Co-Managed Ecological Systems

"Although high levels of urbanization are not in and of themselves a problem, urban development undertaken with litte regard for its ecological implications can be extremely destructive"

McGranahan et al. (2005, p. 816)

The third and final difference between the 'factual world' and the 'possible world' elaborated in this second research project concerns, in general terms, the feasibility of co-managed ecological systems. The need to demonstrate the possibility of these arrangements evolves not only in response to the aim of incorporating, as demanded by the introductory quote, the SD dimension, but lower level versions of these institutional configurations also impinge, as indicated in section 10.2, on the two foregoing discussions: whereas the consideration of physical spaces in urban localities under a collective property-rights regime contributes to the possibility of community-driven development, especially the creation of formal civil society organizations, because these initiatives require a physical space in the locality to function as an anchor or point of contact for local citizens, it simultaneously offers an alternative to the privatization of decaying urban commons and thereby sheds light on the availability of equally accessible physical spaces that are, in turn, pivotal to foster contact between different cultural and/or socio-economic groups. Furthermore, collective property-rights regimes or co-management arrangements that govern 'urban green commons' (Colding et al. 2013, p. 1039) are critical to promote the relationship between local citizens and ecological systems. Most notably in 'developed' urban localities, the experience gained through direct interaction with ecological systems is, despite its indispensable role in SD efforts (cf. Ohlson et al. 2008, p. 438; Pyle 2001, pp. 17–18; 2002, pp. 261–262; 2003, pp. 207–210), globally declining (cf. Cullen-Unsworth et al. 2012, p. 351; McGranahan et al. 2005, p. 820; Pilgrim, Smith, and Pretty 2007, p. 1748; Pilgrim et al. 2008, p. 1004). This is what Pyle (2002) termed the 'extinction of experience' (see also Pyle 2003, p. 206). Within literature the deterioration of local ecological knowledge, often interwoven with arguments in regard to traditional and/or indigenous knowledge, is discussed under the heading of decreasing ecoliteracy levels (cf. Berkes, Colding, and Folke 2000, p. 1252; Colding et al. 2013, pp. 1043, 1045; Cullen-Unsworth et al. 2012, p. 352; Fernandez-Gimenez, Huntington, and Frost 2006, p. 306; Hall et al. 2009, p. 2051; H. P. Huntington 1998, pp. 237–238; 2000, pp. 139–140; Krasny, Tidball, and Sriskandarajah 2009, pp. 1, 5; Pilgrim, Smith, and Pretty 2007, pp. 1742, 1747–1748; Pilgrim et al. 2008, p. 1004; Roseman and Stern 2003); the latter defined as a knowledge system, which, in contrast to the dominating scientific understanding, is a value-based, culturally transmitted, cumulative body of knowledge about social-ecological systems that local citizens developed through the continual observation of and engagement with ecological systems. As the level of this type of literacy is, in turn, an important determinant of the willingness to support and/or participate in conversation efforts (cf. Bendt, Barthel, and Colding 2013, p. 18; Pilgrim, Smith, and Pretty 2007, p. 1748; Pyle 2001, p. 18; 2002, p. 261–262; 2003, pp. 206, 208), the possibility of fostering this development is—if not a prerequisite—vital to establish co-management arrangements to govern ecological systems on higher social units.

However, such endeavors are, from a SHD perspective, necessary, because cities rely on services produced by ecological systems beyond their boarders (cf. Bendt, Barthel, and Colding 2013, p. 18; McGranahan et al. 2005, p. 798), especially those of peri-urban and rural areas as well as distant ecological systems (cf. McGranahan et al. 2005, pp. 805–818), and because the former two ecological systems are directly interrelated with those in urban areas (cf. Levin 1998, pp. 432–434; 1999, p. 1; Lovelock [1979] 2000, pp. 30–43, and section 10.2):

> "Several natural resource systems, such as forests and river basins, are [...] complex natural systems. They produce multiple goods and services, sometimes hundreds—each of which has its own set of inputs and

outputs in its production. And the production of goods is often non-linear. Each of the goods may have its own distinct spatial ranges at any point in time. Each may interact with other goods. Some may have more resilience than others when responding to interruptions to their production. Such complexity challenges any attempt to create institutions to manage natural resources [...]" (Andersson and Ostrom 2008, p. 74).

In the 'possible world' the issues involved in the governance of interrelated and interdependent ecological systems are, similar to the arguments made throughout the present inquiry, handled by providing an interaction platform on which the issue networks of comprised localities, public sector officials, and representatives of ecological systems, distant others, and future generations exchange and adapt their opinions as well as organize dispersed, aligned collective action to make progress in terms of SHD. In other words, what is presently at stake is, in addition to the above-mentioned concerns, the possibility of establishing a co-management arrangement that aligns the governance systems of a larger area; a territory that comprises a set of intimately connected and interdependent ecological systems. Correspondingly, the following possibility assessment and synthesizing design deals with co-management arrangements on two different levels in the social hierarchy: whereas the first is located within the locality and constitutes a, in addition to the optional projects outlined in the discussion of the preceding intervention entry point, mandatory collective effort that community-driven SHD initiatives have to carry out by virtue of their nature, the second is a more highly situated arrangement in which the initiative interacts with actors that form its immediate environment and those that bring in more general and distant perspectives, which, in turn, is a pivotal element to infuse the local identity with a global orientation, i.e., to create a glocal identity.

Figure 10.12: Tag Cloud of Background Search 'Co-managed Natural Resources' (The tag cloud was created using `http://www.wordle.net/`, accessed May 25, 2015)

The following elaboration is, similar to the two preceding discussions, structured along the procedure outlined in section 8.2. Figure 10.12 depicts some of the keywords extracted from the batch of documents retrieved using 'co-managed natural resources' as initial search string, that is, from the performed background search. A selection of these keywords was used to create a query string that comprises the following four categories (see figure 10.13). Whereas the first group of terms specifies the object of interest, that is, ecological systems and relevant synonyms, the second category enumerates activities that can be performed on the former, i.e., conserving, managing, and governing ecological systems. Both these categories are, to explicate their intimate relationship, connected by a proximity operator[285]. The resulting string is, in turn, `AND`-connected with terms[synonyms] that describe the organizational context in which the activities performed on ecological systems are embedded and those that specify the former's level in the social hierarchy, that is, with the third and fourth category respectively. In respect to the discussion in section 10.2, the third category comprises, in addition to 'co-manag*', the query strings 'policentric*' and 'institutional analysis', because these terms are sometimes used in contributions that analyze institutional configurations that are located on higher social units.

As figure 10.13 indicates, executing the query string against the two selected databases (see section 8.2) yields an initial set of 334 documents. After 88 duplicates were removed from this group, the remaining 246 documents were filtered to exclude all articles that do not address at least one of the four above-mentioned concerns and that do not report results of urban localities in 'developed', democratic countries (see footnote 236 as well as sections 6.1 and 10.1)[286]. Based on the examination of the information provided by title, abstract, and keywords, 204 studies were excluded as presently unrelated (see annex A.3). Table 10.6 gives a broad overview of the 21 studies, a subset of the adjusted set of 42 documents, that explicitly discuss co-management arrangements, that is, that demonstrate the possibility of the present elaboration's focal concern. However, before the discussion turns to a more detailed analysis of this facet, the following briefly examines the fragments of evidence that were extracted to illustrate how the creation of co-management arrangements supports the endeavors described in the discussions of the two preceding intervention entry points.

285. As indicated in the caption of figure 10.8, proximity operators allow to refine the set of retrieved documents by defining the maximal number of words that are allowed between the connected keywords.

286. It has to be noted that according to Berkes (2010, p. 492), who references Larson and Soto (2008), most of the co-managment knowledge accumulates from experience gained in rural areas of 'developing countries'. Not only are there substantial differences between 'developed' and 'developing' countries, but also between rural and urban areas (see also UN-HABITAT et al. 2013, p. 3). This includes, inter alia, resource dependency, which is considered as vital success criteria for collective property-rights regimes (cf. Andersson, Barthel, and Ahrne 2007, p. 1276; Andersson and Ostrom 2008, p. 75; Oakerson and Parks 2011, p. 155; Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, pp. 240–241). As these insights are, due to the second research project's focus, not considered in the following, the review of these insights can certainly enhance the discussion (see chapter 14). However, in respect to the exemplary character of the current efforts, the challenges involved in abstracting and relating the different contextual factors tend to be unrewarding.

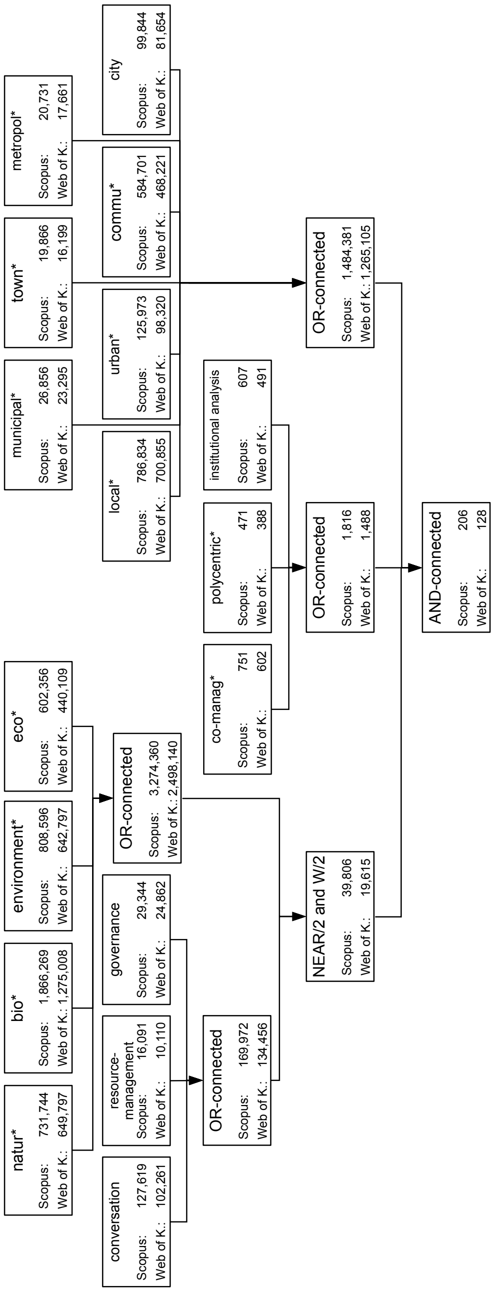

Figure 10.13: 'Co-managed Natural Resources' Query String [The results were obtained on October 13, 2013, using the following query constraints: English journal articles published between 2004 and 2013. The query string for the selected database differed in one minor respect: whereas Scopus uses `W/<distance>` as proximity operator, the Web of Knowledge (Web of K.) substitute is `NEAR/<distance>`]

Table 10.6: Reviewed Co-Management Arrangement Case Studies

Reference	Category	Scale	Location
Armitage et al. (2011)			
	Maritime	Regional	Arctic Region, Canada
Bendt, Barthel, and Colding (2013)			
	Community Garden	Local	Berlin, Germany

Continued on Next Page

Table 10.6 – Continued from Previous Page

Colding et al. (2013)[287]			
	Allotment Garden	Local	Stockholm, Sweden
	Community Garden[288]	Local	Berlin, Germany
Cullen-Unsworth et al. (2012)			
	Landscape	Regional	Queensland, Australia
Enengel et al. (2011)			
	Landscape	Regional	Lower Austria, Austria
	Landscape	Local	Salzburg, Austria
Ernston, Sörlin, and Elmqvist (2008)			
	Landscape	Local-Regional	Stockholm, Sweden
Fernandez-Gimenez, Huntington, and Frost (2006)			
	Maritime	Regional	Alaska, USA
Goven et al. (2012)			
	Biosolid management	Local	South Island, New Zealand
Hill et al. (2010)[289]			
	Landscape	Regional	Queensland, Australia[290]
Hill et al. (2012)			
	Multiple[291]	Mixed	Across Australia
Krasny, Tidball, and Sriskandarajah (2009)			
	Watershed[292]	Regional	New York, USA
	Landscape[293]	Local	Across the USA
Newig and Fritsch (2009)			
	Mixed[294]	Mixed	Across USA and Europe
Oakerson and Parks (2011)[295]			
	Landscape	Regional	New York, USA
Ohlson et al. (2008)[296]			
	Wildlife conversation	Regional	Idaho, USA
Plummer and FitzGibbon (2006)			
	Watershed	Local, Regional	Ontario, Canada
Raymond and Cleary (2013)[297]			
	Landscape	Regional	South Australia, Australia
Rodríguez-Izquierdo, Gavin, and Macedo-Bravo (2010)[298]			
	Wildlife and biodiversity conservation	Regional	Huanuco, Peru[299]

Continued on Next Page

287. They also discuss a co-management arrangement in South Africa, which was, due to the above specified criteria, not considered in the following elaboration.
288. Although the community gardens discussed by Colding et al. (2013) are the same four community gardens that are also analyzed by Bendt, Barthel, and Colding (2013), the perspectives differ considerably.
289. For more information about the Mission Beach Habitat Network Action Committee see its website, which is available at: http://www.terrain.org.au/, accessed May 25, 2015.
290. Although the landscape co-management arrangement discussed by Hill et al. (2010) is the same that is also analyzed by Cullen-Unsworth et al. (2012), the perspectives differ considerably.
291. This is actually a comparative analysis of 21 co-management case studies across Australia.
292. The Urban Environment Service-Learning Course at Cornell University's (NY, USA) website is available at: http://www.sci-links.com/urbanenvironments.html, accessed May 25, 2015.
293. The garden mosaics' website is available at: http://gardenmosaics.org, accessed May 25, 2015.
294. This is actually a meta-analysis of different 47 case studies that belong to different categories.
295. For more information about the Adirondack Park's agency see its website, which is available at: http://apa.ny.gov/, accessed May 25, 2015. For a general overview of the Park see its official website, which is available at: http://visitadirondacks.com/, accessed May 25, 2015.
296. For more information about the program see its website, which is available at: http://www.nezperce.org/programs/wildlife_program.htm, accessed May 25, 2015.
297. For more information about the South Australian Arid Lands Natural Resource Management Boards see their website, which is available at: http://www.saalnrm.sa.gov.au/, accessed May 25, 2015.
298. For more information about the park see its website, which is available at: http://www.sernanp.gob.pe/sernanp/zonaturismoi.jsp?ID=14, accessed May 25, 2015 (in Spanish).
299. As will be explicated more fully below, this case study was excluded in a first iteration of the screening process. However, due to the need to discuss the evolution path of co-management arrangements, another iteration

Table 10.6 – Continued from Previous Page

Robinson and Wallington (2012)[300]			
	Multiple	Regional	Nothern Territory, Australia
Stenseke (2009)			
	Landscape	Regional	Southern Öland, Sweden
	Landscape	Local-Regional	Mälarhaar, Sweden
Spak (2005)[301]			
	Multiple	Regional	Northwest Territories, Canada
Tuschiya, Okuro, and Takeuchi (2013)			
	Urban Forest	Local	Tokio, Japan

Carlsson and Berkes (2005, p. 67) state that although there are numerous attempts in literature[302] that try to capture the essence of co-management arrangements, there is no commonly agreed upon definition. Nevertheless, they also point out that two features are regularly mentioned: firstly, the idea that the arrangement is not fixed but continuously changes its configuration, and secondly, that it involves the collaboration or cooperation of actors from the public and the private sector (cf. Plummer and FitzGibbon 2004, p. 878; 2006, p. 51). In the social capital terminology introduced before, the creation of a co-management arrangement can thus be understood as the formation of linking social capital (cf. Bertotti et al. 2012, pp. 170–172; Bowen 2009, pp. 246–247; Muir 2011, p. 962; Kay 2006, pp. 164–167, and footnote 275), that is, the envisioned initiative establishes linkages to actors located on higher social units[303]. The primary goal of these public sector-civil society networks is, as indicated at the end of the discussion of the possibility assessment and synthesizing design of the first intervention entry point, to participate in the modification of operational rules and to get actively involved in the exercise of governance functions. If successful, such a development changes the nature of the rather centralized governance structure of the 'factual world' (see section 10.1) by transforming it, as indicated in the Barcelona Model case study (Blakeley 2005), into a policentric system. However, this presupposes a constitutional change, that is, a change in the way authority is organized in localities. Literature refers to this already ongoing process as double devolution (Bailey 2012, p. 12; Berkes 2010, p. 491), that is, the decentralization and devolution of governance functions (see section 10.2). Although this is a general process, the present focus rests on the allocation of rights and responsibilities in regard to a specific ecological system to the different actors who are involved in the arrangement (cf. Plummer and FitzGibbon 2004, p. 878).

was initiated. Within this second screening this case study was identified as one that discusses the emergence of co-management arrangements most explicitly.

300. For more information about the park see its website, which is available at: http://www.parksaustralia.gov.au/kakadu/index.html, accessed May 25, 2015.

301. For more information about the Gwich'in Renewable Resource Board see its website, which is available at: http://www.grrb.nt.ca/, accessed May 25, 2015; for more information about the Beverly and Qamanirjuaq Caribou Management Board see: http://www.arctic-caribou.com/, accessed May 25, 2015.

302. Carlsson and Berkes (2005, pp. 68–69) extract five different co-management arrangement conceptualizations from literature: (i) the exchange system in which the public and private sector act indepedently but exchange resources, (ii) the joint organization in which actors of the public and the private sector form a joint venture, (iii) the nested civil society arrangement in which actors of the private sector work in public sector initiatives, and (iv) the nested public sector arrangement in which public sector officials participate in activities of civil society organizations. In contrast to these four types, each of which perceives the public as well as the private sector as a uniform block, the fifth type, that is, the conceptualization of co-management arrangements as networks (cf. Carlsson and Berkes 2005, pp. 68–69; Plummer and FitzGibbon 2004, p. 878), recognizes the fragmentation of both, the public and the private sector (cf. Ostrom, Tiebout, and Warren 1961, p. 842; Carlsson and Berkes 2005, p. 67; Oakerson and Parks 2011, p. 147–148; Henocque 2013, p. 69) and its nested, multi-level, functional complementary, and dynamic characteristics (cf. Paavola 2007, p. 100; Vatn 2010, p. 1246).

303. For a discussion of the different levels or tiers see Ostrom (1990, pp. 50–55), Ostrom (2007, pp. 44–46), Paavola (2007, p. 99), Rodríguez-Izquierdo, Gavin, and Macedo-Bravo (2010, p. 247), Schlager and Ostrom (1992, pp. 249–251) and the 'nested enterprises' condition in table 10.2.

In reference to the discussions of the two preceding intervention entry points, such a co-management arrangement is, as indicated above, attractive in two respects: on the one side, it can support community-driven development initiatives by providing physical spaces that constitute stable points of contact for local citizens, and on the other side, it facilitates endeavors that aim to strengthen the cohesiveness of the everyday by making spaces, which are equally accessible to all local citizens, available. Although the discussion of the first intervention entry point already indicates that the former is indeed possible [e.g., the Westway Development Trust (Bailey 2012)], the latter has not been addressed explicitly; rather, it was pointed out that such places are, especially due to the privatization of public propertys, constantly declining in 'developed' localities. However, the case studies discussed in the following not only indicate that it is possible to establish co-management arrangements that support both these aspects, but they go even further and demonstrate that this can be done in a way that simultaneously contributes to SD. The latter manifests itself in the increase of green areas, which improves a locality's ecological footprint as well as local citizens' well-being, and the enhancement of ecoliteracy among urban citizens—a development that is instrumentally important to build awareness and support for other SD endeavors.

A case study that exhibits all these features is the Prinzessinnengarten[304] in Berlin Kreuzberg (Bendt, Barthel, and Colding 2013). Although the following discussion of this community garden project is mainly based on the elaboration of Bendt, Barthel, and Colding (2013), it is complemented by a little background information gathered from the Statistical Office of Berlin-Brandenburg and reports of other public agencies in Berlin as well as enriched by the insights gained in the Garden Mosaic case study (Krasny, Tidball, and Sriskandarajah 2009) and those of further community garden projects discussed by Colding et al. (2013).

The Prinzessinnengarten is located in the Friedrichshain-Kreuzberg district of Berlin. The latter can be characterized as densely populated and underproportionally—in comparison to other areas in Berlin—greened locality (cf. Kabisch 2011, pp. 60–62). It is, in addition, also a culturally diverse place, i.e., more than 35% of the local population have a migratory background[305]. Despite these, in the light of the foregoing discussion, rather unfavorable conditions, Kreuzberg is considered to be among the liveliest parts of Berlin and it has relatively few religious and/or ethnic incidents[306]. Within this context the internationally recognized[307] Prinzessinnengarten, which has also won several awards[308], emerged from a so-called 'guerrilla gardening technique' (Colding et al. 2013, p. 1043–1044), i.e., the construction of a community garden on a resource owned by the state. This ecological system lied fallow for several decades and was cleaned from more than two tons of waste by a self-organized initiative that later evolved into the more formal civil society organization Normadic Green, which has one full-time and five part-time employees. One particular characteristic that distinguishes this community garden from comparable projects is its mobility, which, in turn, is a response to the continuous danger of eviction the initiative has to face[309], because the

304. Its website is available at: http://prinzessinnengarten.net/, accessed May 25, 2015
305. Data based on the 2011 census retrieved from the Statistical Office for Berlin-Brandenburg: https://www.statistik-berlin-brandenburg.de/, accessed May 25, 2015.
306. See the reports of the integration office in Berlin Friedrichshain-Kreuzberg: http://www.berlin.de/ba-friedrichshain-kreuzberg/verwaltung/org/intmigbeauftragte/index.html, accessed May 25, 2015.
307. The New York times dedicated an article to the Prinzessinnengarten: http://intransit.blogs.nytimes.com/2011/02/28/berlins-mobile-garden-grows, accessed May 25, 2015 and even CNN made a report about the community garden: http://edition.cnn.com/video/data/2.0/video/living/2010/11/14/magnay.reclaimed.space.cnn.html, accessed May 25, 2015.
308. More details about prizes the initiative has won and those it was nominated for can be found on its website, which is available at: http://prinzessinnengarten.net/, accessed May 25, 2015.
309. See for example the Rosa Rose Garten case study described by Bendt, Barthel, and Colding (2013).

public sector holds all property rights: plants and vegetables are planted in plastic boxes and containers are used for infrastructure components (e.g., office, café, etc.). Nevertheless, the garden, located in the setting outlined above, is, because it is open to everyone, a meeting point for local citizens who belong to different cultural and/or socio-economic groups. This attractiveness is achieved by a multifaceted portfolio of activities, which includes, inter alia, a community café as well as regular art exhibitions and workshops that address the concerns of different kinds of stakeholders[310]. Another endeavor, primarily dedicated to address the needs of a particular category of socially excluded individuals, is the back to work program for unemployment local citizens. The project not only brings these persons in contact with other 'community gardeners', the respective identity unfolding in the Prinzessinnengarten, but it also creates an inclusive place where these individuals feel accepted, which, in turn, results in a sense of belonging to the larger area. Furthermore, a cooperation with surrounding schools allows young people to get in touch with ecological systems—an otherwise rare opportunity in this particular locality and urban areas in general (cf. McGranahan et al. 2005, p. 811). Through this exchange the work of community gardeners not only finds, manifested in the youths' interest, recognition (Krasny, Tidball, and Sriskandarajah 2009, p. 6), the active involvement in the management of ecological systems is also vital to complement formal education through the direct acquisition of local ecological knowledge (Pilgrim, Smith, and Pretty 2007, p. 1748). These benefits are supplemented by another contribution that Krasny, Tidball, and Sriskandarajah carve out in their comparable Garden mosaic case study:

> "By working with, learning from, and respecting the knowledge of immigrant and other gardeners, the young people may be engaging in learning that further enhances resilience, through integrating multiple forms of knowledge, as well as by building trust, social connections, associational involvement, volunteerism, and other dimensions of social capital [...]" (Krasny, Tidball, and Sriskandarajah 2009, p. 8).

In other words and following the conclusion Bendt, Barthel, and Colding (2013, p. 28) draw from their discussion, community gardens and comparably managed urban green commons are (a) a cost-effective alternative to the privatization of decaying urban commons (cf. Colding et al. 2013, p. 1039), (b) provide, through their boundary-crossing interaction activities (e.g., workshops, exhibitions), an opportunity that, given the appropriate lifestyle (Pilgrim, Smith, and Pretty 2007, p. 1748), allows to get in contact with and learn about ecological systems, i.e., to increase one's ecoliteracy, (c) create, in their function as 'placemaking initiatives', a sense of belonging to the locality , (d) offer an environment in which local citizens can become, instead of just being passive recipients of 'ready-made environments', creative actors who can experiment about different forms of 'human-nature collaborations', and (e) create, similar to the afore-mentioned engagement in sport clubs, capacities that can be applied outside of this particular context. In respect to the latter, Bendt, Barthel, and Colding (2013, pp. 25–27) extract the following three domains in which learning occurred through the participation in this particular community garden: firstly, nearly all participants expressed that they gained new and adapted prior existing, often tactic, knowledge about gardening, plants, and the demands of ecological systems, that is, they enhanced their levels of ecoliteracy (see also Pilgrim, Smith, and Pretty 2007, p. 1748). Secondly, many initiative members, as indicated in the following quote of interviewee 27, stated that they, due to the

310. An overview of initiated and carried out projects can be found on the initiative's website, which is available at: `http://prinzessinnengarten.net/projekte/`, accessed May 25, 2015.

continuous danger of eviction, got informed about the ‘politics of space’ in urban localities:

> “‘. . . (Before) I never had a clue . . . about what’s happening around me in the neighbourhood, who has got power and how, (. . .) this helps me also more to think how to intervene and how to be active in this . . . ’ (27)” (Bendt, Barthel, and Colding 2013, p. 26).

Finally, participants reported that they learned, inter alia, about decision structures, division of labor, collective responsibility, organization of collective action, involvement of new members, and engagement with the wider public[311]. In addition to these activities that mainly address the demands of internal legitimacy, the initiative also participates in various extra-local networks and collaborations such as, for example, the UNESCO decade project ‘urban gardening as challenge to landscape gardening training – competencies and network building via prototypical realization [author’s translation]’ (*‘urban gardening’ als Herausforderung an die berufliche Bildung im Garten- und Landbau – Kompetenz- und Netzwerkentwicklung durch modellhafte Umsetzung*)[312]. The goals of this project are to integrate the informal learning that occurs within such initiatives with and in the formal education carried out by the Humboldt-Universität zu Berlin as well as to create a sustainable round table ‘Training Urban Gardening [author’s translation]’ (*Berufliche Bildung Urban Gardening*), i.e., a platform to faciliate the exchange between and cooperation of urban gardening actors.

However, before the discussion turns to such co-management arrangements on higher levels in the social hierarchy, an intermediate reflection of the foregoing elaboration is inserted: the Prinzessinnengarten (Bendt, Barthel, and Colding 2013) and the Garden Mosaic (Krasny, Tidball, and Sriskandarajah 2009) case studies indicate that a collective property-rights regime is not only possible, but that it can even be organized in a way that contributes to the two already discussed differences of the ‘possible world’, that is, to community-driven development endeavors and to efforts that enhance the cohesiveness and inclusiveness of localities. Furthermore, it also reveals that appropriately managed urban green commons, themselves a contribution to the ecological footprint of cities as well as to the health and well-being of local citizens, can foster, as fully explored below, the enhancement of ecoliteracy, which, in turn, is critical to support other SHD endeavors—especially those that address SD concerns. Yet, it was stated above that the demands of SHD go further and require a co-management arrangement on a higher social unit. The detailed rationale underpinning this claim can be reconstructed as follows: there is growing consensus in literature that

(i) environmental problems are increasing (see chapter 1 and section 5.5),

(ii) ecological systems contribute to local citizens’ well-being and health by providing various ecosystem services such as air filtering or noise reduction (cf. Ernston, Sörlin, and Elmqvist 2008, p. 1; McGranahan et al. 2005, p. 805),

(iii) the ‘value’ of ecological systems is only partially measurable, because a complete assessment needs to take into account the, often conflicting, normative and aesthetic valuations of different types of stakeholders (cf. Boyd et al. 2013, p. 823; Henocque 2013, p. 66; Jim 2013, p. 324; Schultz, Duit, and Folke 2011, p. 662, and section 5.5),

311. Bendt, Barthel, and Colding (2013, p. 27) point out that although local citizens in the locality tend to be more mobile and therefore are less likely to engage in formal organizations, the Prinzessinnengarten circumvented this problem by making it open access and allowing gardeners to make nearly all decisions ad hoc. Therefore, there is no need to engage formally in the organization. This freedom of operational decision making is a vital component of this type of co-management arrangement (cf. Ohlson et al. 2008, p. 437).

312. For more information about the project see its website, which is available at: `http://gfbm.de/modellprojekte/urban-gardening-in-berlin/`, accessed May 25, 2015.

(iv) ecological systems and their production of services is not confined to, from the perspective of ecological systems, arbitrary administrative boundaries (cf. Andersson, Barthel, and Ahrne 2007, pp. 1274–1275; Bolund and Hunhammar 1999, pp. 299–300; McGranahan et al. 2005, p. 798; Strohbach, Lerman, and Warren 2013, p. 70),

(v) social and ecological systems are inextricably interlinked and interrelated, that is, they have to be perceived as social-ecological systems (cf. Andersson, Barthel, and Ahrne 2007, p. 1267; Ernston, Sörlin, and Elmqvist 2008, p. 1; Gatzweiler 2006, p. 300; Henocque 2013, p. 66; Levin 1998, p. 432–434; 1999, p. 1; Mincey et al. 2013, p. 554; Schultz, Duit, and Folke 2011, p. 662; Stenseke 2009, p. 215; Tuschiya, Okuro, and Takeuchi 2013, p. 87; Vatn 2010, p. 1245), and

(vi) social-ecological systems are path-dependent, non-linear, self-organizing, multi-scalar, dynamic, and adaptive systems (cf. Berkes 2010, p. 494; Galaz 2012, p. 193; Gatzweiler 2006, p. 297; Hill et al. 2010, pp. 74, 80; Levin 1998, p. 432–434; 1999, p. 1; Ostrom 1990, p. 88; Peterson, Cumming, and Carpenter 2003, p. 359; Pilgrim, Smith, and Pretty 2007, p. 1743; Plummer and Fennell 2007, p. 947; Schultz, Duit, and Folke 2011, p. 662; Stenseke 2009, p. 215; Tuschiya, Okuro, and Takeuchi 2013, p. 87).

In short: ecological systems are important and endangered, but their management is, due to the involved complexity, a 'wicked problem' (Ludwig 2001, p. 759). It is therefore extremely unlikely that, similar to the multi-dimensional endeavors that address the lack of community cohesion and the issues of social exclusion (cf. Stame 2004, p. 69), a single actor or a single discipline alone is capable of managing larger ecological systems adequately (cf. Berkes 2010, p. 490; Cullen-Unsworth et al. 2012, pp. 351–352; Ostrom 1990, p. 88; Plummer and Fennell 2007, p. 947; Spak 2005, p. 234). Furthermore, their interrelatedness in terms of input-output relationships of ecosystem services, which, in addition, cross administrative boundaries, indicates that local outcomes depend on values and needs that have influenced decisions made elsewhere (cf. Andersson, Barthel, and Ahrne 2007, pp. 1274–1275; Bolund and Hunhammar 1999, pp. 299–300; McGranahan et al. 2005, p. 798; Strohbach, Lerman, and Warren 2013, p. 70). One imaginable direction in which a possible solution might unfold is the centralization of governance functions, i.e., to put higher levels of the public sector hierarchy in charge of managing the focal ecological systems. However, it is argued that this institutional configuration is, as already indicated in section 10.2, too inflexible (cf. Armitage, Marschke, and Plummer 2008, p. 87; Berkes 2010, p. 494; Carlsson and Berkes 2005, pp. 71, 73–74; Henocque 2013, p. 67; Stern 2005, p. 981) and delegates responsibility to actors who are too remote (cf. Bodin, Crona, and Ernston 2006, p. 3–4; Cullen-Unsworth et al. 2012, p. 351; Dash, Dash, and Kara 2011, p. 257; Ernston, Sörlin, and Elmqvist 2008, pp. 16–17, 20; Hill et al. 2012, p. 2; Pilgrim, Smith, and Pretty 2007, p. 1742; Uphoff 1986, p. 23) to deal with the wicked nature of the problem. In contrast, what is required is a platform that supports the formation of a flexible, cross-level network of those actors who have a stake in the focal ecological system and on which different knowledge sources can be integrated (Robinson and Wallington 2012, p. 1) to organize dispersed, aligned, and adequately informed collective action. Such an arrangement is, as indicated above, not fixed and plannable, but evolves over time through the experimental learning based on cooperative projects (cf. Carlsson and Berkes 2005, p. 74; Henocque 2013, p. 67), i.e., it is an 'evolutionary product' (Stenseke 2009, p. 221). In other words, it differs considerably from the governance systems based on the political hierarchy, that is, from the first mentioned avenue to address the challenges of managing a larger area of interconnected and interdependent ecological systems:

> "[T]he network approach to co-management and governance is built on a different logic than political-administrative hierarchy. While the latter is built on the assumption that the system is ready-made and can be used for specific management purposes, co-management is a vehicle that is constantly constructed and rebuilt" (Carlsson and Berkes 2005, p. 70).

What Carlsson and Berkes are referring to is the distinction of decision-making and problem solving, the latter generating the options for the former, which H. A. Simon (1978b, 1988, 1992) has explicated in preparation for the elaboration of the 'bounded rationality' concept:

> "Complexity is deep in the nature of things, and discovering tolerable approximation procedures and heuristics that permit huge spaces to be searched very selectively lies at the heart of intelligence [...]. A theory of rationality that does not give an account of problem solving in the face of complexity is sadly incomplete. It is worse than incomplete; it can be seriously misleading by providing 'solutions' to economic [and other] questions that are without operational significance" (H. A. Simon 1978b, p. 12).

A co-management arrangement, although not explicitly referring to it as such, is one of the solutions H. A. Simon (1992, p. 353–354) suggests as an approximation heuristic that is capable of dealing 'intelligently' with complex matters: "divide up the decision-making task among many specialists [... and coordinate] their work by means of a structure of communications and authority relations" (p. 354). From this stance, co-management can be understood as an arrangement that involves several interacting and communicating actors, each considered to be a specialist in certain aspects of the focal issue, who negotiate and finally generate options for decision-making. Hence, a co-management arrangement is one of the 'procedural means' that the public sector can employ to overcome the challenges emerging from the 'serial processing' of 'interrelated problems' (cf. H. A. Simon 1978b, p. 13):

> "For many purposes, a modern government can be regarded as a parallel computing device. While one part of its capability for rational problem solving is directed to fire protection, another is directed to paving highways, and another to collecting refuse. For other important purposes, a government, like a human being, is a serial processing system, capable of attending to only one thing at a time. When important new policies must be formulated, public and official attention must be focused on one or a few matters. Other concerns, no matter how pressing, must wait their turn on the agenda. When the agenda becomes crowded, public life begins to appear more and more as a succession of crises. When problems become interrelated, as energy and pollution problems have become, there is the constant danger that attention directed to a single facet of the web will span solutions disregard vital consequences for the other facets [...]. It is futile to talk about substantive rationality in public affairs without considering what procedural means are available to order issues on the public agenda in a rational way, and to ensure attention to the indirect consequences of actions taken to reach specific goals or solve specific problems" (H. A. Simon 1988, pp. 72–73).

However, this dissociation of co-management arrangements and traditional public sector decision-making should not imply that actors involved in the former do not make any choices; rather, it means that instead of one selection, many decentralized but aligned decisions are made by dispersed actor. In other words, policy options are not devised in intermediary organizations, fed into the public sector hierarchy, and undifferentiatedly imposed on various regions (see section 10.2), but they are negotiated between representatives of directly affected stakeholders and aligned, under consideration of the common goal, to the peculiarities of different areas. Although such an institutional configuration is less common than the organization outlined in the 'factual world', the case studies summarized in table 10.6 suggest that such co-management arrangements are indeed possible. Nevertheless, as indicated above, they are the result of path-dependent processes, which, in turn, explains why concrete realizations exhibit considerable variations. Thus, the following will concentrate on those commonly shared features that capture, in respect to the design of technical systems, relevant interactions between the initiative and other actors involved in such governance arrangements.

One such, in regard to the design of a reference architecture that supports the initiative's decision-making processes, important aspect concerns the knowledge source that underpins negotiations and the organization of collective action. Although it is generally recognized that scientific input is pivotal to enhance the understanding of effects that actions have in interrelated and interconnected social-ecological systems (cf. Stern 2005, p. 977), there are at least two hinderences that render a purely technocratic approach questionable:

Firstly, the path-dependent, multi-scalar character of (social)-ecological systems limits the ability of scientific endeavors to provide a comprehensive information basis:

> "Since effective sampling of all of the world's ecosystems is impossible, management practices imposed by state systems are often based upon conceptual theory of sustainability combined with periodic surveys rather than generations of observations. The synthesis of local knowledge on site permits anticipation and rapid response to sudden environmental shifts, unlike state theory, whereby changes are only detected when they reach large-scale shifts [...]" (Pilgrim, Smith, and Pretty 2007, p. 1743).

Although this argument contains a grain of truth, it needs to be qualified, because not all changes become visible at the local level (e.g., the effects of carbon dioxide emissions on the climate as discussed in section 5.5). Rather, the local ecological knowledge gathered by local citizens who directly engage with ecological systems needs to be integrated with the data collected in conventional scientific inquiries. Such a cooperation is not only beneficial for local citizen, but the exchange works in both directions (Fernandez-Gimenez, Huntington, and Frost 2006, pp. 308–310): local ecological knowledge can substantially enrich scientific inquiries by estimating stocks, predicting trends, gathering levels of resource appropriation, analyzing migratory behavior, etc. However, the integration is by no means an easy process, because local ecological knowledge is often interwoven with values (cf. Boyd et al. 2013, p. 823; Henocque 2013, p. 66; Jim 2013, p. 324; Schultz, Duit, and Folke 2011, p. 662), which are irreconcilable with, as manifested in the value-freedom postulate, scientific practice that aims to deliver, in contrast to the 'inferior' value-ladden knowledge, 'objective' results (see sections 5.3 and 7.1). Although the aspiration is itself questionable, the demand to consider only generalized and 'objective' results as informative deliberately excludes contextual peculiarities; a practice that local citizens often perceive as inadequate (cf. Collins et al. 2007, p. 571). In fact, science is seldom seen as a neutral endeavor; rather, it is understood as a power instrument (cf. Fernandez-Gimenez, Huntington, and Frost 2006, pp. 310–311; Hill et al. 2012, p. 11; Spak 2005, pp. 238–243), which is used to advance particular interests:

> "When an issue becomes highly controversial—when it is surrounded by uncertainties and conflicting values—then expertness is very hard to come by, and it is no longer easy to legitimate the experts. In these circumstances we find that there are experts for the affirmative and experts for the negative" (H. A. Simon 1983, p. 97).

Secondly and closely related to science's inability to deliver 'objective' results are, as Stern (2005, pp. 977–978) points out, the side-effects the realization of a policy option entails: impacts are multi-dimensional and affect, due to incommensurable value positions (see section 5.5), different groups differently, which, in turn, implies inequitable outcomes (see also Krasny, Tidball, and Sriskandarajah 2009, p. 2). He further argues that

> "[w]hen people have these kinds of disparate values or interests, they tend to offer conflicting judgments on the importance, the usefulness, the completeness, and even the meaning of currently available information and on what else must be known to make a well-informed choice" (Stern 2005, p. 977).

In respect to the present concern, this challenge is particularly complex, because ecological systems cross the boundaries of urban, peri-urban, and rural areas (cf. Andersson, Barthel, and Ahrne 2007, pp. 1274–1275; Bolund and Hunhammar 1999, pp. 299–300; McGranahan et al. 2005, p. 798; Strohbach, Lerman, and Warren 2013, p. 70). Therefore, the values and perspectives of numerous different stakeholders need to be taken into account and, in addition, influence the direction of scientific research endeavors. Nevertheless, Stern (2005, p. 977) argues that the latter still makes important contributions, because "human choices set in motion processes that conform to natural laws", which, by virtue of their nature, provide, at least to certain degrees, an intersubjective basis for discussion. In combination with Stern's call for broader participation in the governance of ecological systems (see also Hill et al. 2010, p. 74), this argument can, in reference to the afore-mentioned interconnectedness of social and ecological systems, be extended as follows: actions not only set in motion processes that are governed by natural laws, they also change social structures, which, in turn, set in motion unpredictable, social processes, i.e., processes not covered by laws (see chapter 7). Furthermore, taking into account the second-order and rebound-effects discussed in sections 5.5 and 10.2, broader participation is not only required to direct scientific inquiry and interpret its results, it is also necessary to anticipate potential second-order effects as well as to build awareness and to ensure compliance, which are both essential to avoid rebound-effects.

In other words, these two challenges suggest, borrowing the title of Ludwig's famous article, that "The Era of Management Is Over" (Ludwig 2001), i.e., if the noble, but technocratic enterprise initiated by Comte ([1851] 1875, [1852] 1875, [1853] 1876, [1854] 1877, [1848] 1908) has not failed, it certainly has reached its limits in respect to the governance of larger ecological systems. Co-management arrangements aim to overcome these shortcomings by deviating from the attempt to base decisions solely on 'objective' data in several respects:

(i) they acknowledge that scientific inquiries can inform the management process partially (e.g., monitoring large scale system changes), but they recognize that these efforts need to be complemented by local ecological knowledge, which is, inter alia, necessary to identify the 'tyranny of small steps', that is, (unintended) smaller scale changes of ecological systems resulting from certain usage scenarios (e.g., parking on green areas) (see also Bodin, Crona, and Ernston 2006, p. 3–4; Cullen-Unsworth et al. 2012, p. 351; Dash, Dash, and Kara 2011, p. 257; Ernston, Sörlin, and Elmqvist 2008, pp. 16–17, 20; Hill et al. 2012, p. 2; Pilgrim, Smith, and Pretty 2007, p. 1742);

(ii) they emphasize the importance of an institutional configuration that allows for cross-scale management of ecological systems, because such an organization is better suited to incorporate new information in a timely manner, which is, in turn, the foundation to increase the governance system's responsiveness to changing circumstances (cf. Armitage, Marschke, and Plummer 2008, p. 87; Berkes 2010, p. 494; Carlsson and Berkes 2005, pp. 71, 73–74; Henocque 2013, p. 67; Stern 2005, p. 981);

(iii) they notice the path-dependency of ecological systems as well as context-specific factors (e.g., values, socio-economic conditions, etc.), which suggest that adapted solutions are required not only to account for the multiplicity of different pathways, to respect values and interests of local citizens, and to ensure the latter's compliance[313], but also to increase ecological systems' diversity and redundancy to enhance, in the sense of Campbell's "Reforms as Experiments" (Campbell 1969), their resilience[314], which, in turn, can be perceived as an insurance against uncertainty (cf. Andersson and Ostrom 2008, pp. 73, 78; Armitage, Marschke, and Plummer 2008, p. 87; Carlsson and Berkes 2005, p. 72; Cullen-Unsworth et al. 2012, pp. 351–352; Dash, Dash, and Kara 2011, p. 257; Folke, Holling, and Perrings 1996, pp. 1021–1022; Gatzweiler 2006, p. 297–298; Hill et al. 2010, p. 74; Krasny, Tidball, and Sriskandarajah 2009, p. 2; Levin 1999, p. 2; Loreau, Mouquet, and Gonzalez 2003, p. 12765; Newig and Fritsch 2009, p. 206; Ostrom 2012, pp. 128, 138; Plummer and FitzGibbon 2004, pp. 881–882; Rama and Theesfeld 2011, p. 383; Sandberg 2007, p. 614),

(iv) they foster heterogeneity, transparency, and accessibility to enhance the knowledge base, to incorporate all relevant perspectives, to allow for different interpretations of gathered data, to enhance legitimacy, and to ease the identification of violations of established standards (cf. Bodin, Crona, and Ernston 2006, p. 3–4; Ernston, Sörlin, and Elmqvist 2008, pp. 16–17; Newig and Fritsch 2009, p. 198; Ostrom 2012, p. 138; Plummer and FitzGibbon 2004, pp. 881–882; Rama and Theesfeld 2011, p. 383; Schultz, Duit, and Folke 2011, p. 668; Stern 2005, pp. 980–982), and

(v) they highlight that managing ecological systems is not only about resources and the distribution of entitlements, but that building human capacity in localities is pivotal to foster social learning and to create adaptive capacities[315], which are, in addition to

313. However, as Newig and Fritsch (2009, p. 206) point out in their meta-analysis of co-management arrangements, improved compliance tends to correlate with lower environmental standards: involving private actors, in their case mainly business organizations, in addition to public sector officials tends to accelerate the decision-making process and to enhance the former's compliance, but this is often achieved by lowering environmental standards, i.e., private actors agree to respect lowered environmental standards to avoid expensive and prolonged court trails.

314. Resilience can be, following Krasny, Tidball, and Sriskandarajah (2009, p. 2), defined as "the capacity of social-ecological systems to buffer perturbances and to renew and reorganize in response to change [. . .]. The capacity to reorganize depends in part on the ability to incorporate diverse forms of knowledge into management decisions and to learn adaptively [. . .]" (see also Henocque 2013, p. 66).

315. Armitage et al. (2011, p. 996) define an adaptive capacity as "the ability of an individual or group (i.e., community) to cope with, prepare for, and/or adapt to disturbance and uncertain socio-ecological conditions" (see also Raymond and Cleary 2013, p. 1). They further point out that important determinants are the ability of local citizens to respond to changes via institutional arrangements such as decision-making, information exchange and knowledge acquisition, and the transfer of resources. Andersson, Barthel, and Ahrne (2007, p. 1276) add that the type of the property-rights regime is also an important indicator of the flexibility with which management practices can be adapted to changing circumstances: collectively managed green urban commons and privately owned green areas (e.g., allotment gardens) tend to be more adaptive than, for example, public sector managed parks, because the latter is not only bounded to bureaucratic procedures, but also because the information usually flows only unidirectional from the local administration to the private contractor to whom the day-to-day business is outsourced.

their instrumental importance in respect to the former four aspects, essential to realize local development's ultimate goal, that is, to enhance local citizens' freedom and self-determination (cf. Armitage, Marschke, and Plummer 2008, p. 87; Armitage et al. 2011, pp. 995–996; Bawa, Seidler, and Raven 2004, p. 859; Bodin, Crona, and Ernston 2006, pp. 3–4; Carlsson and Berkes 2005, pp. 67, 74; Lyver 2005, p. 366; Henocque 2013, p. 67; Hill et al. 2010, p. 74; Plummer and FitzGibbon 2004, pp. 881–882).

However, although there is a need to extend public sector decision-making by deliberative local processes, which, in addition, should have, following from the subsidiarity principle, certain degrees of freedom to make their own decisions, the creation of co-management arrangements is not a call to completely reform democratically organized political systems; rather, even if it is recognized that urgent policy needs, i.e., issues that involve high costs if postponed, require a legitimate settings in which rapid choices can be made (Stern 2005, p. 977), the unequal influence different private actors can exercise on the public sector to advance their interests requires a rebalancing change (see also Fisch 2005, pp. 1558–1562):

> "There is, for example, imbalance [. . .] between large corporations and unorganized neighborhood groups whose health and welfare may be affected by corporate activities" (Stern 2005, p. 982).

The influence that, as indicated in section 10.2, the naturally better organized and financially well-equipped corporate actors exercise on political decision-making can, for example, lead to the formation of collective action as a response to perceived 'dilemmas' or 'crises' (cf. Berkes 2010, p. 495; Ernston, Sörlin, and Elmqvist 2008, p. 4; Plummer and FitzGibbon 2004, pp. 878–879; Spak 2005, p. 233), i.e., situations that are similar to the ones that open up the initiative windows specified in the discussion of the first intervention entry point. However, instead of organizing local development efforts, the goal in this case is to create a stable and durable conflict resolution mechanism between the public sector and local citizens. In other words, the establishment of a co-management arrangement to govern larger ecological systems aims to give the directly affected local citizens opportunities to influence political decision-making that are comparable to the ones that the representatives of large, distant corporations have (cf. Enengel et al. 2011, p. 1256; Spak 2005, p. 239; Stenseke 2009, p. 215). Only if there is a more balanced division of power, there will be "a reason for creating norms and institutions to seek shared understanding" (Stern 2005, p. 980).

Although the various case studies listed in table 10.6 indicate that such arrangements can be created, they describe the steps involved in their genesis only partially. A case study that explicates this perspective more thoroughly is the Cordilla Azual National Park case study in Peru (Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010). Although this inquiry actually does not fulfill the conditions to be included in the realist synthesis, e.g., it is located in a 'developing' country and the arrangement differs in some respects from the one envisioned for the 'possible world', it was nevertheless included retrospectively, because it allows to carve out the relationship between facets involved in the creation of co-management arrangements that are only implicit and/or dispersed in the other case studies discussed in the following.

Correspondingly, it is mainly included to illustrate some aspects of the evolution of such an institutional configuration. Rodríguez-Izquierdo, Gavin, and Macedo-Bravo (2010, pp. 242–244) divide the latter into three stages. In the first phase, which ends with the creation of the park, the activists carried out an inventory analysis in the region that later became the protected area and they lobbied the national government to establish the park. Although the latter was unsuccessful at first, a corruption scandal late in 2000 led to the downfall of the national government and the newly established interim government was more susceptible to the activists' endeavor. In other words, the incident opened up an opportunity, which the activists used to create the national park. However, they point out that this phase did not involve, due to the time constraints, local citizens (see also Sandberg 2007, p. 614):

> "As [. . . the key] proponent of the Park's establishment noted: '(Communities) were not too involved in the Park's establishment. We had to rush to establish the Park. .. It is not easy to establish a Park, and we had a window of time and political will of the minister to establish the Park; and we took it to the fullest [. . .]' [adapted brackets]" (Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, p. 244).

This changed to some degree in the second stage, in which the leading NGO, in cooperation with the respective national administration agency, created a zoning plan by carrying out a technique that combined "participatory social asset mapping with resource use mapping in order to obtain socioeconomic and geographic information about the communities surrounding" the park (p. 243)[316]. In the terminology of the ladder of participation (Arnstein 1969, p. 217) discussed in section 10.2, the changing nature of participation can be framed as a shift from non-participation to consultation, that is, to a form of tokenism. However, higher levels of 'citizen power', which are constitutive for the afore-mentioned co-management arrangements, were achieved only in the third stage of the park's formation. Within this phase the NGO, inter alia, initiated the creation of a management committee that involved representatives of all localities to ensure that local citizens are actively involved in the exercise of governance functions. This is, as Rodríguez-Izquierdo, Gavin, and Macedo-Bravo (2010, p. 247) point out, an example of how civil society organizations can adaptively manage the involvement of local citizens in co-management arrangements.

Besides this latter aspect and its relationship to the incident that opened up the opportunity to form a co-management arrangement, this case exhibits some further features that it has in common with the afore-mentioned Prinzessinnengarten case study (Bendt, Barthel, and Colding 2013): both share, for example, that a small and loosely coupled network of actors gathered and claimed land. Spak (2005, pp. 235–236) distinguishes such land-claim-based co-management arrangements from those that emerge in response to a real or perceived crisis. However, as indicated by the Prinzessinnengarten case study (Bendt, Barthel, and Colding 2013), land-claim-based endeavors can be interpreted as a form of crisis-based evolution, because urban citizens felt that the accelerated privatization of state property reduced the ability to access green areas. A similar lens can be applied to indigenous land-claim-based co-management arrangements[317], because indigenous populations tend to see the transformation of land itself as well as the inability to use this land in its traditional way as a threat to their self-determination (see sections 5.5 and 10.2). Therefore, the emergence of co-management arrangements can be understood, similar to the initiative window introduced in the discussion of the possibility assessment and synthesizing design of the first intervention entry point, as response to a real or perceived crisis that requires the establishment of a conflict resolution

316. See also Hall et al. (2010, pp. 764–766) and their discussion of MapChat, a Web 2.0-based tool supporting such participatory mapping exercises.

317. This type of co-management arrangement is common in those 'developed' countries that share a history of European colonization (Ohlson et al. 2008, p. 431), which includes, inter alia, the USA, Canada, Australia, and New Zealand. There is a lot to learn for 'modern citizens' from the struggle indigenous populations had to have their say in policy making, which, as Ohlson et al. (2008, p. 431) point out, eventually lead, at least in the USA, to their acceptance and formal recognition as equal partners, that is, a public sector-indigenous population cooperation is comparable to a government-to-government cooperation.

mechanism (cf. Spak 2005, p. 236). This, however, does not imply that only local citizens can react to crises; rather, the public sector can also initiate, comparable to the NGO in the Cordilla Azual National Park case study (Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010), the formation of such arrangements in anticipation of probable crises (cf. Plummer and FitzGibbon 2004, p. 876). In reference to the typology introduced by Hill et al. (2012, pp. 5–6), these two types of arrangements can be referred to as local citizen-driven co-management arrangement and as local citizen governance system. Although both differ in respect to their origin, they still have in common that they involve, as indicated above, public sector and civil society actors who together govern a focal ecological system. Yet, such an arrangement goes beyond the afore-mentioned public sector-civil society partnership or cooperation (cf. Ohlson et al. 2008, p. 435; Plummer and Fennell 2007, p. 951, and table 10.5): whereas the latter only demands a shared goal at which activities can be aligned, the former is based on a legally established right in regard to the management of an ecological system, which, in turn, creates a hybrid form of the discussed idealized property-rights regimes (see Singleton 1998, p. 7; Uphoff 1986, p. 15, and section 10.2). Despite this considerable difference, co-management arrangements and public sector-civil society partnerships are internally related:

> "[C]o-management is not only about new institutions, but more fundamentally about the new relationships resulting from them. Institutions and legal arrangements can only permit, support, and create incentives for new relationships: it is the new relationships which generate the communication, trust, and willingness to risk innovation which make the benefits of co-management actually materialize" (Pinkerton 1989, p. 8).

As indicated in the discussions of the two preceding intervention entry points, such long-standing, reciprocal relationships are the result of successful cooperative efforts (see also Bodin, Crona, and Ernston 2006, pp. 3–4; Plummer and Fennell 2007, p. 952; Plummer and FitzGibbon 2004, pp. 878–883). Correspondingly, a constitutive element of a co-management arrangement is, in addition to the distribution of governance functions among the involved actors, the network of relationships that have been created through the various projects civil society organizations have carried out with different actors in the public sector hierarchy. This, in turn, suggests that co-management arrangements are path-dependent institutional configurations bound to a specific context. Although this feature makes the extraction of draft meanings and organizational options challenging, the following uses a curtailed version of the framework Carlsson and Berkes (2005, pp. 73–74) propose for the analysis and improvement of existing co-management arrangements to organize the synthesizing design. The suggested approach includes the following six steps: (i) define the focal social-ecological system, (ii) identify required governance functions and their relationship, (iii) determine participants of the co-management arrangement, (iv) analyze relationships between identified actors, (v) evaluate capacity building needs, and (vi) prescribe remedies. Whereas the latter two activities require to analyze a factually existing context—not given in the present case—, the former four tasks are used to structure the discussion of the extracted fragments of evidence in the remainder of this section.

In regard to the above-mentioned, lower-level co-management arrangement the focal social-ecological systems are community gardens, i.e., a form of urban green common, that provide an equally accessible physical space, function as point of contact, and give urban local citizens the opportunity to get in touch with ecological systems. However, the SD dimension of the SHD conceptualization discussed in section 5.5 demands to go further than this;

it requires to tackle issues emerging on different spatiotemporal scales (Newig and Fritsch 2009, p. 198), that is, local problems (e.g., hazardous waste sites), regional difficulties (e.g., the water quality in a river basin), and global challenges (e.g., climate change). The present inquiry excludes, for reasons outlined above, the third of these categories and instead concentrates on the former two. Uphoff (1986, p. 21) states that within this complex the following five governance domains, which, in turn, define specific ecological systems, are of primary importance: (i) social forest management[318] (e.g., forests), (ii) rangeland management (e.g., grasses), (iii) irrigation water management (e.g., the acquisition and distribution of water for agriculture), (iv) watershed management (e.g., the regional water cycle), and (v) soil conservation (e.g., landscapes[319], such as croplands, that are continuously deprived of nutrients). In respect to the urban focus of the second research project (see sections 2.1 and 10.1), this broad classification can be, following Bolund and Hunhammar (1999, pp. 293–294), refined in regard to the ecological systems that are typically found in urban territories: (i) small green areas such as, for example, pavement surrounded street trees or stone walls (cf. Jim 2013, p. 325)[320], (ii) lawns/parks, i.e., all larger green areas that are deliberately managed and that comprise a mixture of grass, trees, and other plants (e.g., parks, zoos, cemeteries, playgrounds, golf courses, ponds, etc.); (iii) (social) urban forests, that is, all less managed zones that are, in addition, more densely populated with trees than the areas covered by (ii); and (iv) cultivated land, which can be, despite a considerable overlap, distinguished from areas belonging to the lawns/parks category in regard to their function, i.e., the former are, in contrast to the latter, primarily used to grow food items (e.g., gardens or allotment gardens). In addition to these four greening spaces, Bolund and Hunhammar state that there are three further areas, namely wetlands, streams, and lakes/seas, which are, because they can be found in almost all urban territories[321], grouped into the blue area category (v). The ecological systems within all these five categories typically provide, according to Bolund and Hunhammar (1999, pp. 295– 299), those urban-relevant services that are, based on the 17 general ecosystem services distinguished by Costanza et al. (1997, p. 254), summarized in table 10.7 (cf. Andersson, Barthel, and Ahrne 2007, p. 1267; Mincey et al. 2013, p. 554).

As table 10.7 indicates, there are not only ethical reasons to maintain and enhance ecological systems in urban areas, the latter are, due to the provided services, also instrumentally important for cities and their inhabitants (cf. Burrage 2011, p. 168). Although some portion of these services could be replaced by private or public sector service provisioning, the burden is enormous: Costanza et al. (1997, p. 259) state that, conservatively estimated, the economic value of the world's ecosystem services lies between \$ 16 and \$ 54 trillion (see also Gallai et al. 2009; TEEB 2009, for more recent studies)[322]. Nevertheless, the key difficulty in respect to the second aspect of co-management arrangements is that ecological systems are,

318. The prefix 'social' is, following Uphoff (1986, p. 40), added to distinguish the economically directed management of ecological systems that belong to this category, from those arrangements that are created to sustain and maintain the, for example, socio-cultural and/or recreational value of forests (see also table 10.7).

319. The term 'landscape' refers to ecological systems that are shaped by years of human influence. In particular, the term can be, following the European Council (2008, p. 9), defined as an area "whose character is the result of the action and interaction of natural and/or human factors" (see also Enengel et al. 2011, p. 1257, and section 5.5).

320. Although it is pointed out that street trees are, because they cannot provide an adequate living space for urban fauna (see also Strohbach, Lerman, and Warren 2013, p. 76–78), too small to be considered as a single ecosystem, they are nevertheless embedded in comprehensive urban greening plans, because they help to maintain and enhance urban biodiversity by provinding vital connections between the dispersed ecosystems in urban areas for some species such as birds (cf. Evans, Newson, and Gaston 2009, p. 19; Strohbach, Lerman, and Warren 2013, p. 70).

321. McGranahan et al. (2005, pp. 798, 801) argue that the world's cities are located close to these areas, because blue areas provide, in addition to transporation benefits, a wealth of ecological services.

322. See Spash (2008, 2011) for a critical reflection of such valuation approaches.

Table 10.7: Urban Ecosystems and their Services, adapted from: Bolund and Hunhammar (1999, p. 299)

	Small Green Areas	Lawns/Parks	Urban Forest	Cultivated Land	Blue Areas
Air Filtering (Gas Regulation)	X	X	X	X	X
Micro Climate Regulation	X	X	X	X	X
Noise Reduction (Disturbance Regulation)	X	X	X	X	X
Rainwater Drainage (Water Regulation)		X	X	X	X
Sewage Treatment (Waste Treatment)					X
Socio-Cultural Values	X	X	X	X	X

in addition to the scattering across the urban territory, fragmented through different property-rights regimes (see also McGranahan et al. 2005, p. 808; Tuschiya, Okuro, and Takeuchi 2013, p. 88, and section 10.2):

> "Specifically, urban forests are fragmented into a multifaceted matrix of property rights and management strategies subject to a myriad of actors and their associated governance regimes. Within many cities, the majority of private property parcels and their trees are owned and managed by individuals, while some private parcels exist under shared ownership and management, and numerous public property parcels are owned and managed by public entities but often heavily used by the general public" (Mincey et al. 2013, p. 561).

In other words, a larger ecological system is divided into several parts that are controlled by different actors, who, inter alia[323], employ a range of management practices to maintain, protect, and improve their chunk of the ecological system as the comparative case study of Andersson, Barthel, and Ahrne (2007, pp. 1267–1268) indicates. Although this variety enhances the overall biodiversity (cf. Andersson, Barthel, and Ahrne 2007, p. 1274; McGranahan et al. 2005, p. 808) and satisfies divergent social preferences (cf. Colding et al. 2013, pp. 1047–104), it nevertheless reduces the ability of the focal ecological system to provide ecosystem services (Ernston, Sörlin, and Elmqvist 2008, p. 1). This, in turn, suggests that a particular important governance function is to ensure that the fragmented parts of a larger ecological system are managed in a way that the system can maintain its ability to produce ecosystem services. As Mincey et al. (2013, p. 561) indicate in their analysis of urban forests (see also Andersson, Barthel, and Ahrne 2007, p. 1272; Colding et al. 2013, p. 1043, for other urban ecological systems), social norms are pivotal to achieve this aim:

> "Unless a community—individuals, associations, and governments—has established institutions that operate across scales [. . .] to incentivize sustainable management of urban trees, it may struggle to influence the structure of the urban forest as a whole and its functional provision of

323. Other dimension along which actors can be differentiated, include, for example, attachment to the place, the level of ecoliteracy, or the frequency of exercising management functions (cf. Andersson, Barthel, and Ahrne 2007, pp. 1271–1274; Colding et al. 2013, p. 1043).

ecosystem services" (Mincey et al. 2013, p. 562).

As outlined in the discussions of the possibility assessments and synthesizing designs of the two preceding intervention entry points (see also chapter 2 and section 5.5), social norms are the result of discourses in which participants exchange arguments to convince each other that a certain behavior is in the interest of the common good. In other words, the co-management arrangement needs, inter alia, to provide a communication platform on which the different actors involved in the governance of ecological systems can devise social norms and organize collective action to create or change social structures to ensure that the ecological system is managed in a way that satisfies the demands of SHD (see also Andersson and Ostrom 2008, p. 80). Figure 10.14, illustrating the actors involved in the governance of urban forests, suggests that this requires to motivate a wide-range of different stakeholders to participate in the envisioned co-management arrangement.

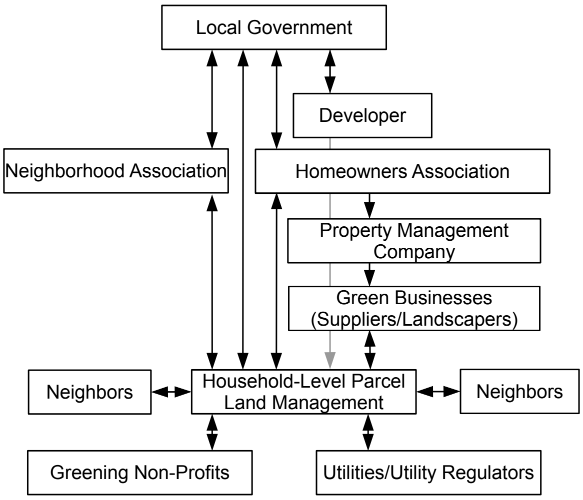

Figure 10.14: Actors in Urban Forest Management, source: Mincey et al. (2013, p. 561)

One of the early contributions that structures this diversity of actors who can and probably should be involved in a co-management arrangement distinguishes the following four classes of stakeholders (World Bank 1999, p. 11): (i) private sector entities, (ii) the central government, (iii) the local government, and (iv) civil society actors (see also Gatzweiler 2006, p. 301). Whereas the community-driven development literature frequently describes private sector actors as sponsors [e.g., the Resilience Center case study (Kelly and Caputo 2006)], the literature of co-management arrangements for ecological systems, in contrast, often excludes these entities by concentrating on the remaining stakeholders or frames them as antagonists, who, by taking advantage of commons from which they cannot be excluded, (deliberately) produce externalities to increase their profits (Uphoff 1986, p. 24). Although not all private sector entities produce externalities, the 'need' to measure everything in monetary terms usually leads to, as indicated in the TBL and the human resource criticisms in section 5.5, a narrow view that is irreconcilable with SHD imperatives. Despite this inherent tension, the private sector is also, as Henocque (2013, p. 68) points out, an important potential partner. This, however, requires to establish adequate accountability mechanisms (cf. Ribot, Agrawal, and Larson 2006, pp. 1881–1882), because large (multi-national) enterprises, in contrast to local businesses, often circumvent local actors and their concerns by dealing directly with higher levels of the public sector hierarchy (Sick 2012, pp. 324–325).

The latter actors, who belong to the central government category, are, as indicated in the 'factual world' description (see section 10.1), mainly responsible for providing a suitable institutional environment in which local development can occur: this includes, inter alia, the decentralization of decision-making power, an adequate intra-governmental resource transfer, the establishment of (downward) accountability mechanisms, the provision of technical support, the sharing of information, etc. (see also Ribot, Agrawal, and Larson 2006, pp. 1881–1882, and section 10.2). In other words, central government actors have a facilitating role, i.e., they are seldom actively involved in the envisioned co-management arrangement.

The two remaining categories stand for, as mentioned above, the two central and most frequently mentioned sets of stakeholders (cf. Schultz, Duit, and Folke 2011, p. 664; Uphoff 1986, pp. 23–24): on the one side, the group of civil society actors, which comprises, in addition to the afore-mentioned NGOs, unassociated local citizens or local resource users, and on the other side, local public authorities, i.e., the local government and local branches of the public sector administration (see also section 10.1)[324]. As already indicated in the private sector discussion (see also section 10.1), each of the four classes is used to refer to an internally fragmented network of actors (cf. Carlsson and Berkes 2005, p. 67; Henocque 2013, pp. 68–69; Oakerson and Parks 2011, pp. 147–148; Ostrom, Tiebout, and Warren 1961, p. 842; Ribot, Agrawal, and Larson 2006, p. 1881): the public sector as combination of (ii) and (iii), for example, is not only vertically diversified, but this variety also stretches over the national, federal, and local level; similarly, the civil society infrastructure encompasses, as outlined in the possibility assessment and synthesizing design of the first intervention entry point and the Grand River co-management planning process case study carried out by Armitage, Marschke, and Plummer (2008, p. 90), a wide range of groups that are located on various social units and that have different and often even competing interests. In addition to this internal fragmentation, Carlsson and Berkes (2005, p. 67) point out that there are also numerous formal and informal relationships across these two groups (see also Stenseke 2009, p. 221), which, as indicated by the afore-mentioned public sector-civil society partnerships, increases the complexity and makes it difficult to classify these hybrid structures as belonging to one category exclusively. Nevertheless, although there are many specific actors within these overlapping groups, who can and should be involved in a co-management arrangement, the following three are, in addition to the envisioned initiative, of particular importance to make progress in terms of SHD: firstly, NGOs that represent general concerns, such as the demands of ecological systems or of future generations, are pivotal to avoid, as illustrated by the Boston City-Region case study carried out by Gibbs and Krueger (2012, p. 375), that urban localities and, by implication, their ecological systems are managed purely in economic terms and/or with a short-term perspective; secondly, a free and independent press in the public service provisioning system is, as indicated in sections 2.1 and 10.2, critical to inform local citizens, to facilitate the formation of public opinion, to foster civil engagement, etc. (see also Tuschiya, Okuro, and Takeuchi 2013, p. 96); thirdly, scientific institutions or research centers, which—at least those that are presently relevant[325]—in the above clas-

324. Not only but especially if co-management arrangements are seen as conflict resolution mechanisms, then the judiciary is another actor that is implicitly engaged in such endeavors and that can be, at least in the above schema, classified as belonging to this category. Although courts are not actively involved, they are vital in the formation (e.g., property-rights) and the maintenance of co-management arrangements (e.g., downward accountability). Their role in the latter is, for example, illustrated in one of the biosolid case studies discussed by Goven et al. (2012, p. 157): a New Zealand court declassified the traditional knowledge and the values of indigenous citizens as unscientific, dismissed their case, and thereby enabled the biosolid enterprise of the local government.

325. This excludes, for example, the think tanks and research centers that are, in virtue of their lobbying character,

sification schema can be seen as belonging to the public sector, are important active parts of co-management arrangements, because they, inter alia, collect data about ecosystem services on an aggregated scale, prepare policy options for public sector actors (cf. Henocque 2013, pp. 67–68; Plummer and FitzGibbon 2004, p. 878; Schultz, Duit, and Folke 2011, p. 664), and, as indicated by the reviewed community garden case studies (Bendt, Barthel, and Colding 2013; Krasny, Tidball, and Sriskandarajah 2009), provide—but also benefit from practical training opportunities—indispensable educational services (cf. Henocque 2013, pp. 67–68; Krasny, Tidball, and Sriskandarajah 2009, p. 13).

This rather abstract and by no means complete overview of specific groups that need to be involved in a concrete co-management arrangement already indicates that there are various relationships between actors who carry out formal and informal cooperative efforts that affect ecological systems within a locality and those surrounding it. The lack of coordination and alignment (see also figure 10.3), which emerges from the different visions actors hold is (cf. Henocque 2013, p. 70; Stame 2004, p. 66), if not the principle cause, one of the reasons that make the evaluation of interventions and the reconstruction of their program theories (see section 8.1) the challenging endeavors that they actually are (see Stame 2004, p. 71, and the open system perspective discussed in section 7.3). It further suggests that the explication of relationships between different stakeholders, as demanded by the fourth and—in the present discussion—final criterion of the above-mentioned framework for the analysis and improvement of existing co-management arrangements (Carlsson and Berkes 2005, pp. 73–74), depends on a concrete context. Although such a specific setting is presently not given, which, in turn, might bring to mind to exclude this criterion just like the fifth and sixth one, the following will, in order to demonstrate the possibility of the envisioned co-management arrangement, scrutinize that case study from the ones listed in table 10.6 that exhibits most of the characteristics devised for the 'possible world'.

Although co-management arrangements involve private as well as public sector actors, they are generally perceived as entities that belong to the civil society infrastructure. Within the latter a number of organizations exist that are connected to each other and to the remaining stakeholder groups. If the quantity and the end-points of these connections are used to distinguish different types of civil society actors, then the following continuum emerges (Ernston, Sörlin, and Elmqvist 2008, pp. 7, 11): it spans from the periphery associations, which are mainly involved in concrete community-driven projects and that have strong connections to local citizens or user groups, to the core organizations, which are less actively involved in concrete projects and that have more connections to the public sector. Between these two extremes there are the semi-core actors or hybrid organizations that are directly involved in specific types of collective action and that have, in addition to more relationships to other civil society associations, a more balanced set of connections to the public sector and local user groups. Whereas the initiative devised for the 'possible world' leans more towards the periphery end of the continuum, the envisioned co-management arrangements can be located somewhere on the semi-core and the core side of the continuum.

The case study examined in the following discusses a co-management arrangement in the Mission Beach area in Queensland, Australia, which the authors describe as follows:

> "Context determines the key design challenges, identified at Mission Beach as institutional fragmentation and uncoordinated decision-making, disparate stakeholder perspectives and knowledge systems, com-

closely associated with specific industrial associations or political parties.

peting visions, competing priorities and poor science integration" (Hill et al. 2010, p. 76).

The central element that helped to overcome these challenges is, according to Hill et al. (2010, p. 76)[326], the creation of a 'boundary organization'. This organization is, in turn, a co-management arrangement that exhibits those characteristics that Star and Griesemer ascribe to objects they term 'boundary objects'; the latter can be defined as

> "objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites [. . .]. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. *The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social world* [emphasis added]" (Star and Griesemer 1989, p. 393).

Although the following description of the creation of the Mission Beach boundary organization partially overlaps with, or more precisely builds upon, the Cordilla Azual case study (Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010), it extends the latter's discussion in important respects. These refinements not only allow to explicate in which way a co-management arrangement can exhibit features of a boundary object, but, more importantly, they also allow to carve out how the former can be organized to align the activities of different involved stakeholders—each of which brings in a specific perspective—with an articulated vision for the focal area that these intersecting perspectives embody. The case study's reconstruction follows those six steps that Hill et al. (2010, pp. 77–80) use to describe the boundary organization's construction as well as operation: (i) exploratory analysis, (ii) community ownership and community vision, (iii) identification of options for collective action and prioritization of activities, (iv) implementation partnership, (v) participatory monitoring, and (vi) updating and refining. Each of these steps is examined in turn.

Firstly, the exploratory analysis refers to, thereby resembling the social asset and resource use mapping in the Cordilla Azual case study (cf. Rodríguez-Izquierdo, Gavin, and Macedo-Bravo 2010, p. 243), an inventory analysis of the social-ecological system that hosts the boundary organization (Hill et al. 2010, p. 77). In this case, however, the focus lies on the identification of potential participants, because a key determinant of all co-management arrangements is existing social capital (see also Andersson and Ostrom 2008, pp. 87–88; Gatzweiler 2006, p. 299; Gibbs and Krueger 2012, p. 363; Ostrom 1990, p. 89; Plummer and FitzGibbon 2004, pp. 878–883; Rama and Theesfeld 2011, p. 370; Uphoff 1986, p. 37):

> "The results of the multiple case study reveal that the degree of co-management achieved in the cases, could be explained directly by the level of social capital present. They also showed that social capital continued to increase throughout the evolution of the co-management process" (Plummer and FitzGibbon 2006, p. 59).

As Ernston, Sörlin, and Elmqvist (2008, pp. 16, 20) point out, a particular useful tool in this first step is network analysis. Its aim is to, at least in the present case, identify organizations, even—or precisely—those that are not tightly integrated into the existing civil society infrastructure (e.g., periphery associations) to support relationship building, which, in turn, is

326. They use this term interchangeably with the term 'bridging organization'. Although the latter, which is, for example, discussed in the inquiry carried out by Schultz, Duit, and Folke (2011, p. 662), exhibits similar characteristics, the present elaboration uses the term 'boundary organizations', because a co-management arrangement goes beyond merely bridging or connecting different actors as the following discussion will carve out more thoroughly.

essential to maintain and enhance the co-management arrangement's internal legitimacy, and to find suitable and committed partners to organize collective action (cf. Cullen-Unsworth et al. 2012, p. 361). Furthermore, network analysis, complemented by adequate data collection techniques (e.g., surveys), also provides the informational basis for 'building stakeholding' (Collins and Ison 2009, p. 370), that is, for the reframing of issues to increase their 'attractiveness' for certain groups, which, in turn, enhances the chance that they get actively involved in efforts that address the underlying concern.

The next step in the process of creating a boundary organization is the facilitation of community ownership and the creation of a shared vision (Hill et al. 2010, p. 77): whereas the former is achieved by employing the 'focal species' approach, the latter is realized using a scenario analysis. In respect to the former, the exploratory analysis of the Mission Beach area revealed, as indicated above, that the latter can be characterized as a fragmented or incoherent area, that is, it comprises at least three groups of actors—an indigenous population, other local citizens, and touristic businesses—that have different values and competing perspectives. The goal of establishing "an ecological viable habitat network that protects community values" was achieved, as Hill et al. (2010, p. 77) point out, by a more detailed investigation of the three groups' interests, an analysis from which the "cassowary emerged as an icon of high significance from all three perspectives": the cassowary is not only an integral part of the indigenous population's identity, it is also a 'flagship species' that represents aesthetics and lifestyle values for other local citizens, and it has, in addition, economic relevance, that is, businesses consider it as important for tourism (see also Plummer and Fennell 2007, p. 951). In short, the cassowary was identified as collaborative focal species, i.e., a specific instance of a boundary object, that unfolds a unifying power (see also Plummer and FitzGibbon 2004, pp. 879–880; Robinson and Wallington 2012, p. 3):

> "The term collaborative focal species encapsulates this combined capacity as an ecological focal species, a cultural keystone species and a flagship species, providing community ownership and a unifying focus for transformation of this linked social and ecological system" (Hill et al. 2010, p. 77).

Such a focal species approach is also successfully employed in the investigation carried out by Ohlson et al. In this case a wolf "provided common ground from which the federal and tribal governments could negotiate the cooperative agreement and collaborate on subsequent recovery efforts" (Ohlson et al. 2008, p. 437). However, this technique is not confined to certain animals as the inquiry of Ernston, Sörlin, and Elmqvist demonstrates. Within their case study about 'the protection and management of urban green areas in Stockholm, Sweden,' more holistic 'protective stories', which incorporate different scientifical, biological, cultural, and historical aspects, are created to mobilize and to unify the various, dispersed, and fragmented actors who have a stake in the urban green commons in the larger Stockholm area (Ernston, Sörlin, and Elmqvist 2008, pp. 5–6, 12, 18). Whatever boundary object is used, such initial agreements provide the basis for more formal contracts, e.g., 'memoranda of understanding' (Lyver 2005) or 'urban development agreements' (Doberstein 2011), in which different stakeholder groups document their goodwill and their willingness to work together (Lyver 2005, p. 366). Although the creation of (formal) agreements is a difficult and exhausting endeavor, it is, nevertheless, one of the first collective actions that create an initial stock of social capital between otherwise unrelated actors. The bonding effect that such an activity creates is, for example, indicated in the comparative case study analysis carried out by Plummer and FitzGibbon. In their case the writing of an invitation letter provided the 'initial spark of trust' that eventually lead to the creation of a co-management arrangement:

> "With each shared action, bonding appeared to increase among different groups of actors. Thus, social outings increased and there was more informal dialogue. This development also reinforced the common understanding among actors, shared values, and the impulse to continue bonding with other groups" (Plummer and FitzGibbon 2006, p. 57).

However, as implied by the phrase 'initial spark of trust' in heterogeneous groups, the writing of invitation letters or formal agreements should not be a 'pointless exercise' (Lyver 2005, p. 368); rather, the created foundation should be used to organize collective action, which, if successful, enhances social capital and thereby provides the basis to extend the initial agreement's scope (see Plummer and FitzGibbon 2006, p. 59, and the discussion of the possibility assessment and synthesizing design of the first intervention entry point).

The next exercise in the second step in the formation of a co-management arrangement is to create, based on the results of the preceding phase, a shared vision. As suggested above, the scenario analysis, defined as a "systematic method for thinking creatively about possible complex and uncertain futures" (Peterson, Cumming, and Carpenter 2003, p. 359), is a suitable technique for such an endeavor. Within the Mission Beach case study the scenario analysis was used to show how the projected business-as-usual scenario threatens the commonly valued focal species (Hill et al. 2010, pp. 79–80), that is, to explicate a crisis that binds together the three actors. Although a threat is a particular forceful motivational factor to induce actors to cooperate (Newig and Fritsch 2009, p. 205), the case study carried out by Goven et al. (2012, pp. 160–161) indicates that a scenario analysis can also be used in a positive way: they present a discussion of various ICT-supported scenario workshops in which participants could select one of four abstract, undecided scenarios—each of which pictured a different, possible development path—as a starting point for the concrete planning of the focal area's future. No matter in which way the scenario analysis is used, the important point is that it can be employed to devise a shared vision, which, in turn, functions as a basis for the development of a collective action plan that sketches out how to prevent a certain outcome or to achieve a particular result respectively (cf. Armitage, Marschke, and Plummer 2008, p. 90; Henocque 2013, p. 68; Raymond and Cleary 2013, p. 4). Before the latter will be discussed more thoroughly in the next step, another important aspect inherent to both mentioned case studies needs to be pointed out: in some situations a strong, charismatic leader (cf. Berkes 2010, p. 495; Plummer and FitzGibbon 2004, pp. 879–880; Stenseke 2009, p. 220), either a member of the local elite (Cullen-Unsworth et al. 2012, p. 356)[327] or an external facilitator, is needed to initiate the process in which a shared vision is formed (see also Raymond and Cleary 2013, p. 3, and the 'Effective Technical and Human Implementation of Computer-based Systems (ETHICS)' discussion in section 5.2), to create a safe environment in which communicative action and a common understanding can unfold (see also Stenseke 2009, p. 218–219, and the possibility assessment and synthesizing design of the first intervention entry point), and to encourage participants to express their views (cf. Goven et al. 2012, p. 161; Raymond and Cleary 2013, p. 5). Although the latter increases the chance for disagreement it is nevertheless, at least if not irreconcilable or hampering collective action, vital in the evolution of co-management arrangements (Nooy 2013, pp. 1, 9) and in the endeavor of in-

327. This refers to the 'benevolent elite capture' (Mansuri and Rao 2004, p. 30) discussed in the possibility assessment and synthesizing design of the first intervention entry point.

tegrating different types of knowledge systems (Berkes 2010, p. 495), which is an important facet of the next phase.

However, it is only an instrument in the third step's core process. The latter is, presupposing a safe environment, a deliberative effort that uses the shared vision to identify and prioritize options, i.e., to plan strategic action to avoid the projected threat or to achieve an envisioned future. The integration of knowledge systems then ensures that this process is adequately informed. It requires, as indicated in the specification of important stakeholders, connecting with scientific institutions and research centers, because they can point out promising paths that deliberation can take (Stern 2005, p. 981). Within the Mission Beach case study the following two tools were employed to facilitate this integrative effort (Hill et al. 2010, p. 77): the 'scientific brokering partnerships' and the 'collaborative habitat investment atlas'. Whereas the former aims, by lowering the gap between scientific and lifeworld knowledge, to ease the identification of options, the latter is a technical tool that integrates the diverse and inter-disciplinary research outputs into a dynamic, interactive, and visual model, which local citizens can use to analyze the effect and side-effects of their preferred option (p. 78), i.e., it is, as discussed more thoroughly below, another—this time co-produced—boundary object that supports coordinated collective action (cf. Pert, Lieske, and Hill 2013, pp. 83–87; Robinson and Wallington 2012, pp. 3, 7–8). The scientific brokering partnership, on the other side, is a tool that helps to create the, for the success of co-management arrangements critical (Fernandez-Gimenez, Huntington, and Frost 2006, p. 307) base of reliable and credible knowledge by infusing scientific with local ecological knowledge and vice versa, i.e., it is a technique that aims to overcome the above-mentioned, inherent tension through the 'co-production of knowledge'. The latter can be defined as the "collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or system-oriented understanding of that problem" (Armitage et al. 2011, p. 996). Based on the insights gained in three case studies, Armitage et al. (2011, pp. 997–999) state that such a process involves the following activities (see also Cullen-Unsworth et al. 2012, pp. 356–362; Goven et al. 2012, p. 161): (i) gather data about the current status of the focal ecological system and about employed management practices, (ii) establish working groups to support formal and informal, oral knowledge sharing, (iii) integrate and document collected data, (iv) let different actors interpret and scrutinize created reports, (v) apply synthesized knowledge in the management of the focal ecological system, and (vi) monitor the effect of changes, i.e., start another iteration of the co-production process. The way in which these activities are carried out can either promote or constrain the co-management arrangement's evolution (cf. Armitage et al. 2011, p. 999; Hill et al. 2012, p. 2; Robinson and Wallington 2012, pp. 3, 7–8)[328]. However, as Lyver (2005, p. 367) synthesizes from his case studies, the 'right way' to execute these tasks not only depends on actors' willingness, but it usually entails lengthy capacity building efforts, because local citizens, even those in 'developed'

328. The evolution of a co-management arrangement can be hampered by 'incorrectly' carried out activities, because they can produce negative experiences that erode or 'wipe out' the bonding capital emanating from the 'initial spark of trust' (cf. Plummer and FitzGibbon 2006, pp. 58–59). Examples of inadequately exercised tasks include, inter alia, the following: local citizens solely participate in the gathering of knowledge, instead of being involved in the *joint production* of knowledge (cf. Armitage et al. 2011, p. 999); the use of technical language to document gathered data makes reports inaccessible to local citizens (see also Andersson and Ostrom 2008, p. 76; Armitage et al. 2011, p. 999; Goven et al. 2012, p. 162; Enengel et al. 2011, p. 1259, and the possibility assessment and synthesizing design of the first intervention entry point); preparing knowledge in a scientifically correct way neglects local citizens' preference for orally transmitted, 'vicarious experience' (Stake 1989, pp. 94–96) and often overwrites local citizens' preferences by hiding values, which are inherent and inevitable to scientific inquiries, behind the 'objectiveness' or 'value freeness' cloak (see the discussion above as well as sections 5.3 and 7.2).

countries, often do not have the basic competencies that are required to get actively involved in the co-production of knowledge (see also footnote 15).

Nevertheless, such efforts are worthwhile, because the involvement of local citizens can improve outcomes significantly (Ostrom 2012, p. 133), enhances their level of ecoliteracy (cf. Andersson and Ostrom 2008, p. 75; Andersson, Barthel, and Ahrne 2007, p. 1268; Cullen-Unsworth et al. 2012, p. 351; McGranahan et al. 2005, p. 820; Pilgrim, Smith, and Pretty 2007, p. 1748; Pilgrim et al. 2008, p. 1004), and, more importantly, fosters ownership, which, in turn, manifests itself in higher levels of compliance (see also Armitage et al. 2011, p. 1002; Rama and Theesfeld 2011, p. 383) and, by implication, reduces monitoring and enforcement costs. Within the Mission Beach case study this latter process is supported by the second tool, that is, the collaborative habitat investment atlas. It is an ICT-based platform that gives users the opportunity to share their own goals and, due to the system's and/or participants' feedback, to relate these aims to intentions and interests of other stakeholders. Therefore, the atlas, by virtue of its nature as a boundary object, transforms the co-management arrangement into a boundary organization, i.e., a space where the intersection of actors' perspectives creates (visually) perceptible effects that provide the basis for learning about other views. In other words, the atlas can be understood as a platform that facilitates transformative learning processes (Armitage, Marschke, and Plummer 2008, p. 90), which are, ideally, the result of a comparative assessment of goals and values that leads to a critical reflection of both. This type of learning is not only an essential part of the endeavor to create a safe environment (see Spak 2005, pp. 237–239; Stenseke 2009, p. 239, the former for the other side of the coin) or to lower barriers that hamper inter-group communication (cf. Berkes 2010, p. 495; Nooy 2013, p. 1; Stenseke 2009, pp. 218–219, and the possibility assessment and synthesizing design of the second intervention entry point), but it is also crucial to initiate the afore-mentioned double-loop, group, or social learning process (cf. Armitage, Marschke, and Plummer 2008, p. 88; Armitage et al. 2011, p. 996; Berkes 2010, p. 495; Krasny, Tidball, and Sriskandarajah 2009, pp. 9–10), that is, to give the boundary organization its 'place-based community of learning' (Cullen-Unsworth et al. 2012, p. 361) character. This second type of learning can be distinguished from the afore-mentioned individual or transformative learning as follows: whereas the latter focuses on the psychological aspects of an individual, e.g., reduce prejudices and disconfirm stereotypes through a change of perception and consciousness, the former is concerned with collective action that aims to transform social-ecological systems by changing the governing social structures (see also Oakerson and Parks 2011, p. 153). This, in turn, relates back to the scenario-based planning, because participants of this approach not only devise desirable changes, but they also start to think about how they can actively contribute to realize the envisioned scenarios (Peterson, Cumming, and Carpenter 2003, p. 362). Form this point of view, collective action is, given appropriate conditions, thus the result of and the starting point for social learning. However, it is important that this relationship does not degenerate into a circle, but becomes a spiral in which activities of increasing complexity and scope enhance social capital formation in a fragmented context.

The next step is responsible for such a development actually taking place. Its central task is the organization of collective action to achieve 'material results' (Berkes 2010, p. 496). According to Hill et al. (2010, p. 77), it is important that this process integrates adequate mechanisms, such as offsets, auctions, competitive grants, or tenders, that incentivize the formation of inter-organizational and/or cross-scale partnerships as well as the production of boundary objects (see also Fernandez-Gimenez, Huntington, and Frost 2006, p. 310; Hill et al. 2010, pp. 78–79), because competent co-management arrangements are not created by decentralizing and devolving power but by connecting vertically and horizontally diversified actors (Hill et al. 2010, pp. 80–82). These collaborative projects are not only effective means to synthesize different knowledge sources and to shorten feedback loops (Armitage, Marschke, and Plummer 2008, p. 93), but, by putting the "two actors most concerned with cheating in direct contact with one another" (Ostrom 1990, p. 95), they can also reduce monitoring costs and build trust between these stakeholders (see also Lyver 2005, p. 366). However, as indicated by the spiral of social capital formation, the latter is, due to various factors involved (e.g., language barriers), a lengthy process and presupposes that either actor is willing to share information and power (cf. Cullen-Unsworth et al. 2012, pp. 361–362; Fernandez-Gimenez, Huntington, and Frost 2006, pp. 306, 311–313; Morse, McNamara, and Acholo 2009, pp. 15, 60; Ohlson et al. 2008, p. 436; Robinson and Wallington 2012, pp. 1–2; Spak 2005, pp. 237, 241; Stern 2005, p. 982, and the possibility assessment and synthesizing design of the first intervention entry point). Although it is generally desirable that periphery associations or the local citizens organized within them carry out collective action, for example, to build capacities or to (re-)establish their connectedness to as well as their appreciation of ecological systems (see also Pilgrim, Smith, and Pretty 2007, p. 1748; Pyle 2001, p. 18; 2002, p. 261–262; 2003, pp. 206, 208)[329], there are nevertheless endeavors that exceed their competencies (e.g., technical complexity, specialized equipment). If such tasks then are outsourced to intermediary organizations, it is, as Goven et al. (2012, pp. 160–161) point out, important to establish 'accountability workshops' to make decisions as well as the project's realization transparent and comprehensible.

This directly connects to the fifth phase, whose central activity is to establish a participatory monitoring system that helps to build a shared understanding of the efficacy of collective actions in respect to the created vision (Hill et al. 2010, p. 77). Although the concept of participatory monitoring comprises activities such as the evaluation of the effectiveness of interventions and the collection of data to have an updated overview of the focal ecological system's condition, it goes beyond these tasks and entails efforts, such as collaborative assessments and reviews, mapping activities, the organization of workshops, etc., that aim to intensify created relationships and to share gained insights with other stakeholders. As indicated before, these two outcomes, that is, the enhancement of social capital and the diffusion of information, are two essential success factors of competent co-management arrangements (cf. Ohlson et al. 2008, p. 437; Stenseke 2009, pp. 216, 219–220). This, however, does not imply that the evaluation of interventions is less important; on the contrary, testing assumptions against an 'uninterested', external world facilitates the convergence of different knowledge systems (Robinson and Wallington 2012, pp. 6–8) and, in addition, opens up the opportunity to learn from experience and adapt worldviews accordingly.

Within the Mission Beach case study this activity is institutionalized by the final step, that is, the updating of the atlas[330] (Hill et al. 2010, p. 77). In the course of time, the latter can, therefore, evolve into the co-management arrangement's organizational or 'social memory' (cf. Bodin, Crona, and Ernston 2006, p. 2–4; Smith et al. 2000, pp. 278–280),

329. This, however, equally applies to local citizens who already have high levels of ecoliteracy such as, for example, homeowners with gardens. In such cases the 'property inspects' discussed by Frandsen, Paton, and Sakariassen (2011, p. 27), combined with a prize for the most sustainable garden, can be employed to involve homeowners into co-management arrangements and the collective efforts they are carrying out.

330. However, the insights gained can also be used to create, in the sense of the above-mentioned co-production of knowledge, scientific reports. These reports then can be presented at conferences, which, if done jointly, not only increase the proud of local citizens but also their capacity (Cullen-Unsworth et al. 2012, pp. 356–362).

but this requires, as pointed out in several case studies (e.g., Lyver 2005, p. 367; Ohlson et al. 2008, p. 436; Stenseke 2009, pp. 220, 222), that not only the ecological system's condition is updated, but that the atlas also captures data about the evolution of the network of involved stakeholders, their connections, their competencies, etc. Furthermore, Stenseke (2009, p. 222) argues that there is also a need "to develop mechanisms for documenting and evaluating processes, as well as modes for sharing experiences of working with participatory approaches", because this knowledge often gets lost, as indicated in the possibility assessment and synthesizing design of the first intervention entry point, if actors change positions and therefore are no longer accessible. However, techniques that address this issue are, to the best of the author's knowledge, currently not available. Nevertheless, even without such an extension, the overall goal of this final step is to add a reflexive element to the foregoing process. Such a component is not only critical to avoid the arrangement's maladaptation, but also to initiate further iterations (see also Henocque 2013, p. 71):

> "Each cycle starts with observation and identification of problems and opportunities, leading to action-reflection and further action. *Outcomes of successive plans need to be monitored and evaluated, followed by reflection, to lead to the next cycle*. Each cycle provides new information for the next iteration, and also serves as a learning step, leading to co-management at successively larger scales [...] [emphasis added]" (Berkes 2010, p. 495).

The reflexive touch the final step adds to the above described process and therefore to the social structures it aims to generate is the last ingredient that the latter require to fulfill all the characteristics that Berkes (2010, p. 489) identifies as vital elements of an adaptive co-management arrangement, that is, "deliberation, visioning, building social capital, trust and institutions, capacity-building through networks and partnerships, and action-reflection-action loops for social learning". Instead of a more detailed summary of the foregoing discussion, which will be part of the following intermediate reflection, the elaboration ends with emphasizing two of the most important insights gained in the preceding synthesis. Firstly, the examination shows that

> "most instances of collaborative or joint management of natural resources are more complex and sophisticated than might be concluded from the mainstream image of co-management defined as the sharing of power and responsibility between the government and local resource users. Exchange of information, allocation of resources, as well as a number of other couplings, including more formal agreements, make up particular webs of relations among different actors. These webs have different qualities that can be described in different ways. However, they should be understood as *governance systems* and as such they literally govern specific areas or resource systems [emphasis in the original]" (Carlsson and Berkes 2005).

Secondly, the preceding elaboration and the case studies listed in table 10.6 also demonstrate, in respect to the overall goal of this third and final possibility assessment and synthesizing design, an even more important point, that is, the co-management arrangement envisioned for the 'possible world' is not fictional or utopian; on the contrary, it is indeed possible:

> "adaptive co-management is not simply a theoretical possibility but something that has been documented in a number of forestry, wildlife, protected area, and wetland cases from both developed and developing countries" (Berkes 2010, p. 489).

Intermediate Reflection

The primary aim of the following intermediate reflection is to prepare the foundation for the application of the reference architecture development method outlined in section 8.3, that is, for the design of a reference architecture that functions as a blueprint for the construction of technical systems that support the decision-making processes of instantiations of the envisioned initiative. This includes, in addition to (i) a short recap of the insights gained in the third step of the design of 'possible worlds', which, as indicated above, also serves as a summary of the discussion of the third intervention entry point, (ii) a brief introduction into decision-making processes, and (iii) an explication of the draft meanings and organizational options identified in the possibility assessments and synthesizing designs summarized in (i) in relation to (ii). In the next chapter (iii) will then provide the basis for the construction of the requirements model in form of user stories and use cases.

In regard to (i), besides the excursion to counter an anticipated claim that might be put forward against the human behavior assumed in the current proposal, the preceding possibility assessments and synthesizing designs centered on, inter alia, the following three characteristic facets of the 'possible world': the possibility of (a) community-driven development, (b) a cohesive and socially inclusive locality, and (c) the aligned management of larger, through property-rights fragmented ecological systems. Although all three discussions on the surface are quite different, communicative action (see section 2) is a reoccurring theme: within the community-driven development elaboration it was the basis for reaching an initial agreement on adversely affected valuable living conditions; within the possibility assessment and synthesizing design of community cohesion and social exclusion it manifested itself in the exchange of perspectives and the critical reflection of worldviews for biases and prejudices, that is, for inequalities in believed to be legitimate structures and processes; and within the co-management arrangement discussion, resembling (b) on an organizational level, it is again involved in the creation of an initial agreement in response to a perceived crisis. In other words, communicative action is the mechanism or process that underpins the achievement of an initial agreement, which, due to the acceptance of all involved, receives a legitimate status and unfolds a unifying effect that binds together dispersed and fragmented individuals or groups. It is therefore the very foundation to create the social capital from which (a) and (c), that is, both types of 'socio movements' (Ernston, Sörlin, and Elmqvist 2008, p. 2) can emerge and that helps to overcome the barriers that hamper interactions between identity-based groups (b). Another similarity that was carved out in all three cases is that the initial spark of trust needs to be translated into collective action that aims to prevent a crisis or to change structural inequalities as this, if projects are successful, enhances social capital, which, in turn, provides the basis for extending the initial agreement and/or reducing prejudices and disconfirming stereotypes. As indicated in the preceding discussion and implied by the 'if successful', the collective endeavors usually start with relatively 'simple' efforts, such as writing an invitation letter, and later increase in complexity and scope, because failure to achieve desired results can destroy the initial stock of social capital, which, in turn, makes other attempts, due to the distrust, more difficult. The mechanism that is involved in this process emerges from the interplay of, on the one side, contributing resources (e.g., time, equipment), which are a sort of promise that participating actors give to demonstrate engagement, and on the other side, the expectation that others are equally committed. Successful efforts then demonstrate, as a sort of empirical evaluation of communicatively reached agreements, that one is dealing with reliable and truthful partners, which, in turn, enhances social capital. This virtuous circle was termed the spiral of social capital formation.

However, there are also essential differences between these three 'possible world' features. Community-driven development and co-management arrangements mainly deal with collective action that aims to modify social structures to enhance human capabilities and ecological systems' conditions respectively. In contrast to this collective or social learning perspective, community cohesion and social inclusion are primarily concerned with the psychological aspects of individuals, i.e., transformative learning. Nevertheless, both types of learning are intertwined: on the one side, changing structural organizations presupposes that individuals have adapted their worldviews about believed to be legitimate arrangements, and on the other side, achieving a truly multicultural society requires, as indicated before, more than the reduction of prejudices and the disconfirmation of stereotypes:

> "In multicultural societies, the coexistence of forms of life with equal rights means ensuring every citizen the opportunity to grow up within the world of a cultural heritage and to have his or her children grow up in it without suffering discrimination. It means the opportunity to confront this (and every other) culture and to perpetuate it in its conventional form or transform it, as well as the opportunity to turn away from its commands with indifference or break with it self-critically and then live spurred on by having made a conscious break with tradition, or even with a divided identity" (Habermas 1998, p. 223).

Another difference refers to the focal concern: whereas community-driven development and community cohesion endeavors have a HD focus, co-management arrangements, at least in the 'second research project's' framing, are driven by SD imperatives. However, both aspects are, as indicated before, inextricably interlinked and efforts trying to enhance one dimension need to be aware of the side-effects on the respective other. Failure to recognize this interdependence leads to situations in which "public life begins to appear more and more as a succession of crises" (H. A. Simon 1988, pp. 72–73). The key prerequisites for an integrated consideration are the enhancement of ecoliteracy through the direct engagement with ecological systems and the development of a glocal identity, that is, a relation to the locality as a reflection of the identification with humanity as a whole, through the integration of general concerns in local structures. Whereas the former is pivotal for the support of SD endeavors, the latter's contribution is, due to the braided strands, twofold: on the one side, the local identity, manifesting itself in a sense of belonging to the locality, is necessary for the cohesiveness of the everyday by providing the axis on which local citizens relate to each other, and on the other side, the identification with humanity, including distant others and future generations, as ingroup not only eases the former process, but it is a universalized normative requirement for fair and equitable structures—the social counterpart of ecoliteracy woven into the SHD conceptualization.

In short and in reference to chapter 2, the reconstruction of the public sphere by creating spaces for communicative action in civil society organizations is an essential ingredient in the necessary SHD endeavor that complements other building blocks such as, for example, technological innovation. This, in turn, suggests that technical systems for SHD have, in addition to the reduction of material consumption as focused by the green ICT research stream (see section 5.5), at least two further important roles to play: on the one side, they can be employed to take over those tasks that do not, from a normative point of view, require social interaction to free volunteers from the burden of these time-consuming administrative activities and to ease these processes to reduce the need for professionalizing civil society organizations, and on the other side, they can be designed to support fallible learners by 'extending' their 'intellectual capacities' and facilitating their learning, that is, to focus communicative endeavors and make them more informed. As indicated in section 6.1, to illustrate the feasibility of using a designed 'possible world' as a basis for the construction of reference architectures, the 'second research project' creates a blueprint for an ICT application that belongs to the latter category, that is, a reference architecture that supports the development of technical systems that back up the communicative decision-making processes within instantiations of the envisioned initiative. Before the extracted draft meanings and organizational options are restated in preparation of this final task in the exemplary application of the design of 'possible worlds' method, a brief and by no means comprehensive exploration of the literature on decision-making processes is inserted to structure the remainder of the current elaboration.

The literature on decision-making processes (ii) usually goes back to H. A. Simon's seminal '*The New Science of Management Decision*' (H. A. Simon 1977, pp. 40–44), which divides the decision-making process into three analytically distinct but interlinked phases: the collection and evaluation of data based on a problem classification (i.e., intelligence), the formulation of alternatives and their assessment (i.e., design), and the selection of a 'satisficing' alternative as well as its subsequent realization (i.e., choice and implementation)[331]. This breakdown is generally kept up in more recent contributions that all depict decision-making—with minor variations and extensions—in a similar way (see Antunes et al. 2010, pp. 101–103; Belton and Stewart 2002, pp. 5–7, 14; Bouyssou et al. 2006, pp. 34–45; Fedra 2000, p. 15; Greene et al. 2010, p. 2103; D. J. Hall 2008, pp. 84–87; Holsapple 2008, pp. 31–33; Katz and Kahn 1978, pp. 487–493; Kersten 2000, pp. 32–34; Soelberg 1967, pp. 4–7; Sprague 1980, pp. 12–13).

More specifically, the process can be reconstructed as follows: it is initiated when decision makers perceive a problem or opportunity or when their attention is drawn to a particular issue by, for example, a group of stakeholders that put forward certain demands (cf. Holsapple 2008, p. 31; Katz and Kahn 1978, p. 488). Although the latter is usually framed as a specific event that triggers a sequential process, it has also to be seen as an ongoing, parallel activity, because other groups will, as soon as they become aware of a planned change that might affect them, start to articulate their concerns to influence the decision-making process (Katz and Kahn 1978, p. 488). This, in turn, often reveals new information, which, as indicated by the above-mentioned interrelatedness of involved tasks, induces the decision maker to re-exercise already carried out phases. Nevertheless, the first step, i.e., the problem identification, is to build awareness for the problem itself (cf. Belton and Stewart 2002, p. 36; Fedra 2000, p. 15) by creating an adequate, that is, confined to relevant facets, representation of the problem situation (cf. Belton and Stewart 2002, p. 6; Bouyssou et al. 2006, p. 35).

Based on this preparatory work, the next step, i.e., the problem structuring or analysis, is to transform the representation of the problem situation into a precise problem specification (Bouyssou et al. 2006, pp. 37–38). The latter can be understood as a problem framing that reconciles the various demands put forward and that shows directions in which the focal issue can be addressed (Rosenhead 2013, p. 1163). This involves the gathering, processing, and preliminary evaluation of data (Katz and Kahn 1978, p. 490; Holsapple 2008, p. 31) about "key concerns, goals, stakeholders, actions, uncertainties and so on" (Belton and Stewart

331. Although he also adds a fourth activity, i.e., review past choices, his discussion concentrates on the three afore-mentioned phases.

2002, pp. 35–36). This data is not only required to classify the problem (D. J. Hall 2008, p. 85), to analyze its structure, causes, and relevance, and to build an environment for the assessment of potential resolutions, but it also narrows down the solution space in which the search for and the exploration of options that address the focal issue are carried out.

Within the next two phases, resembling the build-evaluate loop discussed in section 5.2 on a conceptual, less practical level[332], alternatives are devised and assessed according to their anticipated characteristics. As mentioned before, the 'build' or design phase, which constitutes the third step in the decision-making process, is often conceived as creative in nature. This, in turn, leads to situations in which the individuals who design possible options have to "rely on intuition, experience, and trial-and-error methods" (Hevner et al. 2004, 99). Within the literature on decision-making processes this state is reflected by the frequently made assumption that contemplable alternatives are already given (cf. Belton and Stewart 2002, p. 13). However, this rarely tends to be the case. In their more descriptive account Katz and Kahn (1978, p. 491) point out that, following from the 'conservation of organizational and individual energy' principle, the primary activity to devise alternatives is the examination of attempts that have successfully been carried out in other contexts, that is, a search for draft meanings and organizational options that are reusable in and adaptable to the present problem context; only if this approach does not produce suitable candidates for the following steps the development of custom options is initiated (see also D. J. Hall 2008, p. 85).

Within the evaluation or model building phase "a decision maker [...] analyzes the alternatives to generate knowledge about their respective implications [...] and evaluates those expectations with respect to the decisional context" (Holsapple 2008, p. 31). This examination, however, is carried out only for those options that have not prematurely, that is, without an investigation of their desirability, been declared as impractical or unrealizable (cf. Katz and Kahn 1978, p. 491, and section 8.1). In other words, those options devised in the preceding phase that are considered to be feasible are used in 'what-if' scenarios to determine the effect and side-effects that an option's realization might have (Fedra 2000, p. 15). This activity is usually supported by an, in regard to the problem specification (Bouyssou et al. 2006, p. 41), adequate evaluation method that, based on the specified weightings between solution features, translates each option's attribute scoring into a comparable, overall judgment of the respect option, which, in turn, allows to rank all contemplable alternatives along their desirability (cf. Greene et al. 2010, p. 2103; Mendoza and Martins 2006, p. 15). This ordering then suggests what the most reasonable or rational choice for an implementation is. Although often more than one evaluation method is employed to enhance confidence in the comparison of options (Coutinho-Rodrigues, Simão, and Antunes 2011, p. 722), the reference to the problem specification indicates that the suitability of an evaluation method depends on various aspects of the problem situation, such as, for example, the number of involved decision makers, objectives, and alternatives (cf. Greene et al. 2011, pp. 415–416).

In regard to the envisioned community-driven SHD initiative (iii) the problem context that determines the selection of suitable evaluation methods and that allows to concretize the remaining phases of the generic decision-making process description can be reconstructed from the draft meanings and organizational options extracted in the three possibility assessments and synthesizing designs carried out in the preceding section. Although the main facets of this specification are embodied in the discussion of the first intervention entry point, the commu-

332. However, Katz and Kahn (1978, p. 493) point out that the design of alternatives might include experiments. These experiments then aim to determine how well an alternative performs in regard to certain solution attributes.

nity cohesion and social exclusion as well as the co-management arrangement elaborations can fruitfully inform this task: whereas the former identifies specific conditions that need to be fulfilled to overcome inter-group differences in the initiative as well as in the lifeworld, the latter, although having a different orientation and being anchored on a higher level in the social hierarchy, not only exhibits many features that were carved out in the community-driven development discussion, it also provides, due to the associations' similarities, complementary fragments of evidence that allow to deepen and extend these insights.

Problem identification: The central task in this first phase of the outlined decision-making process is, as described above, the building of awareness for the focal issue. In the initiative's early stages (a) this activity is carried out in a social environment that, as indicated in section 10.1, can be characterized as fragmented locality, that is, a spatial area that comprises numerous and, in regard to values and interests, heterogeneous cultural and/or socio-economic groups that seldom interact with each other. Within this context a loosely coupled network of local citizens is, as carved out in the community-driven development discussion, either formed spontaneously by the respective individuals, evolves out of the existing civil society infrastructure, or is proactively created by the public sector. Although all these three approaches differ in certain respects, they are, nevertheless, all a response to an initiative window, that is, to a particular issue that, by affecting something commonly valued, allows to create the initial stock of social capital required to bind together dispersed actors. After some time the initiative, as indicated by the spiral of social capital formation, matures and evolves into a formal civil society organization (b). In this phase of its life cycle the initiative not only has a larger constituency and, despite increased solidarity, a more heterogeneous board, but it also tackles, a consequence of the former, a wider range of contested issues and, as demanded by the underpinning value position (see section 10.2), incorporates perspectives and arguments even from distant others. This is, as illustrated in the co-management arrangement elaboration, accompanied by the extension of the initial agreement and the compilation of respective indicators that measure the status quo of aspects covered by the agreement. In other words, parallel to the rising number of perspectives as well as the increasing scope and complexity of issues, the initiative's knowledge base becomes, due to the creation of an organizational memory that documents gained experiences and stores monitoring and evaluation data, larger and more informative. In short, the initiative's life cycle in respect to this first phase of the decision-making process can be characterized by two braided developments: on the one side, the few, relative homogeneous perspectives that concentrate on a single, clearly defined focal issue get more dispersed and emphasize different facets as the most pressuring concerns, and on the other side, the initiative's ability to identify, describe, and anticipate problem situations enhances in time due to the evolving knowledge base.

Problem structuring: The central activity within this second phase is the analysis of the problem situation to derive an issue specification that incorporates the various stakeholders' perspectives and that shows the starting points for the design of interventions that address the focal problem. In the community-driven development elaboration this process was part of the 'create a common vision' endeavor: local citizens shared and analyzed personal stories to identify the causal structure that underpinned the described, undesirable event (see Belton and Stewart 2002, pp. 39–52; Mendoza and Martins 2006, pp. 17–18; Rosenhead 2013, pp. 1165–1167, for overviews of other employable techniques). Although this procedure is employed throughout the initiative's life cycle, there are at least two aspects that require a differentiation in regard to the distinguished evolutionary stages. Firstly, the problem structuring in later periods (b) becomes, in contrast to (a), were the number of involved stakeholders is relatively small and were the key concern and goal are given by the initiative window, a decision-making process on its own; a consequence following from the, over time increasing set of issues that demand attention (see also chapter 14). In other words, the selection of the focal or most pressuring problem is based on a simplified, that is, freed from the 'design alternatives' task, version of the outlined decision-making process. Secondly, the transition from (a) to (b) is accompanied by a change in the composition of participants as well as the—depending on the initiative's origin—possible disengagement of external facilitators. Both these developments might, following from the insights gained in the community cohesion and social exclusion discussion, change the nature of this phase: whereas the language in (a) is, due to the relatively homogeneous perspectives and the possible support of external facilitators, more likely to be adequate to provide an encouraging and safe environment, in (b), especially if a broader range of perspectives is incorporated, the maintenance of this environment might require additional mechanisms (e.g., a dedicated member who ensures that the discursive platform remains a place where a local identity can unfold). Nevertheless, this second transformation not only emerges in this phase of the decision-making process; rather, it is a challenge that re-occurs in all tasks that require communicative interaction.

Alternative design: The primary aim of this phase is, based on the causes identified in the preceding step, to devise interventions that resolve the, as perceived by local citizens, problematic focal issue. Although this endeavor depends on the concrete problem that needs to be addressed, in the initiative's early stages (a) the number of possible alternatives tends to be relatively small and largely determined by the nature of the initiative window: the set of options entails either the usage of democratic procedures to avoid a particular externally imposed project, the organization of complementary action to maintain a desirable level of public service provisioning, the lobbying of local government to devolve property-rights of specific urban green commons, or it arises out of the specific goal that the civil society organization pursues with the spin-out of the initiative. Although the solution space is narrowly defined in the first three cases, in the fourth case it is, similar to the situation in the initiative's later stages (b), less well structured, which, in turn, makes the search for as well as the exploration of possible options more challenging. Nevertheless, besides the research strategy extensively discussed in section 8.2 and the support of facilitators described in section 5.2 as well as chapter 9, the discussion of the three intervention entry points carved out at least four different approaches that were employed to devise interventions: initiative members (i) designed alternatives themselves, (ii) worked together with specialized, extra-local agencies to create programs and train local citizens, (iii) organized, possibly supported by an external facilitator, locality exchange programs to examine successful endeavors implemented in other localities (see footnote 258), and/or (iv) collaborated with research institutes to develop novel, unique solutions for the locality. These efforts are, as indicated in the community-driven development as well as the co-management arrangement discussions, carried out by smaller sub-groups that try to mobilize support by presenting their finalized ‘problem resolution’ on events specifically organized to learn about other local citizens’ preferences in regard to planned changes.

Alternative evaluation: The core of the fourth activity in the decision-making process is to evaluate designed options in regard to their anticipated contribution to the focal problem’s resolution. In three of the four above-mentioned cases the intervention is more or less directly determined by the specific initiative window that leads to the formation of the loosely coupled network that aims to address the problematic concern (a). In contrast, in the fourth case and in later stages of the initiative’s evolution (b) the evaluation of alternatives is, as for example, illustrated by the ‘deliberative decision-making’ phase described in the community-driven development discussion, usually organized as scrutinizing, purely communicative endeavor. Approaching the evaluation phase in this way is a consequence of the interplay between the reported studies’ focus on emerging community-driven development, the professionalization of civil society organizations to demonstrate external legitimacy, and the often daunting complexity of scientifically sound evaluation techniques (cf. Chenoweth, Dowling, and Louis 2004, p. 71; Coutinho-Rodrigues, Simão, and Antunes 2011, p. 722). On the other side, within the co-management arrangement elaboration the evaluation of alternatives was, for example, supported by ICT applications that structured carried out workshops or the more sophisticated habitat investment atlas; whereby the latter is an instantiation of so-called collaborative geographic information systems (GIS), which can be understood as ICT applications that structure and support the communicative endeavors of spatial planning processes by visualizing the estimated effect and side-effects of examined interventions (cf. Balram and Dragicevic 2009, p. 1963; Frez, Baloian, and Zurita 2012, pp. 351–352). Although the extracted fragments of evidence do not directly reveal details of the employed technique, the key aspects of an appropriate evaluation method for the envisioned context, based on the SHD conceptualization outlined in section 5.5, the underpinning value position examined in section 10.2, and the three possibility assessments and synthesizing designs carried out in the preceding section, can be reconstructed as follows.

As indicated in the community-driven development elaboration, the decision-making process of a matured, envisioned initiative (b) can be characterized as consultative, management-based endeavor. Furthermore, it combines or involves, as demanded by the underpinning value position (see section 10.2), individual or sub-group as well as public decision-making elements. More specifically: the foregoing discussion explicated that, firstly, the issue identified as the most pressing is analyzed to create a concrete problem specification that describes the cause-effect chains involved in the emergence of undesirable events; secondly, sub-groups[333] are formed to devise interventions that, supported by the causal model created in the preceding step, aim to change specific structural elements to prevent the occurrence of unwanted outcomes; thirdly, the designed alternatives are presented in a public event to allow a wider audience to scrutinize proposed problem resolutions and to articulate their preferences in respect to planned changes. In other words and in reference to the distinction of

333. Although this does not exclude the possibility that a single individual devises an intervention single-handedly, the inter-disciplinary and complex nature of issues renders it unlikely that problem resolutions designed in this way adequately incorporate the intertwined facets of the SHD conceptualization outlined in section 5.5.

decision-making processes Mendoza and Martins make based on Belton and Stewart, the procedure employed in the envisioned initiative can be circumscribed as follows:

> "A group defines a common model [. . .] and then individuals or sub-groups independently use the model to evaluate alternatives or explore possible solutions, coming together again to compare results" (Mendoza and Martins 2006, p. 15).

Correspondingly, the evaluation method, itself building upon the 'common model' evolving from the analysis of the 'problem structuring' step, is employed, on the one side, by the sub-groups that work out interventions expected to address the focal issue, and on the other side, by the wider audience that makes the final decision based on the comparison of devised alternatives; therefore, the 'alternative evaluation' phase can be distinguished, at least in respect to the envisioned initiative, only analytically from the preceding and the succeeding step. Nevertheless, the employed procedure is, despite the varying number of assessed options, the same in both these two phases. In fact, the former case, in which just one intervention is evaluated, is a simplified version of the latter process. Thus, the following can concentrate on the more complex evaluation technique that is adapted by sub-groups to assess designed alternatives against the 'common model'. The key to this reconstruction is the goal that should be achieved by the devised programs. In the community-driven development elaboration it was carved out, that the initiative is generally a community-oriented civil society organization that focuses on the enhancement of the locality's capacity and its use value (see also section 5.5). This, in turn, indicates that the evaluation of alternatives needs to take into account various different, often incommensurable, not necessarily quantifiable criteria, such as, for example, the role of 'committing resources' to foster the formation of social capital, the possibility to facilitate inter-group contact within collective efforts (i.e., alliance building and implementation partnerships), or the need to infuse different domains of the everyday life in order to enhance the cohesiveness of the everyday. In addition, the discussion of co-management arrangements, extending and building upon the insights leading to the SHD conceptualization outlined in section 5.5 and the criticism of the 'factual world' (see section 10.2), suggests that the estimation of impacts caused by interventions not only entails, due to the complexity of social-ecological systems, high degrees of uncertainty, but that a single intervention simultaneously influences numerous distinct dimension, which are valued differently across heterogeneous stakeholder groups (see section 10.1). In short, the evaluation of alternatives is not only based on uncertain data, but it involves a complex array of criteria whose relationships and valuations are neither fixed nor are they determinable in context-independent, non-deliberative endeavors.

All these facets allow to locate the technique employed by the envisioned initiative in the broad category of multi-criteria decision analysis methods (see Ananda and Herath 2009, pp. 2536–2543; Arrow and Raynaud 1986, pp. 101–110; Greene et al. 2011, pp. 415–422; Higgs et al. 2008, pp. 601–603; Mendoza and Martins 2006, pp. 2–3; D. L. Olson 2008; Wang et al. 2009, pp. 2269–2276, and figure 10.15 for overviews of different variations); whereby 'multi-criteria decision analysis method' is used as

> "*umbrella term to describe a collection of formal approaches which seek to take explicit account of multiple criteria in helping indi-*

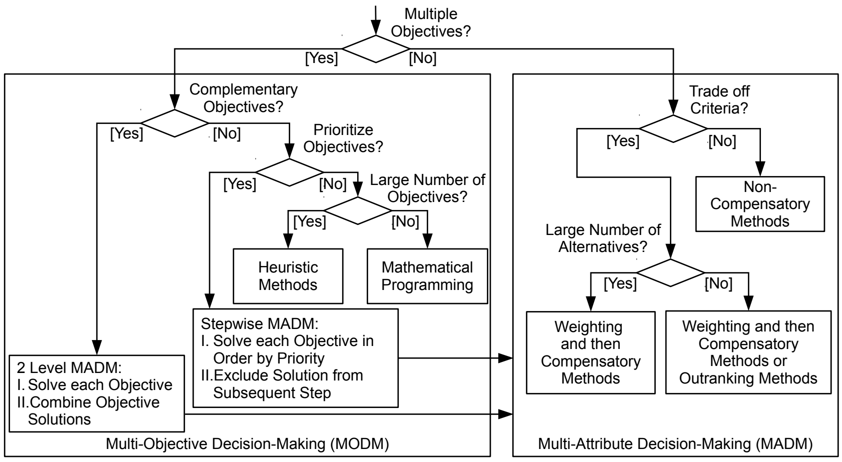

Figure 10.15: Multi-Criteria Decision Analysis Tree, adapted from: Greene et al. (2011, p. 415)

> *viduals or groups explore decisions that matter*. Decisions matter when the level of conflict between criteria, or of conflict between different stakeholders regarding what criteria are relevant and the importance of the different criteria, assumes such proportions that intuitive 'gut-feel' decision-making is no longer satisfactory [emphasis in the original]" (Belton and Stewart 2002, p. 2).

Although, as mentioned above, several methods are often used simultaneously to increase confidence in evaluation results, the decision tree depicted in figure 10.15 indicates that some methods are more appropriate in one situation than in another. Based on the foregoing elaboration and the more detailed description of the decision tree (see Greene et al. 2011, pp. 415–416), the range of techniques applicable in the envisioned initiative can be determined along the following considerations. Firstly, the most significant question in regard to the specification concerns the type of decision-making (see also Ananda and Herath 2009, p. 2536; Mendoza and Martins 2006, p. 2): whereas multi-objective decision-making refers to techniques that are used to figure out the, in terms of a given, quantitative objective function, 'optimal' configuration of continuous alternatives, methods belonging to the multi-attribute decision-making category are more appropriate if a finite set of discrete options is assessed in regard to different attributes. As interventions are usually discrete projects that are evaluated in terms of their contribution to the improvement of certain factors defined in the problem specification, the sub-group of multi-attribute decision-making techniques is, from the perspective of the envisioned initiative, more suitable[334]. Consequently, the second question is if "criteria outcomes [can . . .] be traded off against each other" (Greene et al. 2011, p. 416). Even though this tends to depend on participants and their preferences, the trading off, at least if certain thresholds are maintained, is a more realistic approach if the bounded rationality of 'fallible learners' (see section 10.3) is contrasted with the complexity of the above described decision-making context. Finally, the question in regard to the size of the set of alternatives is, as Greene et al. (2011, p. 416) admit, not easy to answer, but depends on, for example, the computation power of supporting

334. This, however, does not exclude the possibility that certain decision in the envisioned initiative might also require other evaluation methods. Nevertheless, in most cases, as elaborated above and in section 5.5, the application of multi-attribute decision-making techniques tends to be satisfactory.

ICT applications. Nevertheless, in both phases, that is, the alternative design and the alternative selection phase, the number of options to be evaluated is manageable. In the former case there is just one option and in the latter case the, in relation to the organization's resource budget, high costs involved in the development of programs suggests that the number of designed interventions that are in need of an evaluation is relatively small. Correspondingly, the evaluation methods most suitable for the decision-making process in the envisioned initiative belong either to the class of outranking methods (e.g., Brans and Vincke 1985)[335] or are a combination of weighting and compensatory techniques (see Greene et al. 2011, pp. 419–421; Wang et al. 2009, pp. 2270–2274, for overviews). However, as indicated in the community-driven development discussion, the goal is not necessarily the selection of one best intervention (see also section 10.2); rather, the communicative process should be supported by helping to identify a set of—ideally—non-opposed options in the group. In other words, although those methods that belong to the outranking category are sufficient, the evaluation exercises can be substantially enriched if they are informed by the other category's techniques. Yet, such a mixture of methods requires, as Wang et al. (2009, p. 2276) point out, that resulting, possibly divergent rankings produced by different evaluation techniques are aggregated using either voting or mathematical aggregation methods. The latter not only entails, due to the quantification and incommensurability issues, some inherent challenges, but the former also allows to add a reflexive element that, as indicated in the underlying value position, is an important element in public discourses.

Alternative selection: The final activity in a decision-making process is, traditionally, the selection of the highest ranked option. However, in the initiative's case this phase involves the reduction of the suggestions made by sub-groups to a set of—ideally—non-opposed alternatives. This entails, in accordance with the democratic idea guiding the present inquiry and the 'possible world', an aggregation of individuals' opinions, that is, a voting process. As indicated above as well as in the community-driven development elaboration, this does not necessarily imply a majority voting system in which one option is selected; rather, in the envisioned initiative the 'dotmocracy'[336] (cf. Diceman 2010) process is adapted and adopted to make the final choice. It is a form of a cumulative voting system (cf. Blair 1973) that allows to identify a set of preferred, ideally non-opposed options. More specifically: in the dotmocracy process the finalized suggestions of sub-groups are presented on dotmocracy sheets that, in addition to the proposal's description, contain, inter alia, two further sections (cf. Diceman 2010, pp. 12–13, 43): a comment section in which participants can leave review comments, which, as indicated in the preceding phase, adds a reflexive touch to the process, and an opinion section that, based on a pre-defined scale, provides different scale-sections in which voters can record their preferences in regard to the intervention by placing a dot in one of the areas. The counting of dots then gives an overview of the approval and disapproval of the wider audience. However, instead of stating priorities for isolated options, local citizens, as suggested by the afore-mentioned outranking methods, indicate their preferences in a pair-wise comparison of alternatives. Combined with the review comments, the aggregation of local citizen's explicated preferences then serves as a basis for board members to exclude a set of alternatives, which, in turn,

335. For the PROMETHEE method's details see: `http://www.promethee-gaia.net`, accessed May 25, 2015.
336. For more details see: `http://www.dotmocracy.org/`, accessed May 25, 2015.

reveals which interventions can be realized in the name of the initiative. This involves, as described in the community-driven development discussion, a justification in which way comments and preferences of local citizens have been taken into account in the selection process.

Before diving into the development of a reference architecture that serves as a blueprint for the specification of technical systems that support the just sketched decision-making processes of community-driven SHD initiatives, a final remark in regard to the goal of this last activity in the 'second research project' is inserted. As already indicated in section 3.2, one argument of the present inquiry is that ISR's focus on determining 'optimal' SHD outcomes does not exhaust its potential and neglects the equally important process perspective (see also sections 5.3 and 5.5)—a dimension of SHD in which ISR can make even greater contributions. Although the central purpose of the next chapter is to illustrate that 'possible worlds' can function as a basis for the design of technical systems, this aim can be combined with a sketch of the direction in which process-oriented endeavors can unfold. From this point of view, the reference architecture intends to, on the one side, open up spaces to increase communicative interaction between individuals, and on the other side, to structure the process in a way that ensures its alignment with the SHD imperatives outlined in section 5.5. In other words, the development of the decision support system (DSS) blueprint strives to widen and facilitate the communicative parts of the decision-making process not to make decisions or to replace decision makers (cf. Greene et al. 2010, p. 2103).

Chapter 11

The Design of Reference Architectures

> "The claim that if we only think hard enough we will see that everyone actually will agree on the optimal conception of justice is, I think, beyond credulity. The harder we think, the more we disagree. Moral, social, and political theory must learn to face up to this, not veil it."
>
> Gaus (2012, p. 276)

The acceptance of 'incompleteness' and disagreement, however, is not something that only theory has to face. Contrary, it also reaches into the domain of technical systems that are employed in endeavors that communicatively scrutinize the justness and unjustness of social structures and that, based on the former, devise interventions to remove entrenched inequalities. The architectural description of DSS for community-driven SHD initiatives designed in the following is an exemplary instance of a venture in this domain. The aim of technical systems derived from this reference architecture is not to identify optimal solutions for given problem specifications; rather, their purpose is, inter alia, to support the communicative decision-making process by providing means that help to establish structures that give all participants an equal opportunity to get heard, that foster discourses between citizens, that focus the discussion on facets where disagreement exist, and that lower the barriers that hinder or prevent citizens to get involved. That these aspects can be supported by technical systems, especially web applications, has already been investigated in several (empirical) studies (e.g., Bers and Chau 2006; Berry et al. 2011; Palen, Hiltz, and Liu 2007; Redaelli 2012). Starting from this positive outlook, the following, based on the 'possible world' designed in the preceding chapter, will devise a reference architecture for such systems in the 'possible world'. This process is structured along the six steps constituting the preliminary reference architecture development method presented in section 8.3. In other words, the present chapter is divided into six sections: within section 11.1 the requirements model extracted from the preceding chapter is presented. This descriptive work is followed by a discussion of the general objectives that guide the reference architecture design cycle (see section 11.2). Based on this preparatory work, section 11.3 presents the details of those scenarios or use cases that were used in iterations carried out as part of this 'second research project'. These selected scenarios, in turn, provide the basis for the functional design in section 11.4 as well as the identification of key issues or crosscutting concerns in section 11.5. The results of both these latter steps are synthesized into the candidate solution discussed in section 11.6. As already mentioned in the section 8.3, although the following presentation might look like a single iteration in the reference architecture design cycle, it is the condensed content resulting from multiple, jump back-involving iterations pressed into this structure for reasons of readability.

11.1 Requirements Model

> "[D]esign outcomes [. . . are] inevitably unfinished in relation to complex heterogeneous and evolving user requirements. Further innovation takes place as artefacts are implemented and used. To be used and useful, ICT artefacts must be 'domesticated' and become embedded in broader systems of culture and information practices. In this process, artefacts are often reinvented and further elaborated ('innofusion')."
>
> Steward and Williams (2005, p. 195)

The introductory quote, in line with the arguments made in section 5.3, suggests that ICT applications do not create new capacities that exist independently of an embedding social context; instead, technical systems are 'domesticated' by actors in existing social systems, who, on the other side, change social structures to integrate ICT applications into the system's processes. However, a second facet within the statement of Steward and Williams (2005, p. 195) is presently more important: they point out that users' ideas about a technical system's features continuously evolve. In other words, the domestication and usage of ICT applications are intermingled with a process in which new requirements unfold and already existing ones change. Consequently, a requirements model is always a snapshot of demands at a certain point in time. This, in turn, implies that the elicitation of requirements, as already indicated in section 8.3, is an ongoing process that parallels the design and development of technical systems and their descriptions. The last chapter implicitly recognized this interplay between requirements and design by relating the phases of a decision-making process to two analytically distinct stages in an initiative's life cycle: a group of citizens gathering in response to a suddenly opening initiative window has considerably different demands than a more matured organization with a broader activity portfolio. In same direction but from another angle, the concept of 'possible worlds', as extensively discussed in section 8.1, embraces the idea that there are several, differently organized, context-specific realizations of an envisioned 'possible world'. This, by implication, needs to be reflected in a reference architecture description that accompanies such a design. In short, the core, non-functional requirements guiding the reference architecture design in this 'second research project' are the former's extensibility and modifiability (see also section 8.3).

However, non-functional requirements alone are an insufficient input for the preliminary reference architecture development method outlined in section 8.3. The aim of this subsection, thereby preparing the more detailed discussion of key scenarios in the design cycle's third step, is to briefly sketch complementary use cases, that is, of functional requirements, that were synthesized from the user stories extracted from the 'possible world' description in section 10.3 (see annex B for an overview of the user stories). The presentation of this behavioral specification is organized around the five phases of the decision-making process discussed at the end of chapter 10.

Indicator Selection Phase

Although the indicator selection phase itself is not part of the actual decision-making process, it nevertheless offers the 'space' to devise those means that establish the data basis for the identification of problems and for justifying their importance. This nature as a necessary prerequisite provides the rationale to include this phase—despite its disconnectedness—into the 'create/refine requirements model' activity of the reference architecture design cycle: incorporating requirements of this upstream activity allows to consider those demands that unfold if the first two phases of the actual decision-making process should be based on a solid foundation. The use case diagram shown in figure 11.1 summarizes those requirements that the indicator selection phase imposes on a supporting technical system (see annex B for an overview of the corresponding user stories).

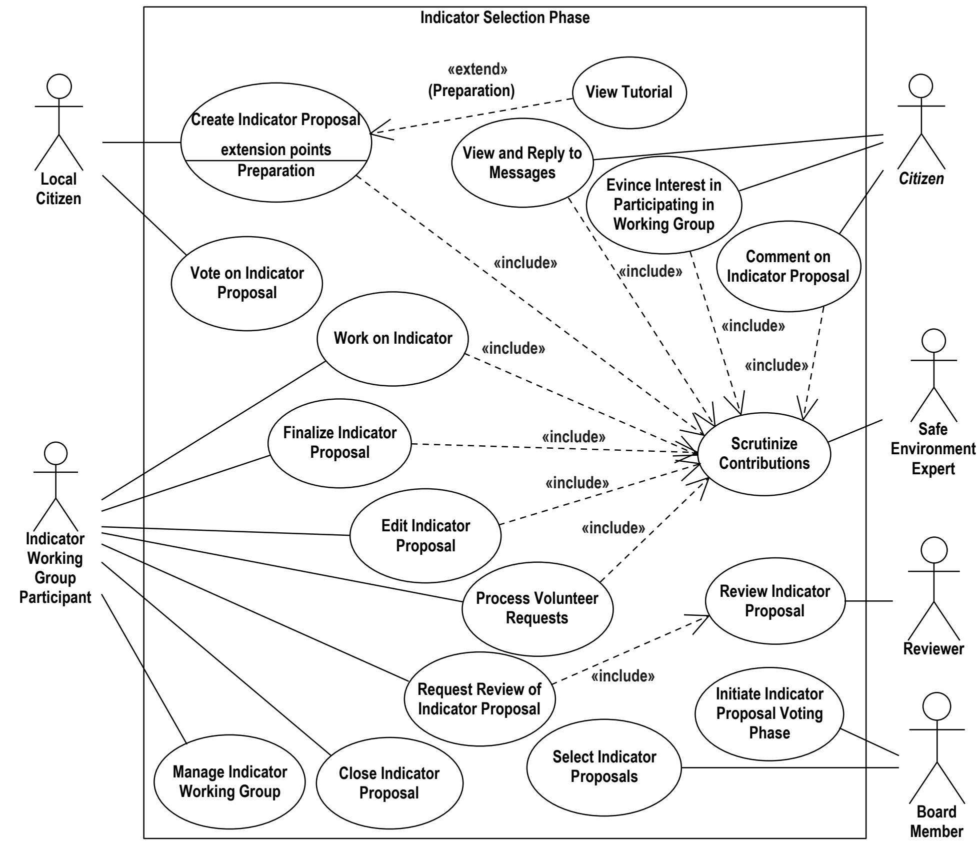

Figure 11.1: Indicator Selection Phase-Use Cases

As can be seen in figure 11.1 the important use cases of this preparatory phase are initiated by six different actors, that is, those roles in which an individual user interacts with the technical system at a certain point in time (cf. OMG 2011b, pp. 598–600). Although the abstract citizen actor[337] is the most general role and, in addition, functions as root from which the remaining five actors are specialized, the local citizen actor, the role dedicated to the residents of a specific locality (see section 10.1), is, despite the small number of associated use cases, the central role in this and the other phases. The second, from the point of the envisioned initiative, crucial actor is the board member. This role can be played either by local citizens who were elected into the initiative's board or by citizens who were appointed for a position in the latter. The safe environment expert, as pointed out in section 8.2, is a role that is assigned to extraordinarily communicative citizens, who, in addition, are sensitive to inter-group issues, to maintain a safe environment. Similarly, citizens in the reviewer role

337. The Unified Modeling Language (UML) prescribes that abstract entities are written in italics.

are usually considered field experts in one of the domains (e.g., health, education) for which local citizens create indicator proposals. However, reviewers, in contrast to safe environment experts, do not review all newly created indicator proposals, they review only those indicator proposals that have been committed for a review by an indicator working group. Indicator working groups, in turn, are groups formed by citizens, the indicator working group participants, who are interested in elaborating a particular proposal.

These six actors, each the primary actor of those use cases listed in figure 11.1 with which it is directly associated, constitute one of the most frequently mentioned element required to be laid out for a complete use case specification. Three further aspects that need to be added are descriptions of the use case's (i) goal, (ii) its flow of events, and (iii) its pre- and postconditions (cf. Cockburn 2001, pp. 2–3; Fowler 2004b, pp. 99–102). Although all these three concretization are usually stated in a textual form, the 'second research project' adopts a different approach for the latter two. Instead of describing the flow of events as an enumeration of "actor does ..." and "system does ..." statements, the inquiry presents the sequence of interactions in form of UML activity diagrams that, compared to the textual description, convey the same information in a more compact format (see annex C.2 for the activity diagrams of those use cases shown in figure 11.1).

Moreover, the declaration of pre- and postconditions, as suggested by Sunitha and Samuel (2013), is added to these activity diagrams in form of Object Constraint Language (OCL) constraints (OMG 2012). This not only enhances the semantic content of the created activity diagrams, but it also allows to state more fine grained conditions and invariants in their respective context. Together these four elements (i.e., description, actors, flow of events, and conditions) form a minimal specification of use cases. Although this minimal specification, by virtue of the 'second research project's' nature as exemplary application of the 'possible world' method, provides sufficient data for the reference architecture design cycle, the inquiry adds a preliminary object model, such as one depicted in figure 11.2, to each of the following discussions (see also annex C.1). These models, serving illustrative and explanatory purposes, must not be mistaken with concrete or prescriptive domain models (cf. Esposito and Saltarello 2009, pp. 130–131). They solely show those concepts—neither domain objects nor realization—that are important in a phase's use cases, that is, these models merely support the specification of flows of events as well as of pre- and postconditions within the former. In other words, a concrete ICT application supporting the use cases depicted in figure 11.1 can and probably has to rework the object model shown in figure 11.2 into a suitable domain model (cf. E. Evans 2003). Two rather obvious examples are, on the one side, the splitting of the `User` concept, exhibiting characteristics of the 'god object anti-pattern', into more specialized classes, and on the other side, the substitution of the `Phase` singleton (Gamma et al. 1995, pp. 127–134) by a variant of the 'objects of states' pattern (Buschmann, Henney, and Schmidt 2007a, pp. 467–468). However, the supporting nature of the object models created in this study justifies that the comprised constructs are kept as simple as possible; otherwise they would miss their actual purpose, i.e., to increase the comprehensibility, meaningfulness, and understandability of the use cases and scenarios discussed below and in the 'key scenario' step of the reference architecture design cycle respectively.

In addition to this rather lengthy clarificatory remark, which prepared the ground for the requirements model exploration of this and the remaining phases, two further, comparatively short notes have to be added: on the one side, due to the lack of space only those use cases, equally applying to the use cases of the phases discussed in the following, that have been selected for one of the reference architecture design cycle's iterations are detailed in the 'key scenario' step (see annex C.2 for the activity diagrams of the remaining use cases), and on the other side, the brief textual description of a phase's use cases is embedded in a specification of the respective phase's structure as the latter provides the context for the former. In other words, before this first substep of the requirements model step closes with the high level sketch of those use cases shown in figure 11.1, it intersects a characterization of the structure of the indicator selection phase as conceived in the present inquiry.

The discussion at the end of the preceding chapter, at least implicitly, indicated that the phases of the decision-making process are considered to be exclusive. The rationale to impose this constraint is that, adopting the 'comprehensive outcome'-perspective (see section 10.2), the process should, in addition to its natural culmination outcome, foster interactions and discourses between (local) citizens, that is, the cohesiveness within the initiative and that of the everyday (see section 10.3). Limiting the activity options to those of one phase tends to be one way in which the technical system can help to concentrate and focus users' activities, which, in turn, increases the chances of (communicative) interaction between them. In addition to this general, decision-making process-specific constraint, each of the phases imposes a refined, complementary substructure. The indicator selection phase, termed `IndicatorVotingPhase` in the preliminary object model in figure 11.2, entails two stages and two steps: the initiated and closed stages as well as the voting and selection steps. Whereas the former two, indicating if the indicator voting phase is the currently active phase, are inherited from the `Phase` concept, the indicator selection phase has the latter two by virtue of its nature as a `VotingPhase` concept specialization. Each of these two steps is used to distinguish a time-dependent status of this phase—the voting on and the selection of indicator proposals. Whereas the indicator proposal, derived from the `Proposal` concept (see the preliminary object model in figure 11.2), is the technical representation of a suggestion that citizens make in a discourse (e.g., an idea for an indicator), the two steps are the mapping of the consultative, management-based decision-making process discussed in section 10.3 into the technical domain (see also the local citizen and board member use cases in figure 11.1): on the one side, the voting step is used to denote the time in a phase in which local citizens indicate their preferences in regard to proposals created since the phase's initiation (i.e., the consultative part), and on the other side, the selection step refers to the, based on local citizens' votes, selection of a set of proposals that are realized in the name of the initiative (i.e., the management part).

As the foregoing discussion illustrates, the life cycle of indicator proposals is intertwined and at least partially defined by the indicator selection phase's structure. More specifically: only if the indicator selection phase is initiated, local citizens, a mechanism to ensure that proposals are locality-specific, can create indicator proposals. However, in contrast to a face-to-face interaction, where—at least in most cases—no one can be hindered to express every of his or her ideas, within the envisioned ICT-mediated discourse all `Contributions`, and a `Proposal` is one such `Contribution`, are scrutinized by a safe environment expert—a process employed, for example, by news web sites in their comment sections (see the 'scrutinize contribution' use case in figure 11.1). This ensures that only those `Contributions` that do not endanger the safe environment are made available to a larger audience (e.g., published on a web site) and a working group, which at this point in time only consists of the proposal's author, is created. On the other side, as only scrutinized proposals are published, citizens do not see un-scrutinized or safe environment-endangering proposals. Correspondingly, the

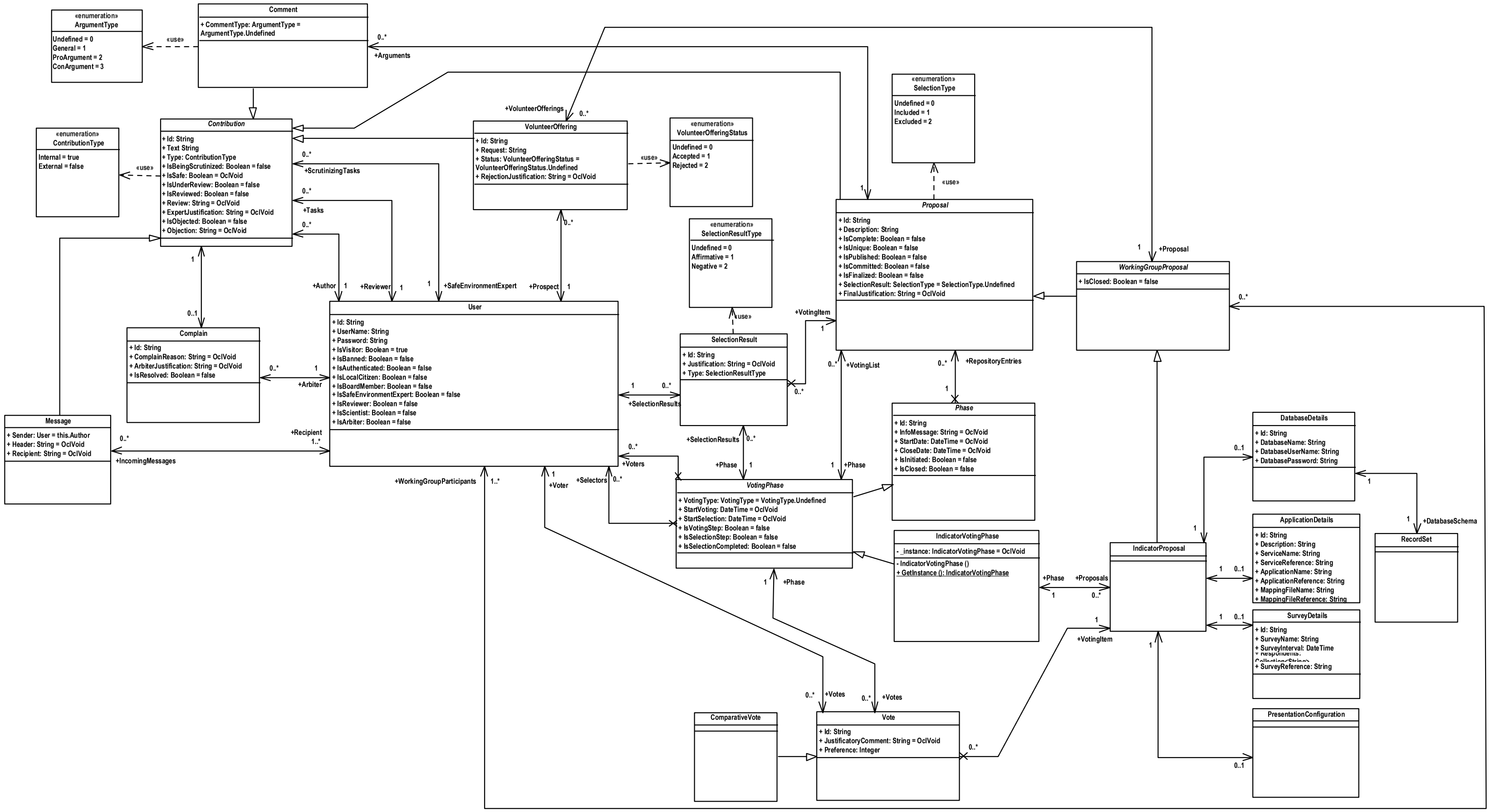

Figure 11.2: Indicator Selection Phase-Preliminary Object Model

'comment on proposal' and 'evince interest in participating in the working group' use cases refer to those proposals that have passed the scrutinizing control. Similarly, as a working group is created only for scrutinized proposals, all use cases associated with the indicator working group participant presuppose a scrutinized and published proposal. These use cases include the extension of the proposal by an indicator (i.e., the concrete realization of the idea expressed in the proposal), the editing of the proposal's description, as well as the closing, committing, and finalizing of the proposal. These latter three activities, not specific to indicator proposals, refer to the statuses the `IndicatorProposal` concepts inherit from the `Proposal` and `WorkingGroupProposal` concepts (see figure 11.2). The closed status is used to distinguish proposals that have been created but not yet scrutinized and proposals that have been scrutinized but should not be shown to a larger audience, that is, not published on, for example, a web site. Working groups can make use of this option if they decide that external comments impede the working group's process (e.g., the writing of replies consumes too much time). Although this 'published opt-out' mechanism, on the one side, has a negative effect on the larger discourse, it, on the other side, might enhance interactions within the working group and it accelerates the proposal's completion. This latter aspect is especially important in regard to the time constraints imposed by the phase's structure: before a proposal is considered in the voting and selection steps, it has to be committed and, presupposing the former, finalized. Whereas the committing activity refers to the 'request review of proposal' use case (see figure 11.1), the latter is the working group's request to include their proposal in the list of options considered in the voting and selection steps. As indicated above, the voting and selection steps are time-dependent, i.e., within the phase's initiation process a board member, as captured by the 'initiate indicator proposal voting phase' use case (see figure 11.1), specifies the dates at which the system automatically sets the `IsVotingStep = true` and `IsSelectionStep = true` flags. Once a flag is set, it is not possible to finalize a proposal and to make a vote respectively (see AD-IS-02[338] in annex C.2). Although this rather restrictive process ensures that all (local) citizens have equal participation opportunities, the constraints might be too restrictive for the indicator selection phase. The rationale underpinning this argument is that, in contrast to the phases discussed in the following, indicator proposals are not as tightly coupled to a particular decision-making process instance as, for example, alternative proposals. In anticipation of the following discussion, alternative proposals are specifically created to address one of the causes identified for a selected focal problem (see chapter 10). Therefore, it might be reasonable, considering the 'phase exclusiveness' argument made above, to relax the phase constraints in the indicator selection phase and put indicator proposals, instead of canceling them if not finalized, in a sort of 'paused' status that can be resumed in the next indicator selection phase. Although an extension of the reference architecture to include this variation, as indicated above, is covered by the non-functional requirements, the following treats all decision-making phases, despite minor variations in their substructure, uniformly to keep the reference architecture development cycle of this exemplary 'second research project' as simple as possible.

338. All activity diagrams created in the 'create requirements model step' of the reference architecture development cycle have an unique identifier. This identifier is structured as follows: AD–<Category>–<Number>, whereby 'Category' refers to one of the decision-making process' phase used to easily identify the activity diagrams in annex C.2 (i.e., IS=indicator selection phase; PI=problem identification phase; PS=problem structuring phase; AD=alternative design phase; AS = alternative selection phase; and the additionl C category, which comprises those activity diagrams and call behaviors that cannot be associated with just one category).

Problem Identification Phase

The problem identification phase, the first phase of the actual decision-making process outlined at the end of the preceding chapter, is primarily concerned with identifying the object of the remaining phases, that is, of the focal problem. A focal problem is a story of a local citizen, who describes a problematic personal experience, probably supported by the data basis created through the results of the indicator selection phase, to point out inequalities and injustices in the locality's current social structure (see section 10.3). As can be seen in the use case diagram shown in figure 11.3 (see annex C.2 for the corresponding activity diagrams), the functional requirements imposed by this phase are similar to the ones of the indicator selection phase. However, there are three variations, each of which is discussed in turn.

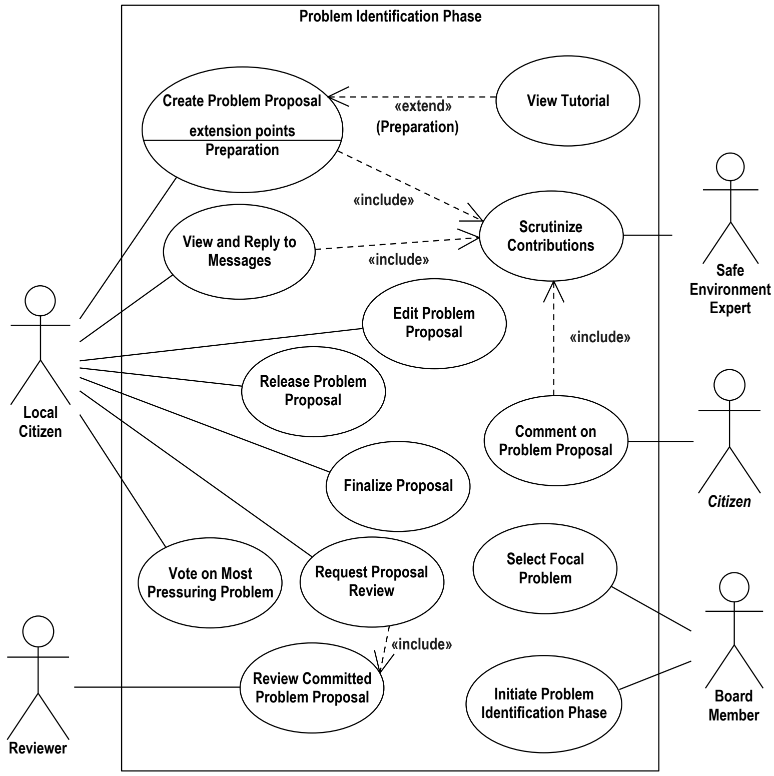

Figure 11.3: Problem Identification Phase-Use Cases

The first of these three variations concerns the process of how the phase-specific `Proposal` concepts are processed. Although the problem identification and the indicator selection phase have in common that they, to ensure that proposals are locality-specific, confine the proposal creation process to the local citizen role, both phases differ considerably in the way in which the elaboration of proposals is organized. As can be seen in figure 11.3, the creation and elaboration of the problem identification phase's proposals, in contrast to the proposals of the indicator selection phase, occurs not within working groups but is done by individual local citizens only. This, for example, manifests itself in the different inheritance hierarchy shown in the preliminary object models depicted in figures 11.2 and 11.4: whereas `IndicatorProposals` are derived from the `WorkingGroupProposal` concept, the `ProblemProposal` is a direct specialization of the `Proposal` concept. This variation accounts for the demand that the issues addressed by the initiative's activities, as indicated above, are self-experienced problems perceived by local citizens as well as that these problems are described in the language of local citizens (see section 10.3). Whereas the former, that is, the personal touch, tends to get lost in stories created by working groups that need to incorporate the demands of different participants, the latter enhances the chances that other local citizens can relate to the experience described in the problem proposal. This, however, does not imply that extra-local perspectives are completely blended out; rather, they are incorporated by the citizen-initiated ‘comment on proposal’ use case shown in figure 11.3.

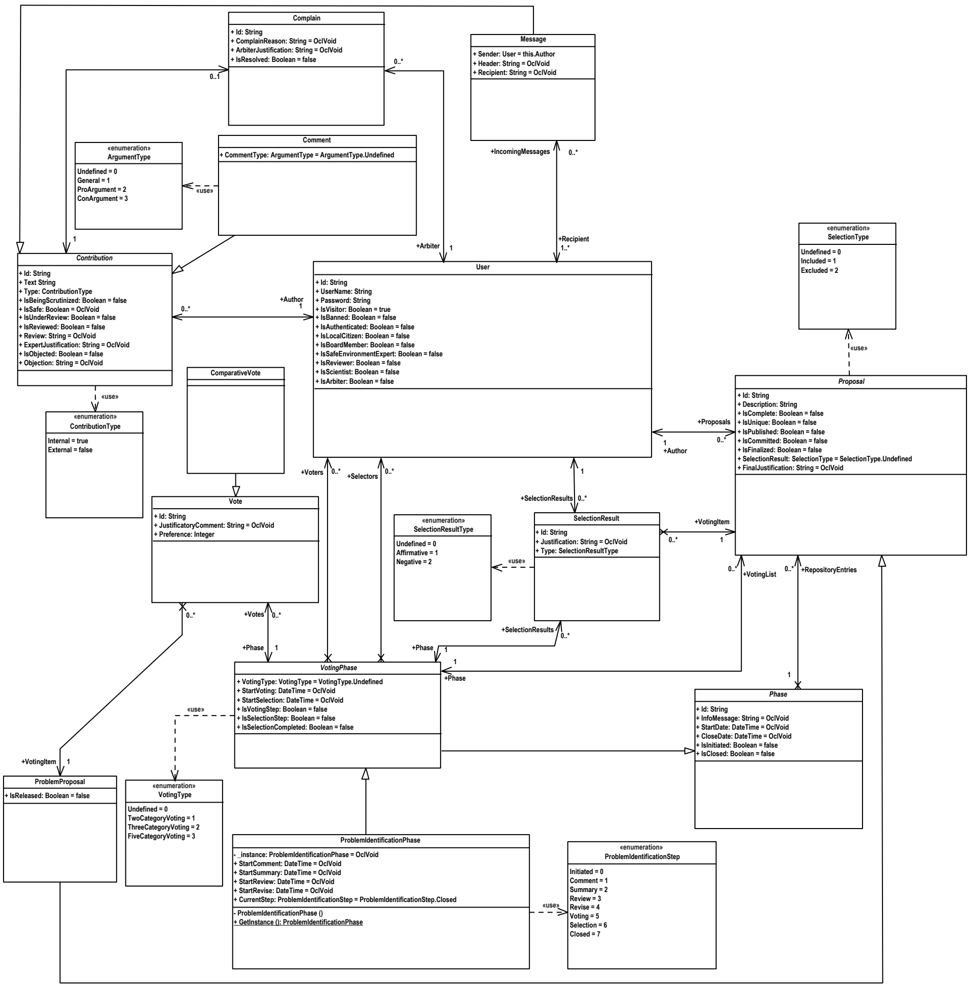

Figure 11.4: Problem Identification Phase-Preliminary Object Model

The second difference between the indicator selection and the problem identification phase unfolds in the ‘select focal problem’ use case associated with the board member actor: the board selection process in the problem identification phase ends with the selection of a *single* `ProblemProposal` and not a *set* of `IndicatorProposals`. This, in turn, implies that there is a one-to-one correspondence between a decision-making process instance and a `ProblemProposal`. The rationale to impose such a constraint is to establish a mechanism that fosters the cooperation between local citizens, which, as pointed out in section 10.3, is a vital prerequisite of the process captured by the social capital formation spiral.

Finally, the indicator selection and the problem identification phases also differ in regard to their phase-specific substructure. Within the latter’s case, a board member, as captured by the ‘initiate problem identification phase’ use case (see figure 11.3), sets the dates when the system automatically changes the status of the phase to one of the eight steps shown in the `ProblemIdentificationStep` enumeration concept depicted at the bottom of the preliminary object model in figure 11.4. Specifically, the problem identification phase can be in one of the following eight steps: initiated, comment, summary, review, revise, voting, selection, or closed. As the initiated, voting, selection, and closed steps are similar to the stages and steps discussed in the indicator selection phase, the following concentrates on the remaining four steps. Firstly, the comment step is the time in the problem identification phase in which the scrutinized `ProblemProposals` created since the phase's initiation are published to allow citizens to comment on these proposals. Although this was also part of the indicator selection phase substructure, the difference is that `ProblemProposals`, on the one side, are not automatically published after they have been scrutinized, but they have to be released by their author to be considered in the subsequent steps (see the 'release problem proposal' use case in figure 11.3 and the activity diagram AD-IS-3 in annex C.2), and on the other side, published `ProblemProposal` instances are not editable as long as they are published. Correspondingly, the comment step resembles the debating step of the process outlined in section 10.3, that is, it ensures that the author of the `ProblemProposal` sees the issue captured in the latter through the eyes of (distant) others. Secondly, the summary step adds a first reflective element to the phase as it is intended to give authors the opportunity to incorporate the perspectives and comments disclosed in the preceding step into their proposal. This summarizing or refining activity has to be finished before the phase enters the review step, because only those proposals that have been committed in this step will be reviewed, which, in turn, is a prerequisite to be considered in the remaining steps. Thirdly, within the review step all committed `ProblemProposals` are reviewed by domain experts. The activities occurring in this step differ from the reviews discussed in the indicator selection phase only in two respects: on the one side, all reviews are carried out in a predefined time span, and on the other side, created reviews are available to authors only after the time span has elapsed, that is, when the revise step is initiated. Fourthly, the revise step constitutes the problem identification phase's second reflective element, which allows authors once more to refine their proposal based on the insights gained through the review. If authors also want their proposals to be included in the list of options considered in the voting and selection steps, they, as already discussed in the indicator selection phase, have to finalize it before the voting step is initiated.

The rationale to impose such a restrictive substructure on the problem identification phase is that this, on the one side, makes the process plannable, which is important to organize resources (e.g., safe environment experts, reviewers), and on the other side, gives, at least in principle, all (local) citizens the same chances to contribute to the identification of the most pressuring problem—the focal problem of a decision-making process instance.

Problem Structuring Phase

Within the second phase of the decision-making process the focal problem selected in the problem identification phase is analyzed to determine those causes that contribute to the emergence of the problematic issue described in the problem proposal. This, as indicated by the use case diagram shown in figure 11.5, imposes two new functional requirements that, in addition to the ones already discussed in the preceding phases, need to be supported by a suitable DSS: the 'structure focal problem' and the 'create model' use cases. However, the brief textual description of these two use cases requires a short exploration of the general characteristics of the problem structuring phase, because the discussion of the phase's peculiarities explicates in which way it differs from the two preceding phases, which, in turn, provides the necessary achoring context for both use case descriptions.

Contrasting the problem structuring phase with the two preceding phases, reveals that the former differs from the latter two in two respects (see also the preliminary object model depicted in figure 11.6): firstly, the problem structuring phase does not define a phase-specific `Proposal` concretization that local citizens create, because all citizens work on the commonly devised problem structuring graph, and secondly, the phase's substructure comprises only two states (i.e., initiated and closed), which it inherits from the `Phase` concept. Together these two states define the time span in which citizens can contribute to the focal problem's structuring by initiating the 'structure focal problem' use case.

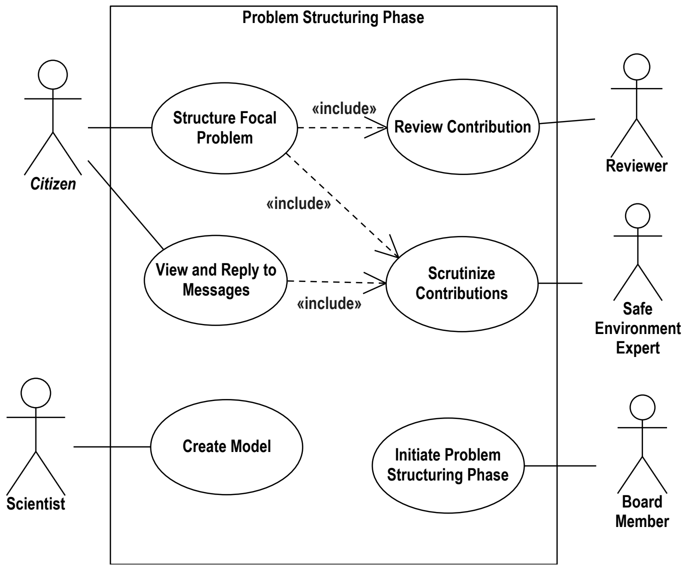

Figure 11.5: Problem Structuring Phase-Use Cases

This use case, as implicated above, refers to the common effort of creating a problem structuring graph, which comprises, in addition to the focal problem, nodes that capture different causes of the problematic issue and connections that relate these causes to each other as well as to the focal problem. As shown in the use case diagram depicted in figure 11.5, there are, in contrast to the creation of proposals, no constraints in regard to the initiating role. Imposing such restrictions is unnecessary, because the problem identification phase already ensured that the focal problem is one of the locality and its residents.

The 'create model' use case, as shown in figure 11.5, is initiated by a scientist, who translates the problem structuring graph into a framework or evaluation model that is used to assess those interventions that are created in the alternative design phase of the decision-making process (see chapter 10). Although the refining activity diagrams of this use case describe the process as the creation of a textual, category-based model (see the activity diagrams AD-PS-04 to AD-PS-09 in annex C.2), a concrete architecture derived from the reference architecture candidate presented in the sixth step of the reference architecture design cycle, might also incorporate visual elements such as maps (see Berry et al. 2011; Ramsey 2009; Simão, Densham, and Haklay 2009, for details of GIS-based DSS), if the problems addressed in the ICT-supported decision-making process can make use such features (e.g., location planning). However, besides this potential refinement in derived architectures, the currently more important aspect is the use case's initiation.

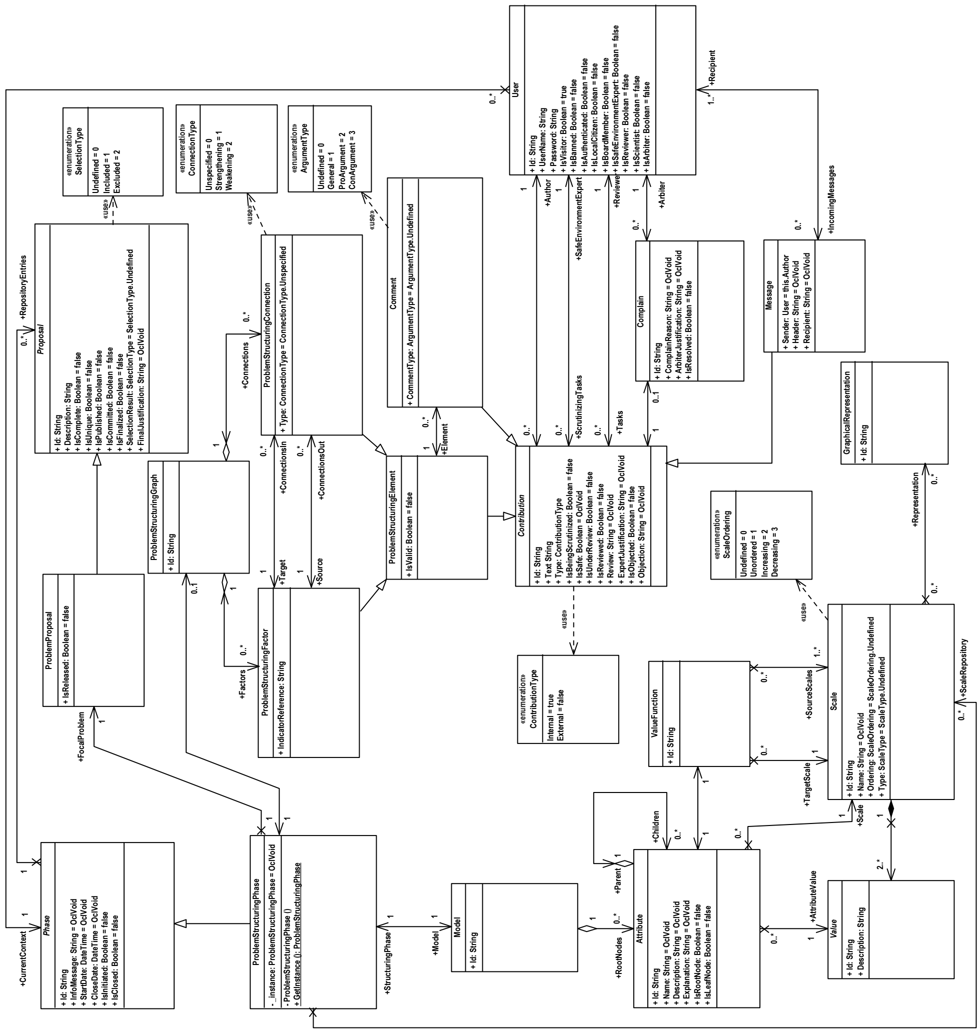

Figure 11.6: Problem Structuring Phase-Preliminary Object Model

The scientist, a role not covered in the discussion of actors in the indicator selection phase, is used to denote an independent, that is, extra-local expert in the focal problem's domain, who is not involved in the decision-making process. The rationale to involve such an independent third party follows from the misuse of evaluation models. More specifically: models, especially those supporting visual representations of interventions, are often misused to present alternatives in a distorting, usually more beneficial way (cf. Lewis, Casello, and Groulx 2012, pp. 91–93). Therefore, delegating the model creation process to an independent third party, as discussed more thoroughly in the next phase, ensures that all designed alternatives are evaluated against the same model. This, in turn, is a mechanism that helps to minimize that distorted assessments are used to make local citizens belief that a certain alternative has a comparative advantage or less side-effects although this is just based on 'technical tricks'.

In sum, each of the two discussed use cases produces an output that supports the activities of the next phase, that is, of the alternative design phase: on the one side, the 'structure focal problem' use case results in a problem structuring graph that indicates which intervention entry points can be exploited by alternatives to address the issue defined in the focal problem, and on the other side, the 'create model' use case provides an evaluation model that serves as common frame for the evaluation of designed interventions.

Alternative Design Phase

The third step in the decision-making process outlined at the end of chapter 10 is the creation of alternatives that aim to address the focal problem by exploiting the intervention entry points identified in the preceding step. As extensively discussed in section 5.2, design endeavors are generally considered to be creative processes, which, in turn, makes it difficult to give a precise and detailed description of the involved steps. Nevertheless, the phase's activities, in contrast to the problem identification and similar to the indicator selection phases, are working group efforts (see section 10.3), that is, interventions are designed by groups of citizens. Therefore, the use cases shown in the use case diagram depicted in figure 11.7, despite the varying content of the comprised activities, are comparable to the functional requirements imposed by the indicator selection phase.

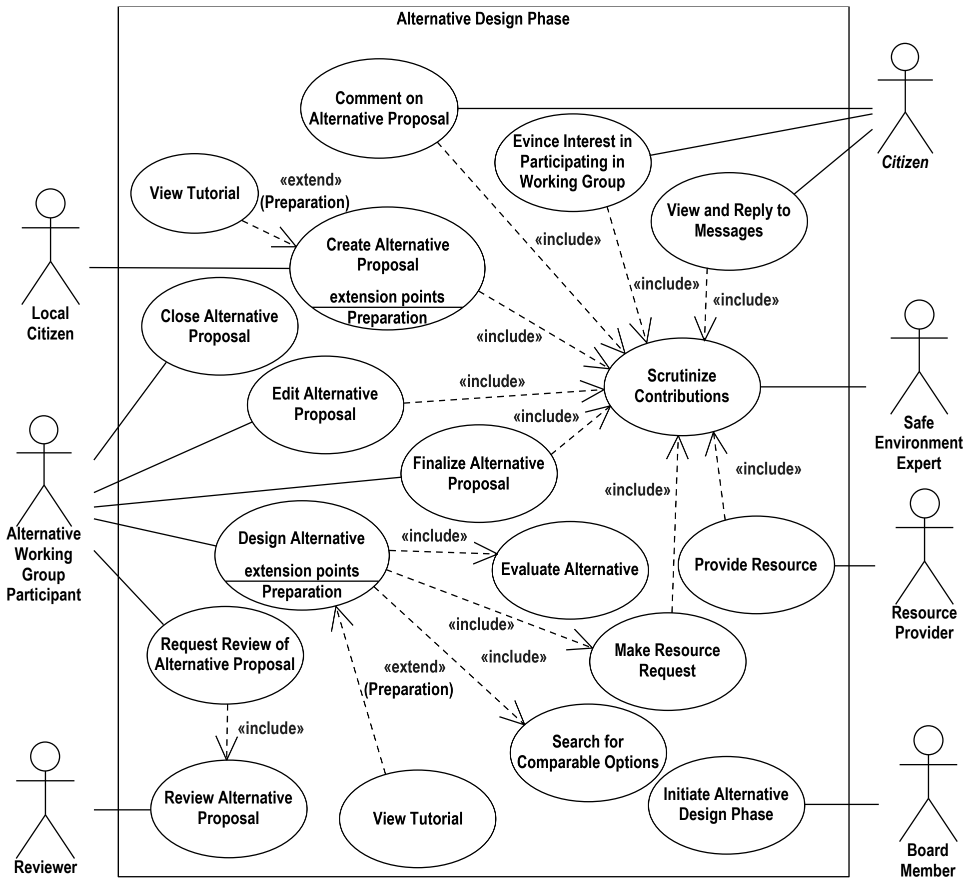

Figure 11.7: Alternative Design Phase-Use Cases

However, the alternative design phase exhibits two differences: on the one side, the phase neither contains a voting nor a selection step as both these steps are shifted to the alternative selection phase, and on the other side, the design of alternatives entails two additional use cases. More specifically, the DSS needs to support the 'provide resource' and the 'design alternative' use cases, whereby the latter, as shown in figure 11.7, includes three further sub-use cases (i.e., the 'evaluate alternative', the 'make resource request', and the 'search for comparable options' sub-use cases). As the first difference solely refers to the exclusion of steps and as the remaining steps of the phase's substructure are similar to the ones already discussed in the indicator selection phase, the following will concentrate on the exploration of the additional functional requirements, that is, on the second difference.

The 'provide resource' use case, as shown in figure 11.7, is triggered by the resource provider actor, a role that was not included in the discussion of actors in the indicator selection phase. This role is used to refer to citizens who provide resources (e.g., manpower, equipment), which are or might be required to realize alternatives, by specifying the details of the `Resource` (see the preliminary object model in figure 11.8). This description, if passing the scrutinizing control, is then published on, for example, a web site where it is explorable by alternative working groups. Although, as discussed in section 10.3, it is, on the one side, preferable that resource providers are local citizens, because this might enhance trust and co-operation within the locality, it is, on the other side, possible that not all required resources are locally available (e.g., funds, field experts). Correspondingly, the constraint needs to be relaxed to increase the number of potential resource providers. The possible negative side-effects on an alternative's ownership pointed out in section 10.3 are, at least partially, counterbalanced by ensuring that only local citizens can create `AlternativeProposals`.

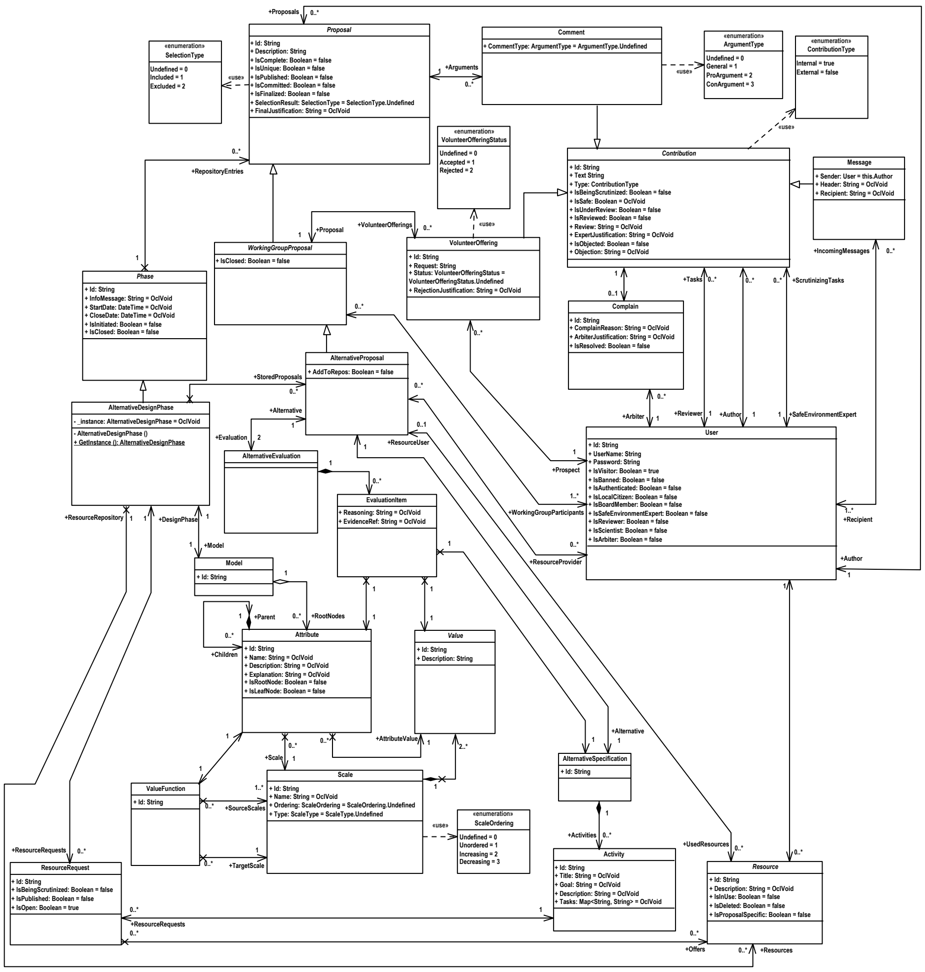

Figure 11.8: Alternative Design Phase-Preliminary Object Model

The 'design alternative' use case, initiated by an alternative working group participant, captures those activities that are involved in the design of an alternative, which, in turn, is the technical representation of the specific plan that is derived from the idea expressed in the `AlternativeProposal` (see the preliminary object model in figure 11.8). Within the present case, an intervention, called `AlternativeSpecification` in the preliminary object model, is considered to be a sequence of `Activities`, each of which describes one step in the plan that is devised to make the idea in the `AlternativeProposal` actionable. While modifying the `AlternativeSpecification's Activities`, working group participants, as captured by the included 'make resource request' sub-use case (see the use case diagram depicted in figure 11.7), can, in addition to the exploration of already published `Resources`, create a new `ResourceRequest`. Similar to the above described resource offerings, the request, if it passes the scrutinizing control, is published on, for example, a web site. The list of published `ResourceRequests` is then explorable by resource providers, who, if able and willing to provide one of the required resources, offer `Resources` as specified in the 'provide resource' use case. In other words, the 'make resource request' sub-use case is the counterpart of the above described 'provide resource' use case and vice versa.

The 'search for comparable options' sub-use case, the second use case included by the 'design alternative' use case, accounts for the fact that successfully implemented interventions often function as blueprints that inform the design of alternatives as pointed out at the end of the preceding chapter. Although this usually includes options belonging to different domains and other localities (see section 8.2), within the following only the finalized alternatives created within the locality are considered in the preliminary object model depicted in figure 11.8 as well as the activity diagram that refines the 'search for comparable options' sub-use case (see AD-AD-04 in annex C.2). However, the discussion of the reference architecture candidate in the sixth step of the reference architecture design cycle, briefly examines a possibility that broadens this search by including other, remote repositories, which contain descriptions of interventions that can support the design of alternatives within the locality (see also the 'virtual repositories' of Li et al. 2011, pp. 1754–1759).

The final functional requirement added by the alternative design phase is covered by the 'evaluate alternative' sub-use case shown in figure 11.7. It involves the assessment of a designed alternative against the third-party-created evaluation model discussed in the preceding phase. As will be explored more thoroughly in latter steps of the reference architecture design cycle, an `AlternativeProposal` is associated with two `AlternativeEvaluations` (see the cardinality of the association between both concepts in the preliminary object model shown in figure 11.8). In other words, an `AlternativeProposal` is evaluated twice within a single alternative design phase instance: whereas the first evaluation has to precede the initiation of the 'request review of alternative proposal' use case (see figure 11.7), the second evaluation can be carried out, for example, if the review indicates that the `AlternativeProposal` and/or its constituents needs to be changed. Whereas the rationale to demand that the first evaluation is carried out before the `AlternativeProposal` can be committed for a review is based on the idea that this assessment then can be considered in the review of a field expert, the nature of the review might make it necessary to rework the `AlternativeProposal` and/or its constituents. This, in turn, implies that the `AlternativeEvaluation` refers to an older version of the `AlternativeProposal` and needs to be updated. However, as the designed reference architecture dose not explicitly provide for a second review[339], both `Al-`

339. As will be discussed more thoroughly in the sixth step of the reference architecture design cycle, most of the processes that the DSS needs to support are translated into workflows. Therefore, a concrete architecture derived from the designed reference architecture might include such a second line of reviews in the respective workflows without causing side-effects in other parts of the architecture.

ternativeEvaluations are stored and, together with the review, presented to local citizens during the voting step that, as indicated above, is part of the next phase. This mechanism ensures that changes to the evaluation in response to the review are traceable for local citizens, which, in turn, helps to prevent that the second evaluation is used, or more precisely misused, to present the AlternativeProposal in a more beneficial way.

Alternative Selection Phase

The aim of the alternative selection phase, the final phase of the decision-making process outlined at the end of chapter 10, is to identify a set of interventions that can be realized in the name of the initiative. The discussions of the first intervention entry point in section 10.3 as well as those of the indicator selection and the alternative design phases already pointed out that this process is divided into two parts. In the first part those alternatives that have been finalized in the preceding phase are presented to local citizens so that they can express their preferences in regard to an intervention's realization. In the second part the finalized alternatives as well as the votes of local citizens are shown to the initiative's board members, who, in turn, select a number of alternatives that are included in the initiative's activity program or portfolio. Although this simplified description covers the main aspects of the voting and selection steps in the indicator selection as well as the problem identification phase, the following will refine this discussion to point out the peculiarities of the alternative selection phase.

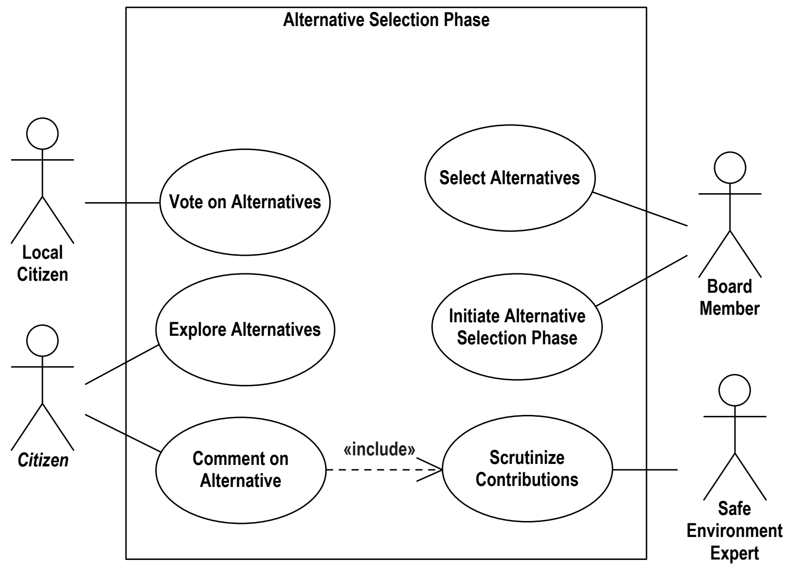

Figure 11.9: Alternative Selection Phase-Use Cases

However, before the phase's voting and selection steps are compared to those of the previously discussed phases, an additional remark in respect to the use cases shown in the use case diagram depicted in figure 11.9 is inserted. As indicated by the 'explore alternative' and 'comment on alternative' use cases, the alternative selection phase also comprises a 'comment' step. Similar to the comment step in the problem identification phase, the comment step in the current phase, although only implicitly modeled through the dates specified in the 'initiate alternative design phase' use case, provides citizens with the opportunity to explore and comment on those options that will be considered in the voting and selection steps (see also AD-C-26 in annex C.2). The purpose of this intermediate step is, even though it might also partially outbalance the ‘missing’ second review, to give citizens a chance to express their concerns about an intervention’s effect and possible side-effects before the actual voting process starts. This is necessary because some alternative working groups might have closed their proposals during the alternative design phase, which, in turn, implies that these proposals could not be scrutinized by (distant) others (see section 10.2). Offering this comment step, thus, is a mechanism that ensures that local citizens are aware of those arguments that (distant) others put forward in favor of and, more importantly, against alternatives, which, as indicated in section 5.5, makes them morally responsible for those negative consequences of an intervention’s realization that could have been known in advance.

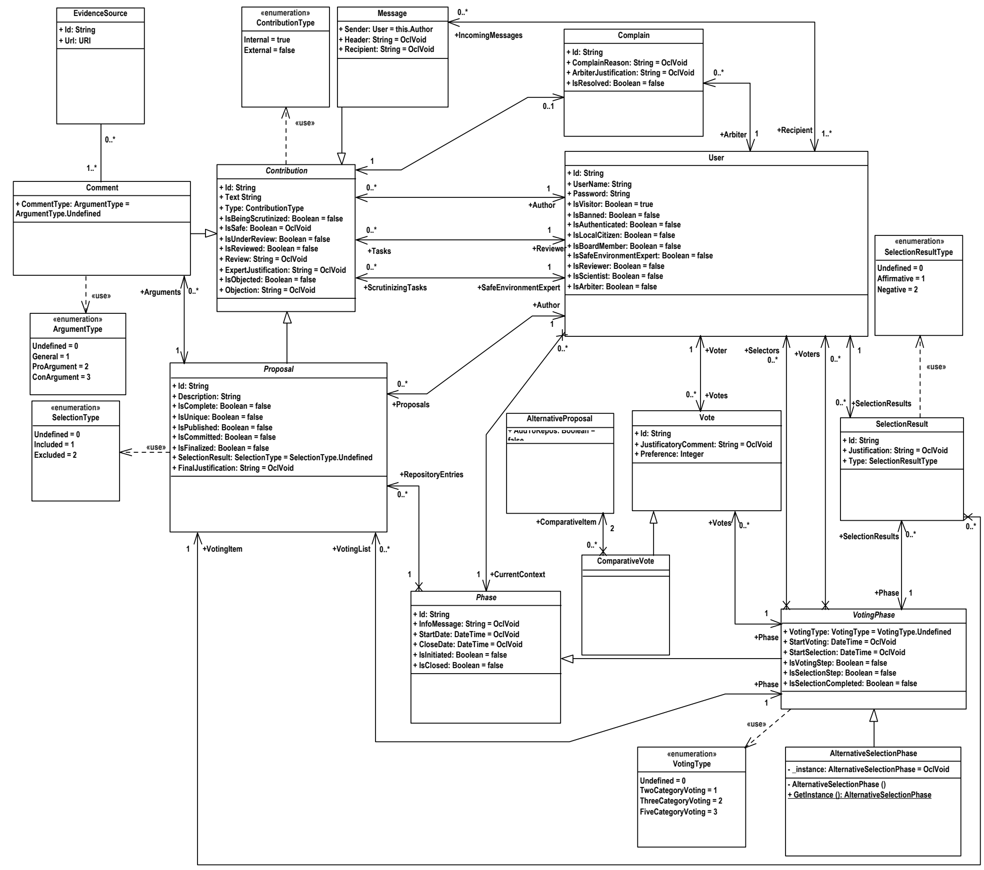

Figure 11.10: Alternative Selection Phase-Preliminary Object Model

Although all voting steps, that is, of the indicator selection, the problem identification, as well as of the alternative selection phases, precede their respective selection steps and are structured in a similar way, the voting step of the alternative selection phase is nevertheless unique in that it employs a comparative voting approach (see also AD-C-04 in annex C.2). This voting approach distinguishes itself from the ‘ordinary voting’ through the number of alternatives that are associated with a particular vote: whereas the ordinary voting creates one vote per option, the comparative voting approach creates one vote per pair of options (see also the cardinality of the association between the `ComparativeVote` and the `AlternativeProposal` concepts in the preliminary object model shown in figure 11.10). In other words, within the voting step of the alternative selection phase a list of pairs of options is created and presented to local citizens, who, in turn, indicate which of the two compared alternatives they prefer (see also the discussion at the end of chapter 10). The rationale to employ the comparative voting approach rests on the idea that `AlternativeProposals` have multi-dimensional, incommensurable impacts and that this makes it difficult to assess alternatives in isolation. This difficulty, at least to some degree, is mitigated by a comparative voting, because votes are not isolated, absolute votes, but they are weighted preferences about two alternatives and their differences, manifesting themselves in different attribute values, in certain dimensions.

The different voting approach employed in the alternative selection phase's voting step, by implication, also has an effect on its selection step. However, this influence is noticeable only in the presentation of alternatives: instead of a list of votes that reflect the preferences of local citizens in regard to a particular `AlternativeProposal`, the system now presents an overview that, based on a list of `ComparativeVotes`, shows how the alternative is ranked in comparison to all other available interventions. Based on this information board members have to select a set of options as the result of one decision-making process instance. Besides this representational difference the selection steps in all three phases, that is, the indicator selection, the problem identification, and the alternative selection phase, are similarly organized. More specifically, they are all divided into two parts[340]. In the first part each individual board member creates a list of options that she or he thinks should be realized (see also AD-C-05 in annex C.2). If all board members have created their own `SelectionResult` lists, the selection step's second part is initiated. Within this part the `SelectionResult` lists of all board members are compared to identify where board members agree about the inclusion and exclusion of options as well as where they disagree. The results of this analysis are then used by the system to structure the communicative interaction in which the final, board-based selection of alternatives is made (see also AD-C-06 in annex C.2).

Before the discussion now turns to the second step of the reference architecture design cycle (see section 8.3), the requirements model elaboration is closed with the 'access dashboard' activity diagram shown in figure 11.11 (see also AD-C-01 in annex C.2). Although this activity diagram is neither directly relevant for the elicitation of requirements nor does it, as it might seem, offer an initial sketch of architectural components and their protocols, it is nevertheless the central anchor point or overarching guide that connects all the activity diagrams listed in annex C.2. It might therefore serve as reference point that provides the context for those use case refinements that are discussed in the key scenario step of the reference architecture design cycle as well as for those that, despite being included in annex C.2, were not considered in those reference architecture design iterations that were carried out in the present inquiry's 'second research project'.

11.2 Architectural Objectives

The central activities of the reference architecture design cycle's second step are the following three tasks (see section 8.3): (i) define the goal that guides the design process to carve out and communicate the understanding of the problem, (ii) identify and explicate the informational needs of the architecture's stakeholders to create an accessible and informative architectural description, and (iii) examine the application context to determine which organizational and technological constraints the social system imposes on the design of a technical system. Within section 8.3 it was pointed out that (i) and (ii) are captured by the goal and con-

340. This refinement was ommitted in the preceding discussions for stylistic reasons.

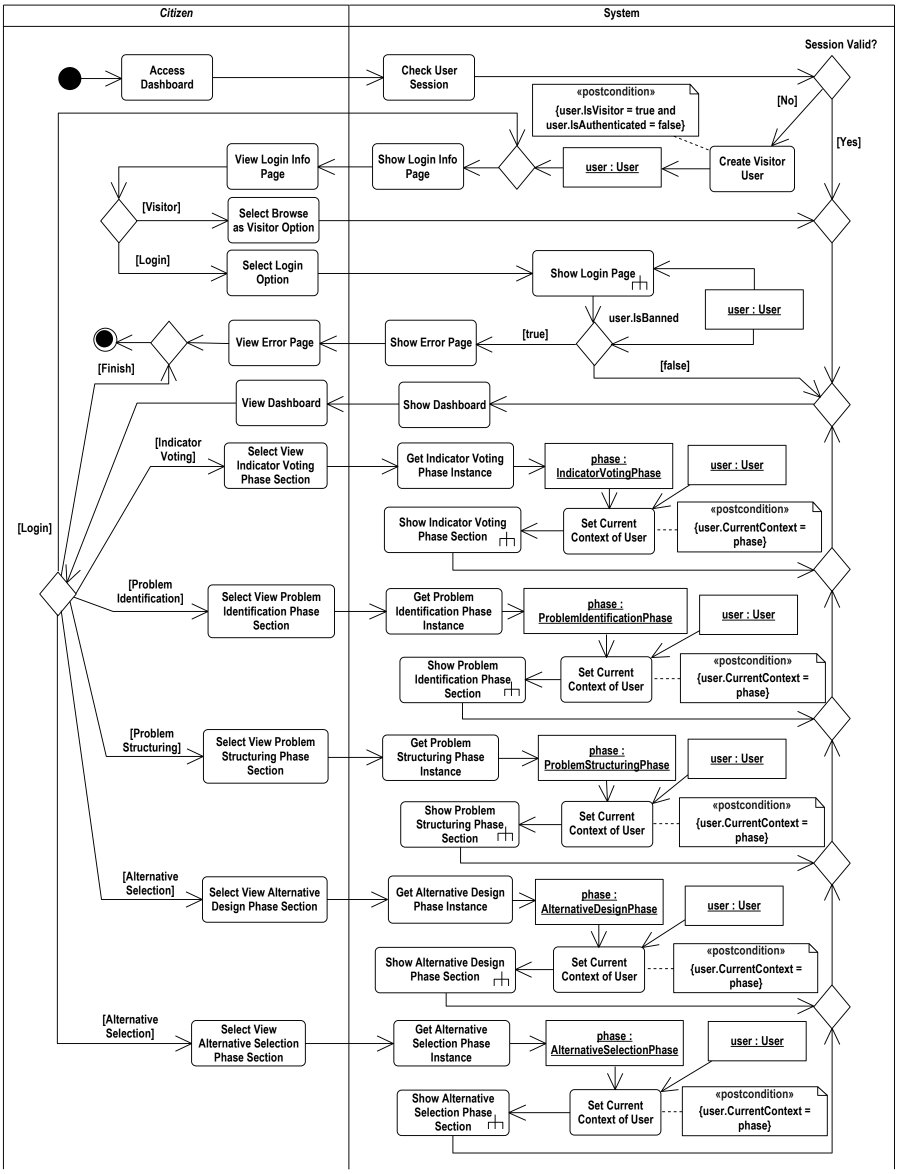

Figure 11.11: Access Dashboard Activity Diagram (AD-C-01)

Table 11.1: Reference Architecture Variant 5.1, adapted from: Angelov, Grefen, and Greefhorst (2012, p. 435)

Dimension	Values
G1: Why	Facilitation
	↓
C1: Where	Multiple organizations
C2: Who	Research centers (Requirements Provider, Designer)
C3: When	Preliminary
	↓
D1: What	Components, algorithms, protocols
D2: How	Detailed or semi-detailed components and algorithms
	Aggregated or semi-detailed protocols
D3: How	Abstract elements
D4: How	Formal or semi-formal element specifications

text dimensions of the 'reference architecture development framework' (see Angelov, Grefen, and Greefhorst 2012, and section 5.4) and that (iii) is only partially viable in the present case, because the abstract natures of 'possible worlds' as well as of reference architectures deliberately exclude organizational and technological peculiarities (see sections 5.4, 8.1, and 8.3). On the other side, constraints that are shared in a domain are already embodied in the requirements model extracted from the 'possible world'[341]. Correspondingly, the specification of architectural objectives can be confined to the first two of the three above-mentioned tasks.

In regard to the first task, the goal that should be achieved with the design of a reference architecture unfolds on two levels: from the perspective of the present inquiry, the 'second research project's' primary intention is to demonstrate that 'possible worlds' can function as bases for the design of technical systems; however, from the 'second research project's' point of view, the aim is to devise a blueprint for the construction of ICT application specifications that can be used to construct concrete technical systems, which, in turn, support the decision-making processes of community-driven SHD initiatives. If, as done in the following, the second stance is adapted, the designed 'possible world' is merely a summary of options for the construction of progressive social systems. This, in turn, allows to characterize the reference architecture, based on the decision tree depicted in figure 5.8, as a preliminary, facilitating reference architecture: it is preliminary as community-driven SHD initiatives constitute future, not yet existing social systems and it is facilitating because it should support the design of technical system specifications instead of standardizing the latter. Furthermore, the 'second research project's' illustrative nature suggests that the design is not conducted in cooperation with a software organization; rather, it is a purely theoretical research endeavor. This together indicates that variant 5.1, whose main properties are summarized in table 11.1, is, in the present case, the most suitable congruent reference architecture type.

However, as implied by 'congruent', which unfolds through the alignment of the goal, context, and design dimensions, the result of the second above-mentioned task (ii) is already given by the design dimension of the selected reference architecture type. Correspondingly, the next steps in the reference architecture design cycle focus, as specified by D1 in table 11.1, on the following three architectural elements (see also table 5.5): (a) components, which describe the modules that realize the system's core functionalities, (b) algorithms that specify

341. For instance, in the discussion of the third intervention entry point the collection of data to determine the status of environmental systems was largely based on mobile devices. Although this aspect was not fully unfolded and will play only a minor role in the reference architecture description presented in section 11.6 it is nevertheless considered in the process of creating indicators and the corresponding proposals (see AD-IS-03 in annex C.2).

the operations within components, and (c) protocols that describe how components interact with each other. Furthermore, D2 suggests that whereas components and algorithms have to be specified on an at least semi-detailed level of granularity, protocols should have, due to the technology agnostic character of reference architectures, a lower level of detail. These prescriptions are further refined by D3, which recommends that only the very general characteristics of the three architectural elements should be defined to leave open all specific choices to the designer of derived technical system specifications. Finally, D4 complements these suggestions by proposing that the architectural description should be at least semi-formal to, inter alia, facilitate future research. Therefore, the following will use the UML (cf. OMG 2011a, 2011b) to create the architectural description (see also section 5.4): it is not only a semi-formal language, but it also enhances, as international standard (cf. ISO 2012a, 2012b), the description's accessibility and understandability. In reference to table 8.8, which lists those UML diagram types that are usually employed to specify different entities of a reference architecture description (see table 5.5), the three above-mentioned entities are mapped onto the following three UML diagram types: on the one side, the system's static structure is described using component diagrams, and on the other side, its dynamic facets, manifesting themselves in algorithms and protocols, are captured using activity and sequence diagrams. Whereas activity diagrams, as already indicated in the requirements model step (see section 11.1), are used in the discussion of key scenarios, which, at least partially, specify the details of algorithms (see section 11.3), the presentation of the architectural candidate in section 11.6 employs sequence diagrams to specify the interaction protocols of components and, based on the refinement of components into submodules, to map algorithms onto the technical constituents of the reference architecture's core entities.

11.3 Key Scenarios

The aim of the reference architecture development cycle's third step is to identify key scenarios that guide the current design iteration. Key scenarios, as discussed in section 8.3, are those use cases contained in the requirements model (see section 11.1) that either deal with an unknown part of the architecture's development, involve a wide range of system functionality, contain functional requirements that intersect with quality attributes, or require trade-offs between quality attributes. Although the identification of key scenarios is an iterative activity, in the introduction to this chapter is was already indicated that the cyclic design approach is 'squeezed' into a linear representation. This, in turn, implies that the following will present more key scenarios than usually required for a single design iteration. On the other side, the elaboration will not explore all key scenarios that directed the reference architecture's development in the 'second research project'; rather, it will focus on a small subset of those key scenarios (see annex C.2 for an overview). Their selection, in addition to the above mentioned characteristics, is based on the idea that the totality of surveyed key scenarios should represent an adequate cross section through all important functional requirements that a DSS for community-driven SHD initiatives needs to support. Therefore, although the following discussion is organized around the phases of the decision-making process outlined at the end of chapter 10, the key scenarios examined within each of these phases are not necessarily confined to this phase nor do they cover all important demands imposed by this phase. Nevertheless, their totality provides a suitable overview of those functional requirements that the reference architecture needs to integrate.

Indicator Selection Phase

As the foregoing elaborations, especially the one in section 11.1, have explicated, the central elements that a DSS for community-driven SHD initiatives needs to support are the specializations of the `Proposal` concept, that is, the technical representations of suggestions that local citizens make in three of the phases of the outlined decision-making process. Although each of these three phases deals with one from the abstract base concept derived type (see the preliminary object models depicted in figures 11.2, 11.4, and 11.8), the respective life cycles—with minor variations—are similar in all cases (see section 11.1). Furthermore, proposal-related use cases are not only central to several phases and involve the interaction of multiple components of the technical system, they also, due to restrictions in regard to roles that can create, view, modify, and delete proposals, require to take security considerations into account (see section 11.5). Correspondingly, all these reasons indicate that those use cases that contain proposal-related processes are viable key scenarios. Therefore, the remainder of this first part of the key scenario selection step will discuss five of such use cases. This includes the creation, editing, committing, closing, and finalizing of proposals[342]. Similar activity sequences are involved in other use cases such as, for example, the deletion of proposals. Therefore, as the specification of these further use cases does not substantially enhance the design process, their details are omitted and left for the designers of derived architectural descriptions.

Similar to a proposal's life cycle, the exploration of use cases that are involved in the former starts with the 'create proposal' process depicted in figure 11.12. The flow of events shows that if the authenticated local citizen selects the create proposal option, the system, depending on the currently active phase, loads a template and builds a page on which the user can enter the proposal's details (see also the comment in figure 11.12). The preliminary object models shown in section 11.1 reveal that this, considering the abstract nature of reference architectures (see section 5.4), involves, for example, a proposal description. However, a concrete specification derived from the reference architecture will probably enrich the architecture-specific `Proposal` variant to allow users to specify further details. Nevertheless, after the user entered the proposal's description and decided to save it, the system creates a `Proposal` concept and associates it with the user. It further performs two types of validations: whereas the 'complete check' determines if all required fields are filled out with appropriate and secure values, the 'unique check' analyzes, based on, for example, a keyword comparison, if other local citizens have already created similar proposals to make phase-specific recommendations such as 'join working group X' or 'comment on proposal Y' respectively. If the proposal successfully passes both these inspections, the system shows a final info page to the user, that is, the user interaction ends at this point. However, parallel to this, the system also, as discussed more thoroughly in the next part of the key scenario selection step, engages a safe environment expert to scrutinize the proposal. If the proposal also clears this second hurdle, it is added to the proposals repository, which, in the preliminary object models shown in section 11.1, is realized as simple list of `Proposal` concepts—taking the role of `RepositoryEntries`—in the `Phase` concept. As depicted in figure 11.12, the 'create proposal' process ends with phase-specific activities that are carried out in two parallel flows. More specifically: if the proposal is an `IndicatorProposal`, then the system,

342. All of these use case event flow specifications are embedded in the phase-specific 'show phase section' call behaviors depicted in the 'access dashboard' activity diagram briefly touched at the end of section 11.3 (see activity diagrams AD-IS-01, AD-PI-01, and AD-AD-01 in annex C.2 for the use cases' activation conditions).

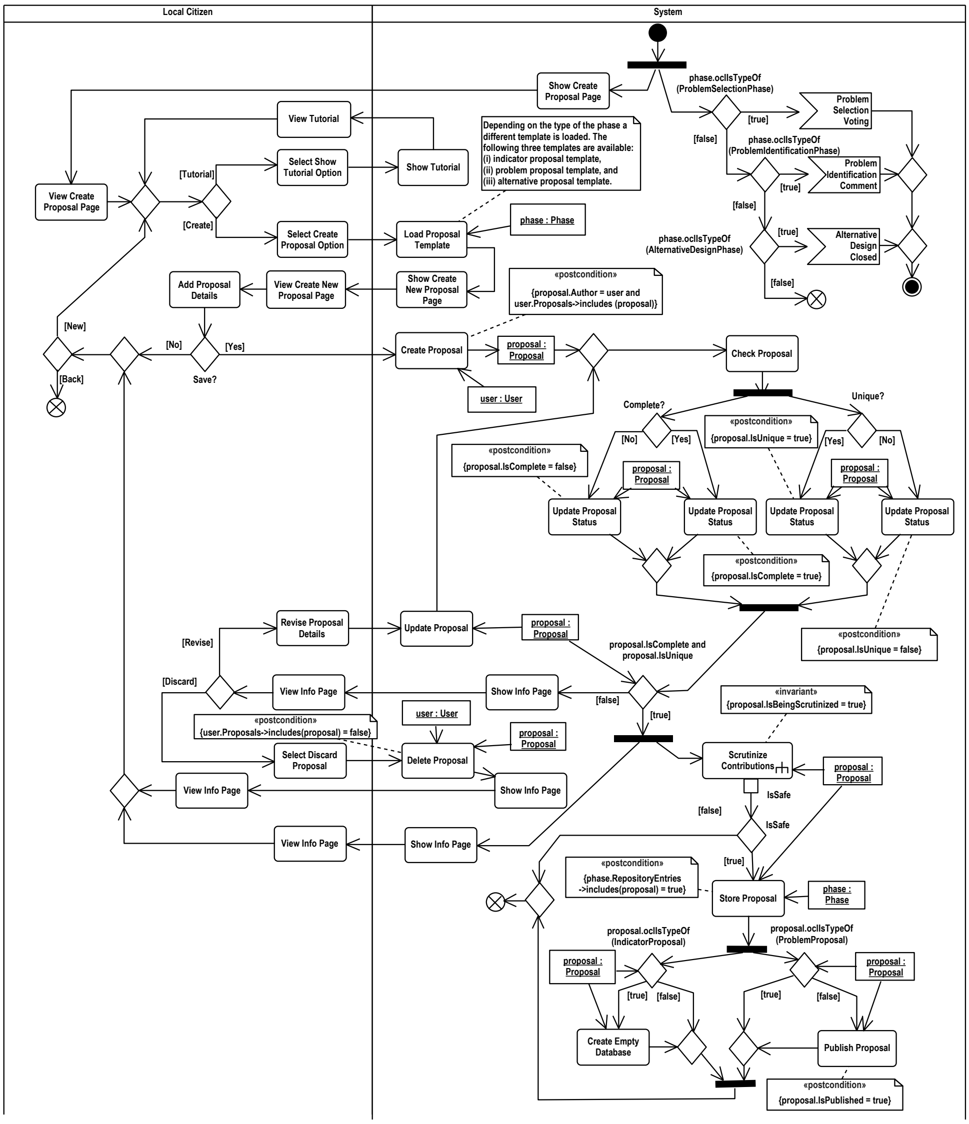

Figure 11.12: Key Scenario-Create Proposal (AD-C-03)

for instance, creates an empty database and publishes the proposal[343]; if the proposal is an `AlternativeProposal`, then the system just publishes the latter; however, if the proposal is a `ProblemProposal`, then the system does not even publish the proposal, because, as pointed out in the requirements model step, `ProblemProposals` are not published until the problem identification phase enters the comment step.

Before the exploration of key scenarios turns to the examination of the second above-mentioned, proposal-related use case, a brief remark in regard to the, till now omitted, flow

343. Although not fully explored in the discussion of the indictor selection phase in the requirements model step (see section 11.1), indicator working groups might, as indicated in the flow of events shown in the activity diagram AD-IS-03 in annex C.2, not just work on the description of an indicator proposal, but also on surveys and/or mobile applications, which gather the data underlying indicators. To store the collected data, the system, once a proposal has passed the scrutinizing barrier, creates an empty database that working group participants can use for such purposes. The rationale to 'burden' citizens with all these tasks is that scientifically produced indicators are often too 'remote' for 'ordinary' citizens to comprehend (cf. Redaelli 2012, p. 656, and the discussion of the 'unfinished project of modernity' in part I). Hence, involving citizens directly in the creation process enhances the chances that they understand why which data is collected for what purpose. This, however, is not to suggest that scholars should not participate in indicator working groups; rather, the aim is to foster the formation of mechanisms such as the 'scientific brokering partnerships' explored in the discussion of the third intervention entry point (see section 10.3).

of events in the upper right area of the activity diagram shown in figure 11.12 is inserted. As already indicated in the requirements model discussion (see section 11.1), proposals can be created only in certain steps of a phase. This, in turn, implies that if the defined time span of a step elapses and the phase's status is automatically changed to a step in which the creation of proposals should not be possible, the 'create proposal' activity should not be callable anymore and all still ongoing creation processes have to be interrupted or canceled. Exactly this latter behavior is modeled by the 'accept event actions' (cf. OMG 2011b, pp. 214–243) in the upper right area: if triggered by the respective signal, an accept event action releases the token that it received when the process began[344], which, in turn, stops all flows in the activity as captured by the activity final node (cf. pp. 339–341, see also AD-IS-02, AD-PI-02, and AD-AD-02 in annex C.2 in which the corresponding signals are fired).

The second key scenario, the 'edit proposal' use case flow of events shown in figure 11.13, presupposes that the above-described 'create proposal' process finishes with the flow in which the safe environment expert classifies the scrutinized proposal as safe (i.e., `IsSafe = true`). After this successfully completed activity sequence, the proposal author and, if the respective proposal is derived from the `WorkingGroupProposal` concept, other working group participants can edit the proposal's description. Within the process of storing changes, the system has to decide if the proposal has to be scrutinized again (see also section 11.1): whereas `WorkingGroupProposals`, i.e., `IndicatorProposals` and `AlternativeProposals`, that have not been closed need to be scrutinized each time they are modified (see also the 'close proposal' key scenario [AD-C-21] described below), `ProblemProposals` are not scrutinized till they are released (see AD-PI-03 in annex C.2). Similar to the 'create proposal' process described before, the 'edit proposal' activity is canceled if one of the accept event actions shown in the right area of the activity diagram depicted in figure 11.13 releases its token in response to a fired signal, which, in turn, indicates that the current phase enters a step in which the editing of proposals should not be possible (see also AD-IS-02, AD-PI-02, and AD-AD-02 in annex C.2 in which the corresponding signals are fired).

In contrast to the 'commit proposal' and 'finalize proposal' key scenarios discussed further below, the 'close proposal' process described in the following is not applicable to all concepts in the `Proposal` inheritance tree; rather, this flow of events solely deals with concepts specializing the `WorkingGroupProposal` type, that is, `IndicatorProposals` and `AlternativeProposals` (see the preliminary object models shown in figures 11.2 and 11.8). As elaborated in the first intervention entry point (see section 10.3), alternatives—equally applying to indicators—should be designed in small working groups to, for instance, encourage contact between and cooperation of (local) citizens, because this, if the appropriate interaction conditions are fulfilled, leads to the creation of social capital. One crucial aspect to get (local) citizens involved in a working group and to foster the formation of social capital beyond the working group's borders is that the latter's processes are public. However, interruptions through new participants or the time required to reply to external comments might interfere with the development of social capital within the working group. The closing of proposals is a mechanism that addresses this issue. It creates a 'private space' where working group

344. Accept event actions receive their initial token through the flow created by the fork that follows the initial node. This initial token, if not directed to any accept event action by one of the decision nodes, is consumed by a flow final node, which does not affect other flows in the activity (cf. OMG 2011b, pp. 386–387). However, this path actually indicates that the system is in an unstable state, because this activity should be called only if one of the three decision nodes' guard conditions evaluates to `true`. Therefore, the flow final node might also be replaced by an exception mechanism (see, for example AD-C-14 in annex C.2). Yet, to keep diagrams simple, such mechanisms are omitted in all proposal-related use case refinements and left for the designers of derived architectural descriptions.

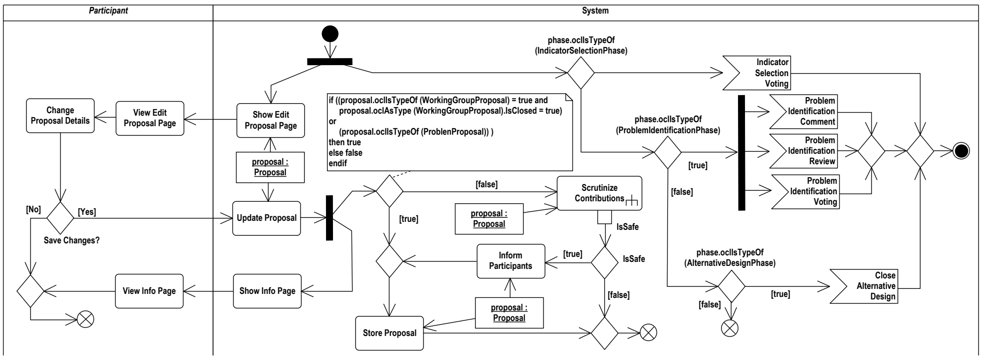

Figure 11.13: Key Scenario-Edit Proposal (AD-C-19)

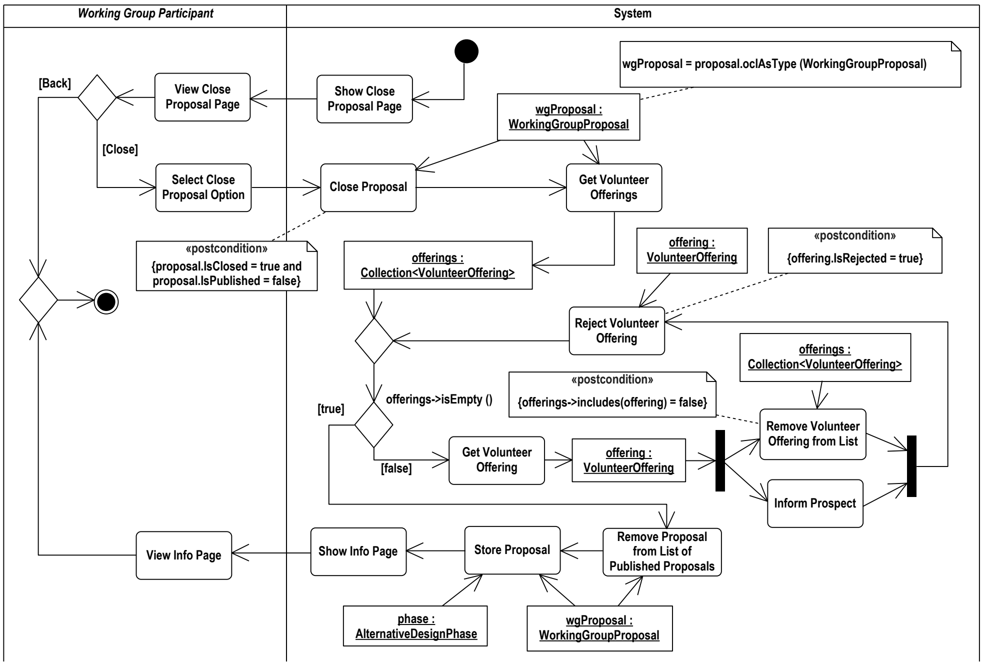

Figure 11.14: Key Scenario-Close Proposal (AD-C-21)

participants can interact without being disturbed by the above-mentioned external influences. The sequence of activities shown in figure 11.15 reveals that the closing of a working group proposal entails, inter alia, a status update and the removal of the proposal from the list of published proposals. In between these two actions, the system also deletes all volunteer offerings that have not been processes and that are not processable after the proposal has been closed (see also AD-C-20 and AD-C-25 in annex C.2). In anticipation of the more detailed discussion in the alternative design part of the key scenario selection step, a `VolunteerOffering` is the technical representation of a citizen's request to participate in a working group. These requests are issued within the 'evince interest in participating in working group' use cases comprised in the use case diagrams shown in section 11.1. However, instead of going into the details of this process here, the discussion now turns to the two remaining use cases explored in this first step of the key scenario selection step.

The committing of a proposal, as manifested in the 'request review of proposal' use cases shown in the use case diagrams in section 11.1, is similar to the process in which a safe en-

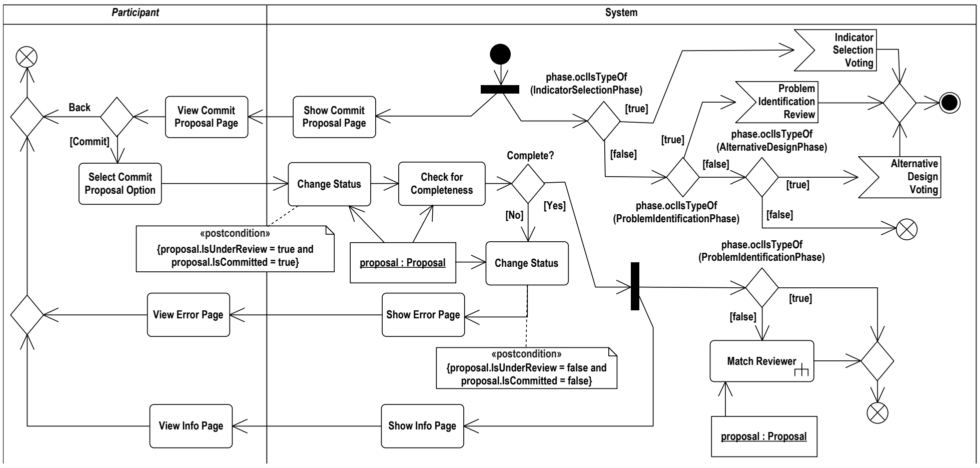

Figure 11.15: Key Scenario-Commit Proposal (AD-C-22)

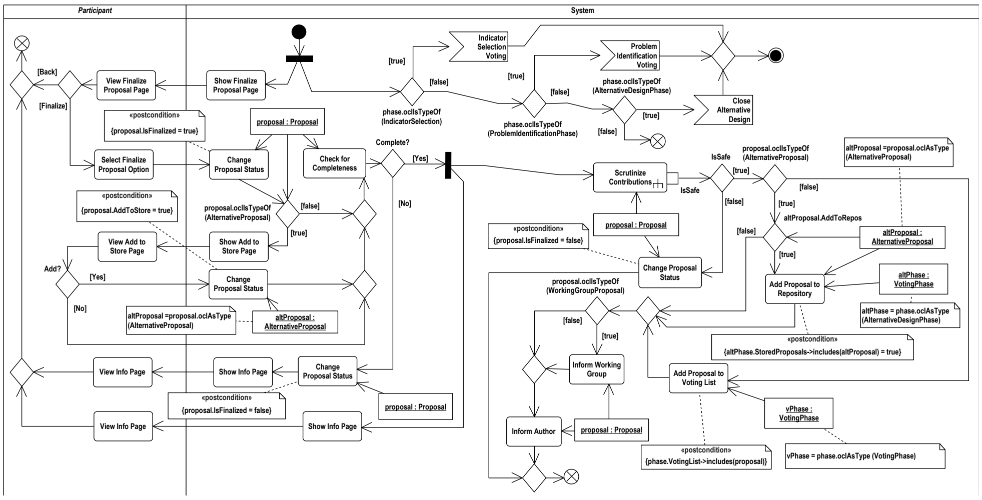

Figure 11.16: Key Scenario-Finalize Proposal (AD-C-23)

vironment expert scrutinizes a contribution. However, a review is mainly concerned with a proposal's realizability as well as its correctness and less with its language and goal. The activity sequence of a review, depicted in figure 11.15, is usually initiated, if the focal proposal has reached a state that the author or, if applicable, a working group participant considers to be stable and nearly finished. In this case the proposal can be submitted for a review. As shown in figure 11.15 this entails, besides the obligatory cancelation mechanism and the status update, the 'check for completeness' action and the 'match reviewer' call behavior (see AD-C-12 and AD-C-18 in annex C.2). Whereas the former provides an integration point for validation logic (e.g., are all comments connected to replies), the latter, in anticipation of the more detailed exploration in the next part of the key scenario selection step, captures a sequence of activities in which the system determines a suitable reviewer, engages the reviewer to assess the proposal, and adds the reviewer's written evaluation, the `Proposal` concept's `FinalJustification`, to the focal proposal (see also the preliminary object models shown in section 11.1). However, a concrete architectural description derived from the designed reference architecture will probably substitute the `FinalJustification` placeholder with a more sophisticated entity that entails, as often found in reviews of scientific (conference) contributions, a set of remarks that represent assessments in different categories and/or a decision flag that indicates if the reviewed proposal should be ‘finalizable’. Nevertheless, after the review has been added to the proposal or, in case of `ProblemProposals`, after the revise step has been initiated, the author or, if applicable, a working group participant can rework the proposal, for example, to incorporate the recommendations made in the review. Before the time for revisions, as explicitly or implicitly defined in the respective phase’s initiation processes (see AD-IS-02, AD-PI-02, and AD-AD-02 in annex C.2), elapses the author or, if applicable, a working group participant has to finalize the proposal, because without the proposal will not be considered in the voting and selection steps of the respective phase or, in case of an `AlternativeProposal`, in the subsequent alternative selection phase.

The details of the ‘finalize proposal’ use case are shown in the activity diagram depicted in figure 11.16. In addition to the afore-mentioned actions, the core of this activity sequence can be found on the diagram’s right side. It involves, inter alia, a final investigation of the safe environment expert and, if the former classifies the proposal as safe, an action that informs the author and, if applicable, other working group participants about the final status update. In between these two actions, the system performs additional, proposal-specific operations. More specifically: if the proposal is an `IndicatorProposal` or a `ProblemProposal`, then the system adds the proposal to the list of options considered in the voting and selection steps of the respective phase; if, on the other side, the finalized proposal is an `AlternativeProposal`, then the system, if working group participants had set the `AddToRepos` flag to `true` in the proposal’s revision (see also the preliminary object model depicted in figure 11.8), stores the proposal in the repository of searchable interventions, that is, the list of proposals that all working groups can explore to gather ideas and insights for their design activities (see the discussion at the end of chapter 10 as well as that in section 11.1). However, as the activity diagram shows, `AlternativeProposals`, in contrast to the former two types of `Proposal` specializations, are not each individually added to the list of voting and selection items, but the process that was started by the board member who initiated the alternative design phase adds all `AlternativeProposals` at once to this list when the alternative design phase is finally closed (see AD-AD-02 in annex C.2).

Although the key scenarios selected for the foregoing exploration constitute a real subset of those use cases that the indicator selection phase imposes on the reference architecture’s design (see the use case diagram depicted in figure 11.1), the outlined behavioral specifications, as indicated by the phase-specific variations described above, are not unique to this phase; rather, all phases that deal with a type that has been derived from the `Proposal` concept have similar requirements. This pattern is followed—as far as possible—in all remaining parts of the key scenario selection step, because it allows to carve out those demands that are vital in more than one phase of the decision-making process, which, in turn, provides a more coherent and comprehensive set of functional requirements for the design of the architectural candidate as a result of the present inquiry’s ‘second research project’.

Problem Identification Phase

The use case diagram of the problem identification phase depicted in figure 11.3 contains only four use cases that have not already been examined in the preceding part: the ‘scrutinize contribution’, ‘initiate problem identification phase’, ‘vote on most pressuring problem’, and 'select focal problem' use cases. An exploration of the latter two, despite their centrality in several decision-making phases, is carried out in the final part of the key scenario selection step, because, as pointed out in section 11.1, these use cases are the core processes of the alternative selection phase. As the second use case is not only phase-specific, but it, from a reference architecture design perspective, is also relatively poor in terms of general functional requirements, the following will not delve into the details of this use case. Therefore, the focal key scenario of this part of the key scenario selection step is the 'scrutinize contribution' use case. It, in contrast to the 'initiate problem identification phase' use case, is a viable key scenario, because, on the one side, it is a crucial aspect in all phases of the decision-making process, and on the other side, it intersects with those quality attributes that, at least partially, depend on data consistency (e.g., reliability, integrity). The latter, in turn, is an issue in this use case, because the safe environment expert and the contribution's author might work simultaneously on the very same contribution (see also section 11.5).

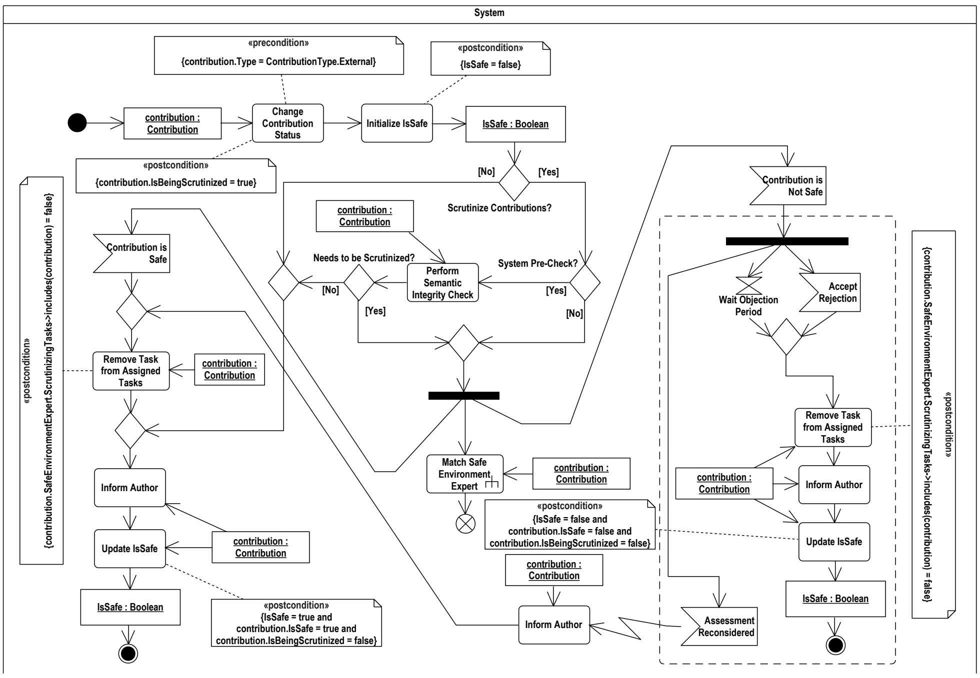

Figure 11.17: Key Scenario-Scrutinize Contributions (AD-C-14)

The detailed activity sequence of the 'scrutinize contribution' key scenario is depicted in figure 11.17. In contrast to the activity diagrams shown in the preceding part of the key scenario selection step, this process deals with the more general `Contribution` concept. As the preliminary object model, depicted, for example, in figure 11.4 indicates, the abstract `Contribution` concept functions as the base concept for several specializations (e.g., the `Proposal` concept). All these derived types have in common that they comprise pieces of information that are exchanged within communicative interactions (e.g., they are published on a web site), which, in turn, suggests that they need to be scrutinized by a safe environment expert. The contribution's central function is to make those pieces of information accessible without the need to deal with the peculiarities of each concept separately. However, the first precondition in the activity diagram displayed in figure 11.17 suggests that at least two different types of contributions need to be distinguished: internal and external contributions. Whereas the former refers to `Contributions` that are exchanged between participants of the same working group (see also AD-C-07 in annex C.2), the latter value is used to indicate that a `Contribution`-based type is transmitted between users who do not directly know each other, i.e., who are not associated by a technical grouping concept (e.g., `Messages`, as described in UC-C-08 and UC-C-09 in annex C.2, are the prime example of such a hybrid type). The rationale to distinguish these two types of conversations rests on the idea that working groups should be able to create a safe and constructive internal working environment on their own (see section 11.1), which, in turn, implies that their internal debates do not need to be scrutinized.

Correspondingly, the event flow of the 'scrutinize contribution' key scenario, as manifested by the first precondition shown in figure 11.17, solely processes external contributions such as, for example, the per definition external `Proposals` (see section 11.1). After the system has validated this constraint for the focal contribution, its updates the latter's status and initializes the process' output, before it, by examining its configuration, determines if the focal contribution needs to be scrutinized. In regard to this decision the activity diagram shown in figure 11.17 covers the following three cases: the system might be configured in a way that it (i) skips the scrutinizing process (e.g., the initiative does currently not have the required capacities), (ii) uses a module that, based on 'semantic integrity checks' (cf. Hirschheim and Klein 1989, p. 1209; 1994, pp. 90–91), analyzes if a manual scrutinizing process is required, or (iii) directly initiates a manual scrutinizing process. In other words, the action sequence either classifies the contribution as safe and carries out those actions that are planned for this final part of the key scenario (i.e., inform the author and change the contribution's status) or it starts the sequence of actions in which the focal contribution is scrutinized manually. In the currently more interesting latter case, the system issues, as indicated by the fork, three different tokens. As depicted in figure 11.17, two of these tokens activate accept event actions: the 'contribution is safe' on the diagram's left side and the 'contribution is not safe' accept event action on the right side. The corresponding signals are fired in the path that is taken by the third token, which executes the 'match safe environment expert' call behavior. The latter's details are revealed in the activity diagram shown in figure 11.18.

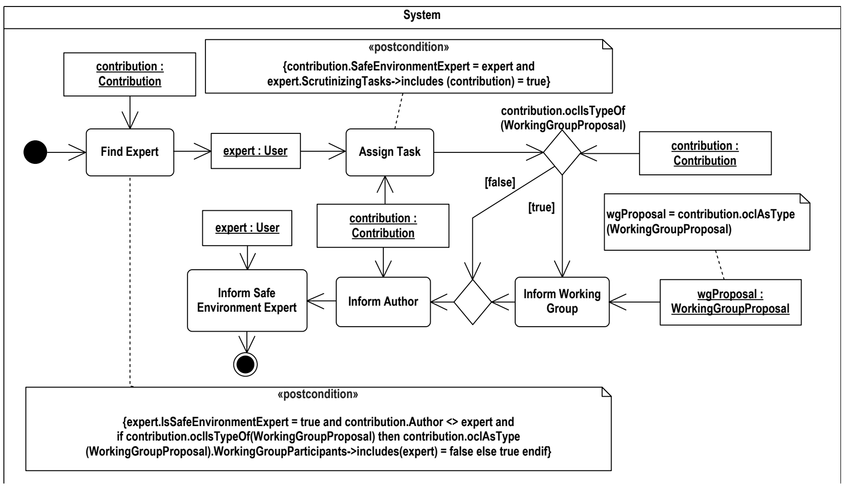

Figure 11.18: Key Scenario-Match Safe Environment Expert (AD-C-11)

This call behavior entails several actions that inform different involved parties about certain facets of the scrutinizing process. For example, the author of a contribution is informed about the process' status to make her or him feel connected (cf. Hertzberg and Monteiro

2005, p. 382), which, in turn, is essential for the development of a glocal identity (see section 10.3). However, although these activities are valuable and, as indicated by their frequent occurrence in the previously discussed activity diagrams, irreplaceable, the 'find expert' and the 'assign task' actions constitutes the call behaviors' core. Therefore, the following discusses the details of each of these two actions in turn.

Firstly, the function of the 'find expert' action is to identify a suitable safe environment expert. Although the system will probably incorporate different author- and contribution-related characteristics[345], the postcondition in figure 11.18, following from the abstract nature of reference architectures (see section 5.4), provides only some exemplary, general conditions that the matching process needs to ensure (i.e., the safe environment expert is neither the author nor, if applicable, a member of a the working group). Even though these constraints will remain valid in derived architectures, their designers, however, need to specify further, locality-specific criteria that are considered in the 'find expert' action to turn the scrutinizing process into a mechanism that helps to achieve the aims the initiative is striving for.

Secondly, if the system has found an adequate safe environment expert, it, as captured by the 'assign task' action, adds the contribution to the expert's list of scrutinizing tasks. The processing of these tasks, in turn, manifests itself in the sequence of interactions displayed in the activity diagram depicted in figure 11.19. This flow of events comprises, besides the presentation of an overview of tasks as well as of a single task's details, the 'select objected assessments option' call behavior (see AD-C-16 in annex C.2). Without going into the details of this process, the call behavior, in its essence, is part of the set of interactions between an author whose contribution has been classified as 'unsafe' and the safe environment expert who has made this assessment. In addition to the procedure comprised in the call behavior, the set of interactions also includes (i) the author's option to contest the safe environment expert's rejection of a contribution, i.e., the counterpart of the above-mentioned call behavior, (ii) the author's option to accept the expert's evaluation (see AD-C-09 in annex C.2), (iii) the option of both parties to involve an arbiter if no mutually satisfactory solution can be found (see AD-C-10 and AD-C-17 in annex C.2)[346], and (iv) the expert's option to reconsider her or his rejection of a contribution in response to the arguments an author puts forward in (i) (see AD-C-16 in annex C.2). Whereas the author has to carry out (i) in the time span captured by the afore-mentioned 'objection period' (see figure 11.17), exercising (ii) solely sends the signal that starts the process that would have been initiated after this period. On the other side, if the safe environment expert exercises (iii), the signal that the 'assessment reconsidered' accept event action is waiting for is sent. This, in turn, cancels the rejection process as modeled through the interruptible activity region (cf. OMG 2011b, pp. 391–393) and starts the flow of events that is usually taken by the 'contribution is safe' accept event action (see figure 11.17).

After this brief excursion that has caught up on the explanation of those elements that the 'scrutinize contribution' description bypassed (see figure 11.17), the discussion now comes back to the processing of scrutinizing tasks. As depicted in the middle of the activity dia-

345. Author-related characteristics might, for example, include characteristics such as the belonging to different socio-economic and/or cultural groups of the author and of the safe environment expert (see the discussion of the second intervention entry point in section 10.3). On the other side, contribution-related characteristics might, for instance, include that the safe environment expert's contributions—if the former is the author of such—are predominately related to other domains to avoid the temptation to prolong the scrutinizing process.

346. This option, not further discussed in the following, is selected if one of the two parties sees the need for involving an independent third party to make a final decision. The arbiter, possibly a board member, analyzes the arguments both parties exchanged in form of messages as well as the contribution and its rejection justification to make one, for both parties binding decision about the contribution's final status.

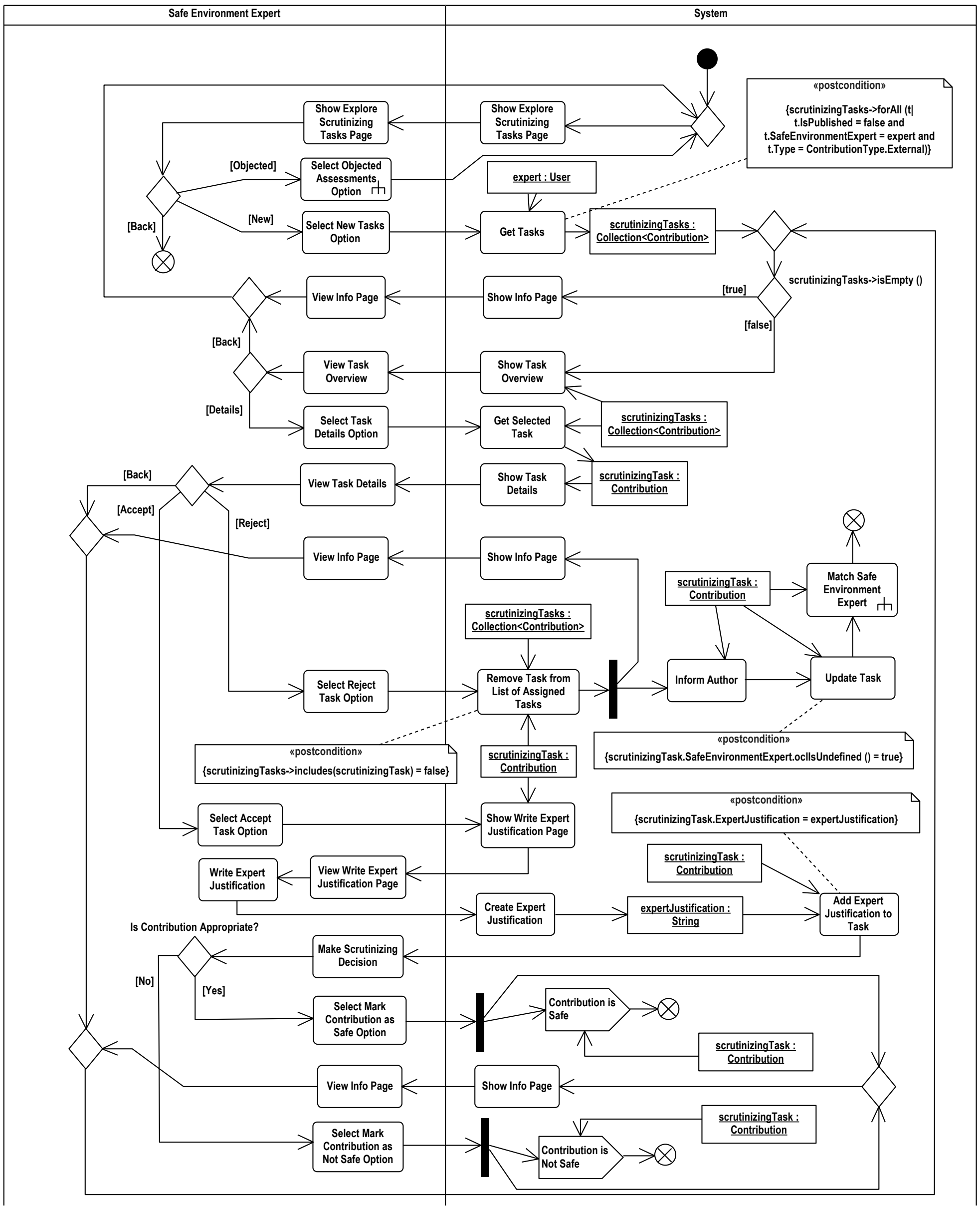

Figure 11.19: Key Scenario-Explore Scrutinizing Tasks Page (AD-C-15)

gram displayed in figure 11.19, the safe environment expert, besides being able to reject the assigned task (e.g., no time), can also accept the scrutinizing task. If this path is taken, the safe environment expert has to write a justification and make a final decision—a decision that might be followed by the above-mentioned interactions. Whereas the justification is added to the scrutinized contribution, the decision involves the activation of one of the two send signal actions shown at the bottom of the activity diagram depicted in figure 11.19. Each of these send signal actions has an accept event action counterpart on either the left or the right side of the 'scrutinize contribution' activity diagram discussed above (see figure 11.17). In other words, the safe environment expert's decision fires the signal that resumes one of the two paused flows of events in the 'scrutinize contribution' process, each of which, at least temporarily, brings the key scenario's flow to an end.

Similar to the proposal-related key scenarios presented in the preceding part of the key scenario selection step, the key scenario examined in the foregoing discussion, despite being a subset of the use cases of the indicator selection phase, is not phase-specific; rather, it is involved in all decision-making phases as shown in the use case diagrams in section 11.1. Furthermore, the process of scrutinizing contributions also serves as a blueprint for another frequently occurring use case in these diagrams, that is, the ‘review proposal’ use case. As the exploration of this use case, following from the former, will not substantially enhance the set of functional requirements comprised in the reference architecture design cycle’s product backlog, this process will not be discussed in the remainder of the key scenario selection step. However, designers of derived architectures can find the semi-formal specifications of this scrutinize contribution specialization in AD-C-12 and AD-C-18 (see annex C.2). After these more general and multiple phase-spanning use cases, the next part of the key scenario selection step will present key scenarios that have a considerably narrower scope.

Problem Structuring Phase

The problem structuring phase of a decision-making process aims to build a comprehensive understanding of the focal problem selected in the preceding phase by taking it into pieces and analyzing the relationships of those pieces. This task is usually not fully appreciated in decision-making processes, which often skip this phase and directly jump to the design of alternatives (cf. Ramsey 2009, p. 1973). However, the structuring of the focal problem provides insights that are important for the design as well as the evaluation of alternatives (e.g., different intervention entry points). These findings are the result of those two activities shown in the use case diagram depicted in figure 11.5 that have not already been discussed in the preceding parts of the key scenario selection step: the ‘structure focal problem’ and the ‘create model’ use cases. As pointed out at the end of chapter 10 and in section 11.1, the former is an effort of citizens, who jointly create a problem structuring graph. Although this use case is clearly phase-specific and, on first examination, does not involve the interaction of multiple different components, it nevertheless represents a valid key scenario according to the characteristics outlined in the introduction to the key scenarios selection step, because, on the one side, it involves, as indicated above, a neglected and therefore unknown part of the development of DSS for community-driven SHD initiatives, and on the other side, similar to the ‘scrutinize contribution’ use case discussed in the preceding part, it intersects with quality attributes, because multiple citizens work on the very same problem structuring graph at the same time (see also section 11.5). The ‘create model’ use case, i.e., the second key scenario candidate, represents a flow of events that is initiated by a scientist, who, as an independent third party, translates the problem structuring graph created by citizens into a model that is used for the evaluation of alternatives devised in the decision-making process’ next phase (see section 11.1). Similar to the first scenario, this use case is also a suitable key scenario, because the translation of the problem structuring graph into an evaluation model constitutes a relatively unknown development aspect. Correspondingly, this part of the key scenario selection step comprises two key scenarios, each of which is discussed in turn.

As can be seen in the detailed flow of events shown in figure 11.20, the structuring of the focal problem mainly entails the following three activities: citizens either add factors or causes of the focal problem to the graph, connect factors with each other or the focal problem, and/or comment on one of the former two entities. Although a concrete architecture will probably extend the range of possible options (e.g., group or merge nodes), these three

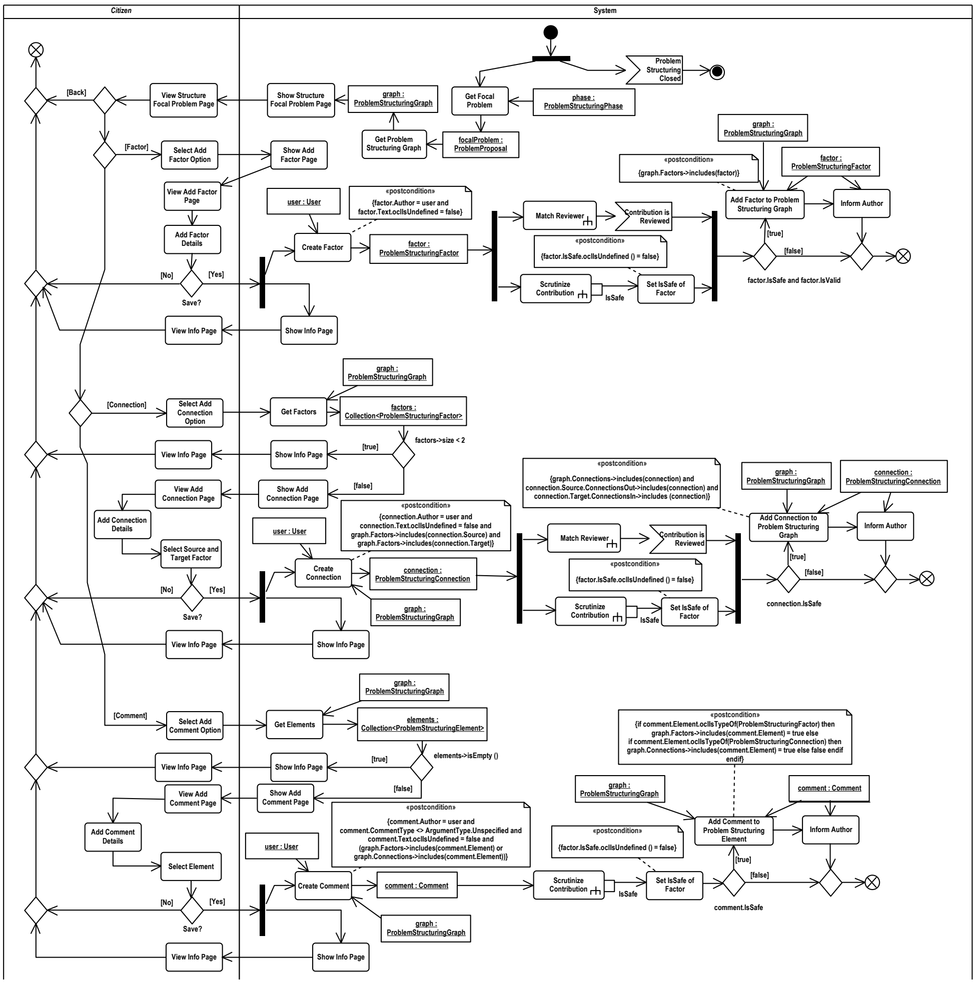

Figure 11.20: Key Scenario-Show Structure Focal Problem Page (AD-PS-03)

functions represent the minimal set of services a supporting tool needs to provide[347] and they are sufficient to illustrate the functional requirements this use case imposes on the reference architecture. The displayed activity diagram, in addition, reveals that created entities are not directly added to the publicly available problem structuring graph; rather, after the citizen's input has been transformed into the respective concept (see also the preliminary object model depicted in figure 11.6), the newly produced contribution is scrutinized and, if applicable, reviewed. The latter activity, as indicated at the end of the preceding part of the key scenario selection step, is similar to the 'scrutinize contribution' process but focuses on the correctness and appropriateness of factors and connections. However, as shown in figure 11.20, in contrast to the 'scrutinize contribution' call behavior, the 'match reviewer' call behavior does not have a process output, but waits for the 'contribution is reviewed' signal, which, in turn, is fired if the reviewer has added the review to the contribution (see AD-C-12 and AD-C-18 in annex C.2). Although the join implies that both, the scrutinizing and the review task need to be finished for the path to proceed, the decision node following the join suggests that only the `IsSafe` output of the 'scrutinize contribution' process is decisive in regard to a submission's publication. Even though a derived, concrete architecture might change the

347. An existing tool that can serve as blueprint to devise further functions is DebateGraph (`http://www.debategraph.org/`, accessed May 25, 2015). Although this web-based application is mainly used to structure debates, it might also be 'misused' for the structuring of problems.

character of the review procedure and make it exactly like the scrutinizing process, the rationale on which this distinction rests is as follows: whereas an unsafe contribution endangers the safe environment, which manifests itself in the destruction of social capital and the erosion of the basis from which citizens' willingness to participate arises (see section 10.3), the review is solely a first expert opinion in a discourse between citizens who jointly create a problem structuring graph by, inter alia, commenting on each other's contributions. This, in turn, is the reason why comments, in contrast to both other above-mentioned entities, are not reviewed but only scrutinized. In short, the 'structure focal problem' key scenario merges two of the process steps involved in a proposal's life cycle into a single submission procedure, which tends to be feasible due to the considerably narrower scope—measured in terms of complexity and size—of the former's contributions. This similarity between the current and the 'create proposal' key scenario gives the former the appearance of being a relatively straightforward procedure. However, the challenging facets of the 'structure focal problem' key scenario arise, for example, when a user explores the problem structuring graph, that is, she or he views the 'structure focal problem page' (see figure 11.20), while the system adds new scrutinized and reviewed elements to the graph without propagating this change, i.e., the user's page does not reflect this update. Another class of issues emerges if, for instance, the above-mentioned grouping and deletion functionalities are offered to users, who then might overwrite each other's submissions. Whereas the former challenge falls into the consistency category of quality attributes, the latter example belongs to the group of concurrency problems. Correspondingly, to maintain the integrity of the problem structuring graph the system needs to take synchronization and concurrency control mechanisms, both of which are discussed more thoroughly in section 11.5, into account, so that users can exercise the provided functions in a stable and reliable environment. Nevertheless, citizens, as indicated by the accept event action in the upper right corner of figure 11.20, can make use of these options only as long as the problem structuring phase is not closed (see AD-PS-02 in annex C.2 for the sequence of interactions in which the corresponding event is fired).

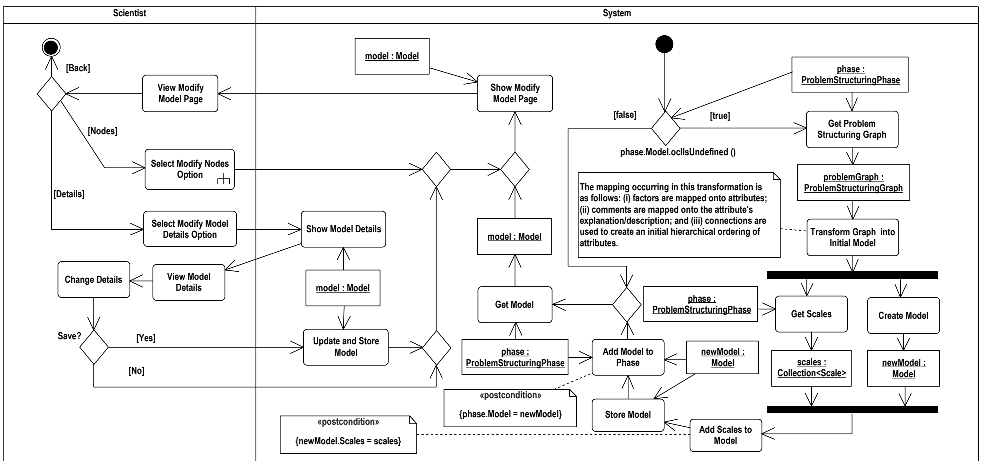

Figure 11.21: Key Scenario-Show Modify Model Page (AD-PS-04)

The process of closing the problem structuring phase, however, not only sends the signal that cancels the 'structure focal problem' process, but is also informs the scientist that she or he can start to create the qualitative evaluation model as captured by the 'create model' key scenario (see also the discussion at the end of chapter 10 and in section 11.1). The detailed flow of events of this second use case in this part of the key scenario selection step is depicted in figure 11.21 (see also AD-PS-5 in annex C.2 for the sequence of interactions in which scales are created). The activity diagram shows that the first time the process is initiated, i.e., the phase's `Model` concept instance is `OclUndefined` (see also the preliminary object model in figure 11.6), the system translates the problem structuring graph into an initial model (see also the comment in figure 11.21). This initial model is then stored so that it can be retrieved the next time the scientist exercises the 'create model' option. Nevertheless, either the initial model or, if applicable, a loaded model is then presented to the user, who, in turn, can edit it. More specifically: the system allows the user to either modify the model's metadata, a process also included in the activity diagram depicted in figure 11.21, or, as captured by the 'select modify node option' call behavior, to rework the loaded hierarchy of nodes or the initial one created out of the problem structuring graph's elements. Whereas the former activity solely involves the presentation, changing, and updating of the `Model` concept, the 'select modify nodes option' call behavior is a more complex process as the activity diagram displayed in figure 11.22 reveals (see also the activity diagrams AD-PS-07, AD-PS-08, and AD-PS-09 in annex C.2 for the entailed call behaviors' details).

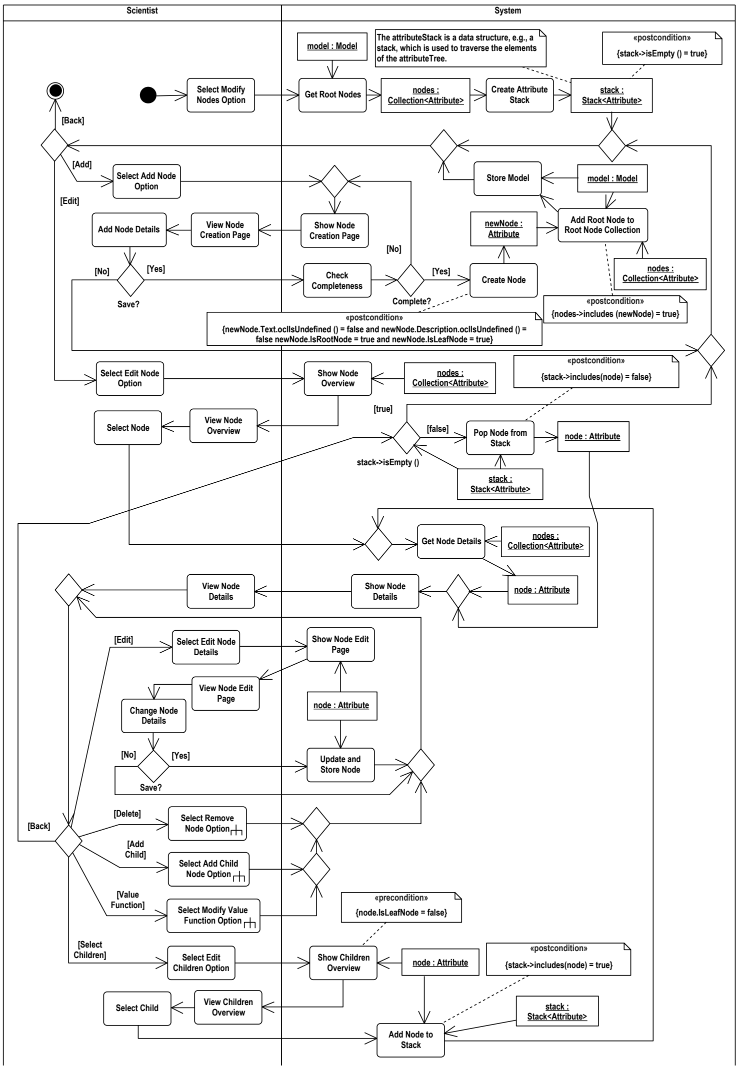

Figure 11.22: Key Scenario-Show Modify Nodes Option (AD-PS-06)

The flow of events shown in figure 11.22 implicitly indicates that the qualitative evaluation model[348], due to the multiple root nodes, is conceptualized as a forest, that is, a set of trees (see also the association between the `Model` and the `Attribute` concept as well as the reflexive association of the latter shown in the preliminary object model displayed in figure 11.6). Whereas the leaf nodes of trees in the forest represent certain characteristics of the problem situation that can or might be influenced by an alternative (e.g., inter-group contact, consumed resources), higher level nodes in a tree group their children into categories that describe an intervention's performance in a particular dimension (e.g., social and environmental impacts as root node categories). This grouping within a tree is realized by `ValueFunctions`, which, in turn, define how the `Scales` of a node's children are mapped onto the `Scale` of the node[349]. On the other side, `Scales` provide a certain number of qualitative values that represent different directions and degrees of an intervention's impact on the dimension represented by the node with which the scale is associated. As briefly touched in section 11.1, such a model constitutes the frame against which alternatives devised in the alternative design phase of a decision-making process are evaluated. In anticipation of the discussion in the next part of the key scenario selection step, this assessment then takes the form of selecting a value from the scale of each leaf node in the forest. Based on value functions it is then possible to determine an intervention's performance on different intermediate dimensions or the base categories as manifested in the evaluation model's root nodes. After this rather lengthy and, considering the abstract nature of reference architectures (see section 5.4), specific remark in regard to the model as well as the brief glimpse on its usage in one of the use cases discussed in the next part of the key scenario selection step, the flows and call behaviors shown in the activity diagram of the 'select modify node option' call behavior depicted in figure 11.22 become relatively unspectacular: nodes and their children can be created and deleted, the description of nodes can be edited, and value functions, if certain conditions are fulfilled, can be defined (see AD-PS-07, AD-PS-08, and AD-PS-09 in annex C.2 for details of these activities). As already indicated in section 11.1, the scientist can exercise all these and other functions that might be provided by a derived, concrete architecture until the alternative design phase of the decision-making process is initiated, because at this point the model, using the terminology introduced in the discussion of the proposal life cycle, has to be 'finalized' (see section 11.1).

The rationale to impose this constraint on the creation of an evaluation model is as follows: changes to the model in the alternative design phase would interrupt the efforts of alternative working groups, because it implies, for instance, that evaluations have to be redone and it might even require supplementary review cycles. If, however, there are reasons for weakening or abandoning this constraint, additional processes such as, for example, calls to rework evaluations and/or the assignment of review tasks need to be integrated into the flow of events in the alternative design phase. As will be discussed more thoroughly in the final step of the reference architecture design cycle, the technical system is specifically designed to incorporate such and other refinements. Nevertheless, the next part of the key scenario selection step discusses the use cases of the 'more restrictive' conceptualization of the design alternative phase outlined at the end of chapter 10 and in section 11.1.

348. The following discussion of the evaluation model is an adaption of ideas proposed by Bohanec (2011), who in addition to his theoretical descriptions also provides an implementation of this multi-attribute decision-making approach (see `http://www-ai.ijs.si/MarkoBohanec/dexi10.html`, accessed May 25, 2015).

349. As leaf nodes are per definition childless, they, by implication, do not have an associated `ValueFunction`.

Alternative Design Phase

Based on the results of the preceding phase, the alternative design phase's central aim is to devise options that exploit those intervention entry points that are captured in the problem structuring graph to address a decision-making process instance's focal problem, that is, to remove entrenched inequalities and injustices in the social structure of the locality. The exemplary illustration of the design of 'possible worlds' method carried out in this chapter of the present inquiry conceives alternatives, based on the discussions in sections 5.2, 8.1, and 8.2, as a sequence of activities that describe the intervention's operating as well as its transient structure. Although a derived architecture might replace the highly abstract `Activity` concept shown in the preliminary object model depicted in figure 11.8 with a more concrete representation of an intervention's constituents, the planning of these elements, nevertheless, is the central task in the 'design alternative' use case. It is one of the five use cases depicted in figure 11.7 that were not already discussed in the preceding parts of the key scenario selection step. The other four use cases can be divided into two categories, if the initiating actor is used as demarcation criterion. Whereas the first of these two groups comprises the 'evaluate alternative', 'make resource request', and 'search for comparable options' use cases, which are all included by the 'design alternative' use case and, by implication, are exercised by an alternative working group participant, the second group is established by the citizen-initiated 'provide resource' use case. As explicated in the brief discussion in section 11.1, those two use cases that are concerned with the requesting and provisioning of resources respectively, involve flows of events that are similar to the creation and publishing of proposals. Therefore, the 'make resource request' and the 'provide resource' use cases are not further discussed in the following (see AD-AD-03 and AD-AD-05 in annex C.2 for the use cases' details). Moreover, the 'search for comparable options' key scenario candidate, at least in the form considered in those iterations of the reference architecture design cycle carried out in this 'second research project' of the present inquiry, solely involves the study of proposals that have been added to the repository of searchable options in preceding iterations of the decision-making process (see section 11.1). Correspondingly, due to its closeness to the exploration of, for instance, proposals or scrutinizing tasks an analysis of this use case can be omitted as it will not substantially enhance the reference architecture design cycle's product backlog of functional requirements (see AD-AD-04 in annex C.2 for a specification of the sequence of interactions involved in the use case). This leaves the 'design alternative' and 'evaluate alternative' use cases as potential key scenarios for the following discussion. Whereas the former fulfills the attributes of a valid key scenario, because it describes a process in which multiple working group participants simultaneously elaborate the very same intervention, i.e., it, similar to the previously examined 'structure focal problem' use case, intersects with quality attributes (see section 11.5), the latter is a valid key scenario by implication, that is, it inherits its characteristics from the 'create model' use case surveyed in the preceding part of the key scenario selection step. Correspondingly, the following will explore two phase-specific key scenarios that are closely connected to the ones examined in the preceding part of the key scenario selection step. This discussion starts with the 'design alternative' key scenario, because it not only entails the 'evaluate alternative' key scenario, but it also describes the flow of events that embeds the three excluded use cases.

As shown in figure 11.23 the design of an alternative comprises, inter alia, the adding as well as modification of activities, the evaluation of an alternative (see also figure 11.24), and the exploration of stored alternative proposals. The first of these activities, as indicated in the discussion of the first intervention entry point in section 10.3, also includes the creation of resource requests, that is, a request for a resource that is required to realize the devised alternative or, more specifically, the respective part of the intervention with which the resource request is associated (see AD-AD-03, AD-AD-06, and AD-AD-06 in annex C.2). Although a derived architecture might add further functionalities (e.g., merge activities) and/or refine the concepts with which these activities are dealing (e.g., the `Activity` concept), focusing on the first two of these activities and conceptualizing an intervention as sequence of activities is sufficient to illustrate how the participants of an alternative working group cooperate to devise an action plan that aims to address one of the causes contributing to the emergence of the decision-making process instance's focal problem. The details of these activities are depicted in the second half of the activity diagram shown in figure 11.23.

The flow of events shows that after a user has selected the 'show design alternative page' option while viewing the details of one `AlternativeProposal` with which she or he is associated (see AD-AD-01 in annex C.2), the system first loads the `AlternativeSpecification` linked to this proposal. From this concept the system can then, as indicated in the preliminary object model depicted in figure 11.8, get the `Activities` that constitute the intervention's action plan. These `Activities`, in turn, are used to create an overview that can be presented to the user. In this or some similar context devised in a concrete architecture the user is then able to select the add activity option. Within the flow of events shown in figure 11.23, this is realized via the 'add activity' page. On this page the user can specify all the details that are defined as necessary for a complete and valid `Activity` instance. In the preliminary object model depicted in figure 11.8 this includes, for example, a statement in regard to the activity's goal, a description of the general procedure involved in carrying out this activity, a refinement of this description in form of specific tasks that need to be performed, as well as, if applicable, the activity's relation to already existing activities. Based on this data the system then creates a new `Activity` concept instance and adds it to the `AlternativeSpecification` container. A similar process is involved in the modification of activities shown at the bottom of the activity diagram depicted in figure 11.23: after the user has selected one of the `Activities` presented in the overview, she or he can change its details or might even delete the selected instance. Although these processes seem relatively straightforward, the challenging part of the sequence of interactions displayed in figure 11.23 is that different working group participants exercise the specified functions simultaneously. For example, if two users edit an `Activity` instance at the same time this might result in lost updates, which, in turn, requires to take concurrency and data integrity considerations into account. Similarly, the synchronization issue discussed in regard to the problem structuring graph re-occurs in this case, although the number of participants in working groups is considerably smaller than in the unrestricted problem structuring process. Nevertheless, as indicated before, section 11.5 discusses these problems and possible technical solutions more thoroughly.

The second key scenario discussed in this part of the key scenario selection step is the 'evaluate alternative' use case. It, in contrast to the first key scenario's implicit dependency on the causes captured in the problem structuring graph, directly depends on the second output of the preceding phase of the decision-making process. More specifically, it uses the model created by an independent third party to determine how the designed alternative influences certain dimensions of the focal problem, which, as indicated in the preceding part of the key scenario selection step, are represented by the model's leaf nodes. As shown in figure

11.23, this sequence of interactions presupposes the same situation as the above described flow of events, that is, the user has already selected an `AlternativeProposal` with which she or he is associated. Within this context the user can exercise the 'evaluate alternative' option. The details of this call behavior are depicted in the activity diagram displayed in figure 11.24. It shows that the system, if the user decides to create a new evaluation, carries out some groundwork operations before it starts the actual evaluation loop. The core aspect in the preparatory step is the construction of two temporary lists: one that comprises all leaf nodes of the model and one that entails all of an alternative's activities. Whereas the former list provides the set on which the collection-controlled evaluation loop is based, that is, the loop iterates through all relevant characteristics of the focal problem, the latter is required to connect the alternative to the focal problem and vice versa. As the actions in the alternative working group participant's swimlane shown in figure 11.24 indicate, this coupling, in its minimal form, can be broken down into three separate steps (see also the discussions in sections 5.2, 8.1, and 8.2). The user (i) has to indicate the direction and the degree of the intervention's impact by selecting one of the values specified in the scale that is associated with the current iteration's leaf node, (ii) might add evidence, such as references to comparable interventions that had a certain effect on a similar cause, to support the selection, and (iii) should articulate the reasoning on which the selection of the value is based, which, if applicable, makes references to the attached evidence. These three inputs are then translated into an `EvaluationItem` instance, which, in turn, is added to the `AlternativeEvaluation` container created during the afore-mentioned preparatory phase. The final task in one such evaluation loop iteration is the removal of the current iteration's leaf node from the temporary list so that the loop's cancel condition can be specified as `nodes->isEmpty ()`, that is, until the system has looped through all leaf nodes of the model[350].

As indicated by the reference to 'minimal form', a derived, concrete architecture might refine the evaluation of alternatives by, for example, making the assessment more fine grained, that is, instead of forcing the user to specify the overall impact of the intervention per leaf node, it might enable the user to select a value for each activity comprised in the alternative. This, however, requires to replace the `EvaluationItem` concept with an appropriate substitute, which, inter alia, is capable of calculating the intervention's overall impact for a single leaf node. Although such a refinement is out of scope of the present inquiry, it might be a suitable option to enhance the meaningfulness in regard to the evaluation's analysis function. This application of the evaluation, in contrast to its informative employment in the voting and selection steps of the final phase of the decision-making process, supports alternative working group participants in their endeavors of refining and reworking the intervention (see section 11.1). This, however, is based on the calculation of the intervention's performance in regard to the focal problem's relevant dimensions and the possibility to explore this relationship, that is, to drill down the assessment's categories to understand how the intervention's impact on leaf nodes affects the model's root categories. To enable this option, the system's final tasks in the 'evaluate alternative' key scenario are to store the `AlternativeEvaluation` instance and, more importantly, to retrieve the model to calculate the alternative's overall evaluation based on the values selected by the user and the value functions specified in the model.

After this brief exploration of the two central key scenarios in the alternative design phase,

350. The described approach differs from the collection-based or -controlled loop constructs of programming languages such as Java or .NET, which realize this procedure, for example, via iterators, because the conditions within the presented activity diagrams are specified using the OCL, which, due to its aim, does not support such constructs.

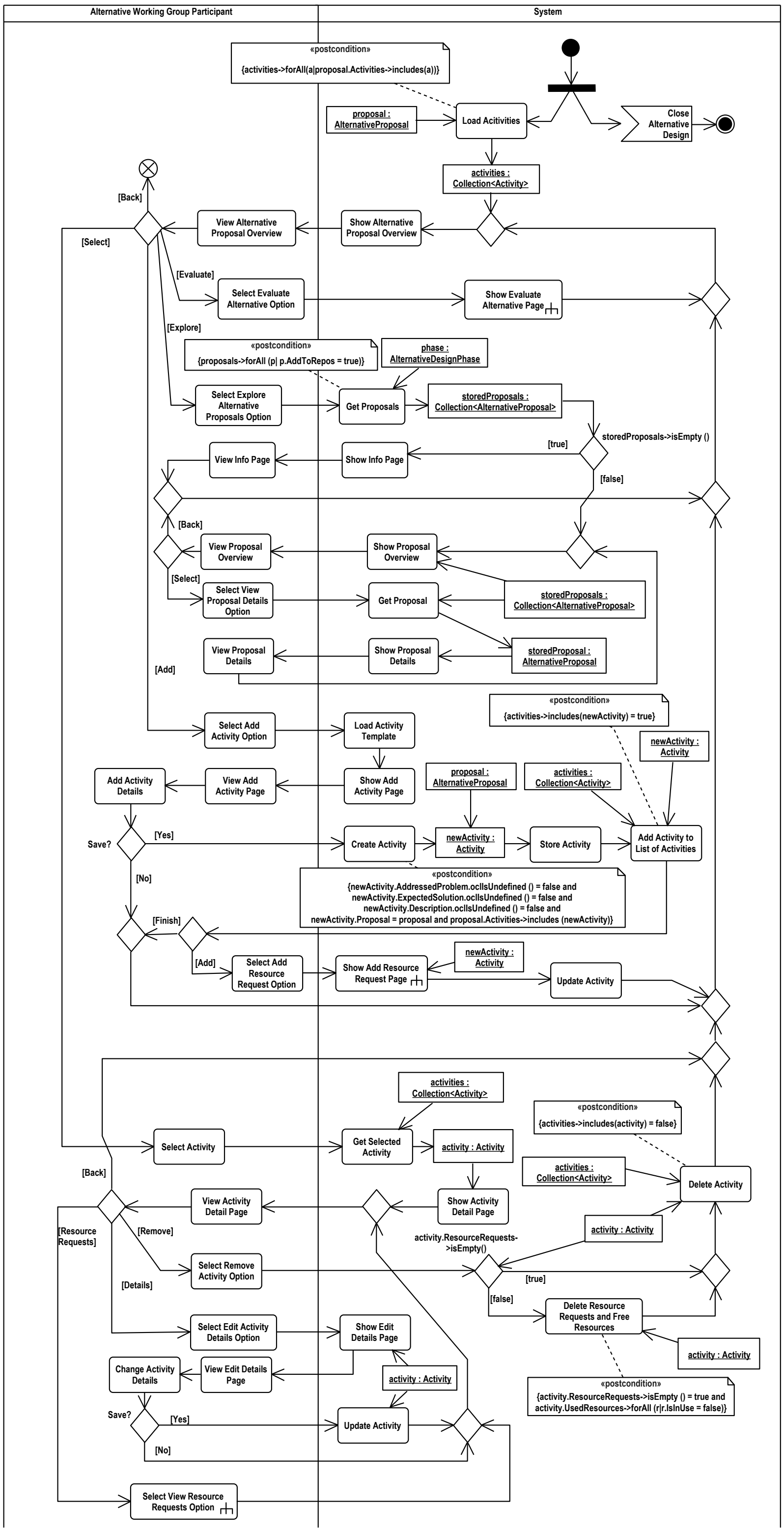

Figure 11.23: Key Scenario-Show Design Alternative Page (AD-AD-04)

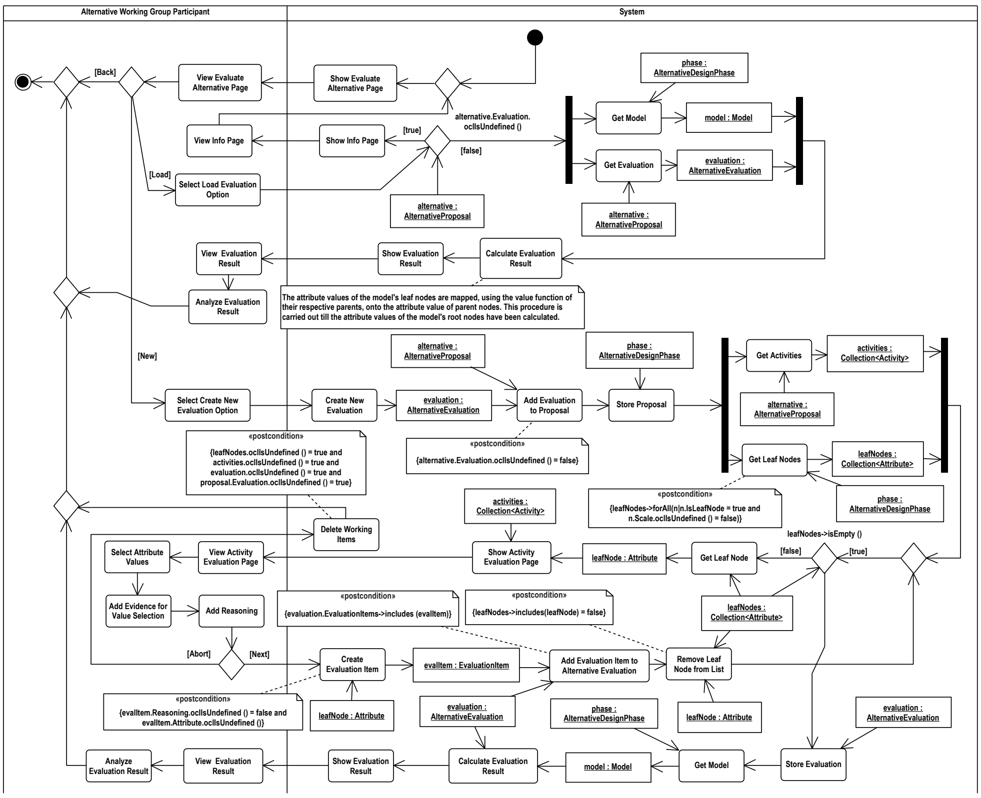

Figure 11.24: Key Scenario-Show Evaluate Alternative Proposal Page (AD-AD-07)

which, together with the three currently excluded use cases, provide support for the creative design process (see section 5.2), the discussion now turns to the final phase of the decision-making process outlined at the end of chapter 10, that is, to the phase in which the interventions devised in this phase are scrutinized and, if considered to be suitable candidates for the mitigation of the focal problem, finally selected for implementation.

Alternative Selection Phase

The foregoing discussion already pointed out that the two central flows of events in this final phase of the decision-making process are the voting and selection steps, which, however, are not unique to this phase, but, for example, occur in the indicator selection phase as well. In addition to these two steps, the problem selection phase entails a comment step in which citizens can scrutinize interventions by recording their arguments put forward in favor of and against each option considered in this phase (see section 11.1). Whereas the latter is comparable to the afore-mentioned processes of commenting on proposals or problem structuring graph elements, the former two represent those use cases shown in the use case diagram in figure 11.9 that have not yet been explored in preceding parts of the key scenario selection step. Nevertheless, both are valid key scenarios, because they are involved in several different decision-making phases, thereby constituting important processes that a DSS needs to support, and they require the interaction of multiple of the technical system's components. Correspondingly, this final part of the key scenario selection step examines two use cases, i.e., the 'vote on alternatives' and the 'select alternatives' key scenarios. Each of these two processes will be discussed in turn, whereby this analysis also incorporates a brief review of variants of these steps that exist in other phases of the decision-making process.

The details of the first key scenario are shown in the activity diagram depicted in figure 11.25. Similar to the previously discussed multi-phase flows of events, this interaction sequence also entails cancelation conditions in the upper right area, however, this time the accept event action is not activated as soon as the process starts; rather, the sending of the required token is preceded by an initial test that checks if the voting step's precondition is fulfilled, that is, if there are options to vote for (see section 11.1 for a discussion about the requirements of proposals to be considered in the voting step). After this validation and in parallel to the activation of the accept event action, the system, based on the currently active phase, determines which voting approach to set up: whereas the indicator selection and the problem identification phases employ an 'ordinary' voting approach, that is, they iterate through all available options to enable local citizens to express their preferences in regard to the current iteration's proposal, the alternative selection phase, as pointed out at the end of the preceding chapter, realizes a comparative voting process. In contrast to the 'ordinary' voting procedure, this approach presents a pair of options per iteration and requires local citizens to indicate which of both they prefer to which degree. Although this difference affects the preparation of voting iterations, the presentation of voting pages during iterations, as well as the technical representation of the vote that local citizens make within each iteration, the general flow of events is similar in both cases as a comparison of the middle and the bottom area of figure 11.25 reveals: the system takes one of the collection items created in the preparatory step (i.e., a single proposal or a pair of alternative proposals) to present it to the user, who, in turn, expresses her or his preference either in regard to an isolated proposal or in regard to the two contrasted alternative proposals. Furthermore, the user also justifies the choice by writing

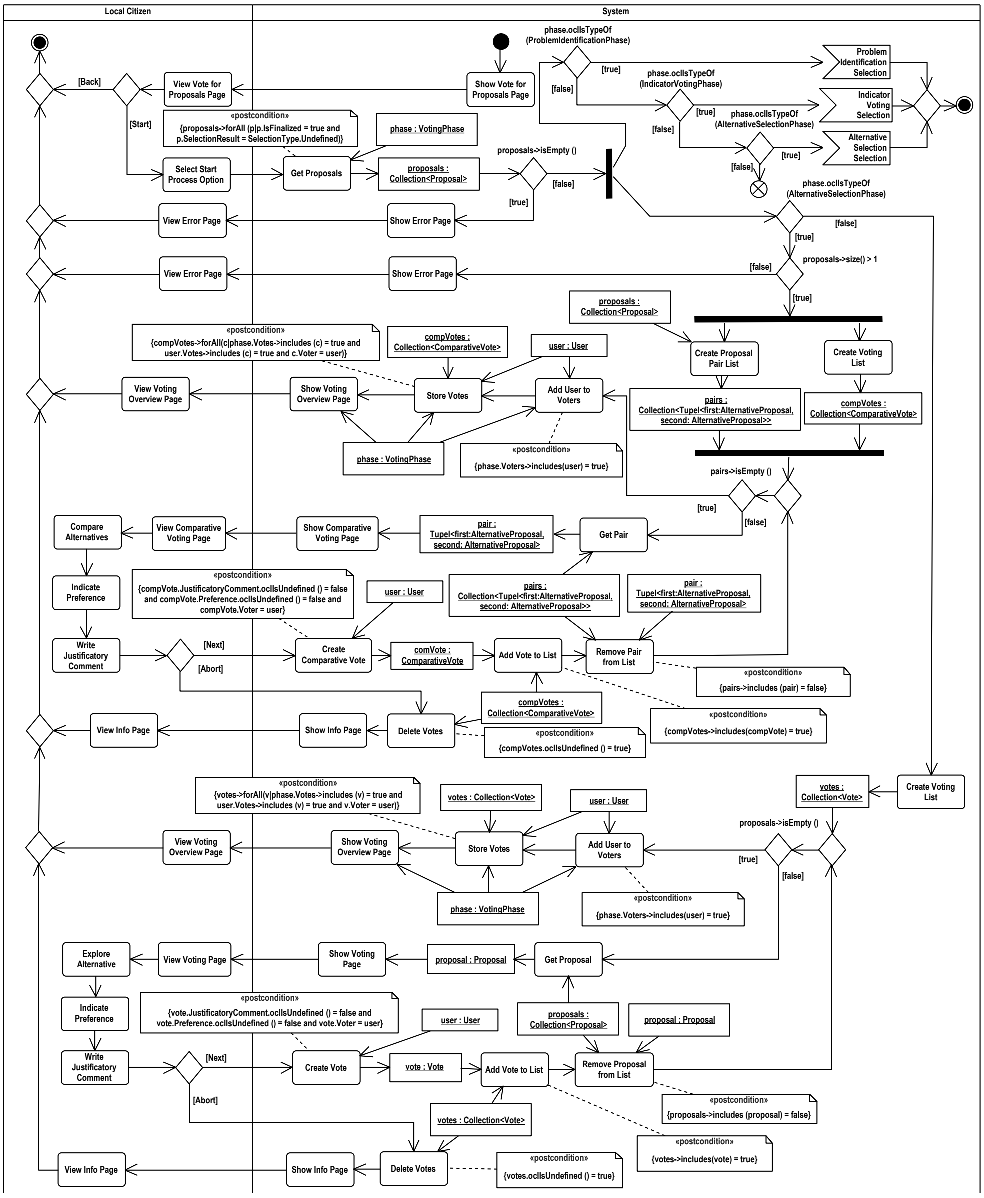

Figure 11.25: Key Scenario-Show Vote for Proposal Page (AD-C-04)

a justificatory comment that contains an overview of the reasons that underpin the opinion manifested in the vote. The system uses this information to create either a `Vote` or a `ComparativeVote` instance (see the preliminary object model depicted in figure 11.10), which it then adds to the temporary list of a user's votes. Similar to the evaluation loop discussed in the preceding part of the key scenario selection step, the system finally removes the current iteration's voting item from the list on which the voting loop is based (see also footnote 350). This process is repeated until the system has looped through all available voting items, that is, until either `pairs->isEmpty()` or `proposals->isEmpty()` equals `true`. If this point is reached, the system enters the voting step's closing stage within which it carries out the following three tasks: (i) it adds the user to the list of voters, which, as shown in the activity diagram AD-AS-01 (see annex C.2), ensures that each local citizen can vote only once, (ii) it stores the user's votes in a repository, and (iii) it presents, for example, an overview of the user's votes as final page in the voting process.

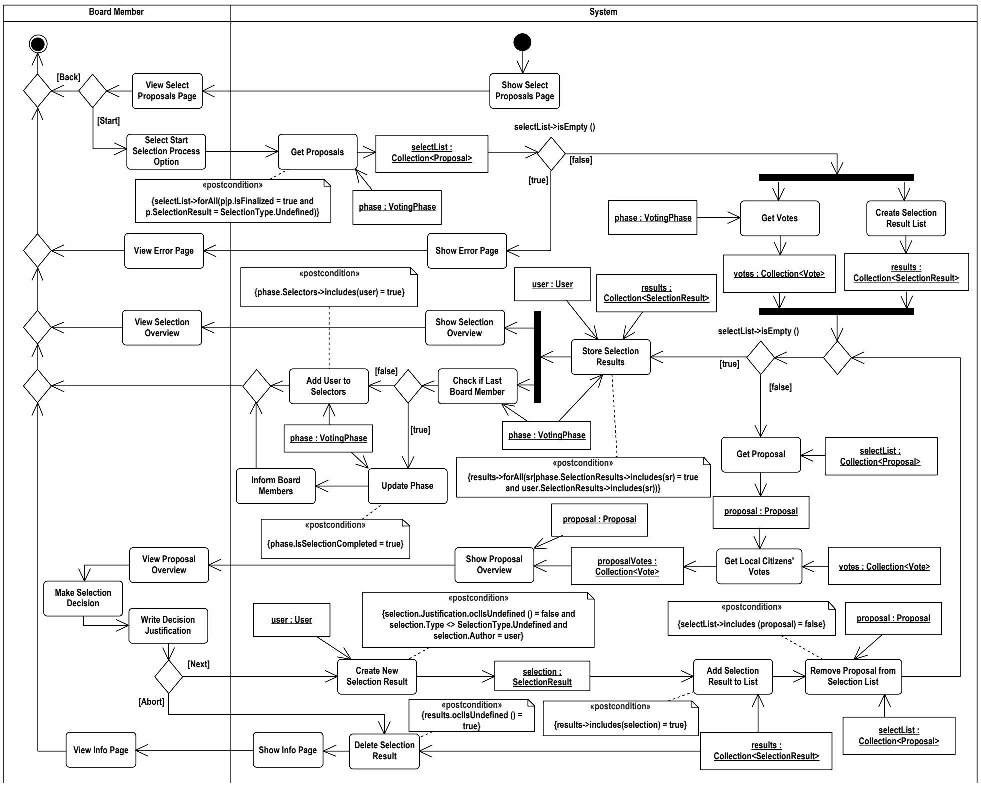

Figure 11.26: Key Scenario-Show Select Proposal Page (AD-C-05)

Although a concrete, derived architecture might replace the ‘show voting overview page’ with another action, the logic of calculating an overview might, in a revised form, be fruitfully reused in the second key scenario, that is, the ‘select alternative’ use case, which will be discussed in the remainder of this final part of the key scenario selection step. As indicated in section 11.1, the selection steps within different phases of the decision-making process entail two separate moments (see also the personal and public reasoning discussion in section 10.2): an individual and a group or board selection process. The individual selection process, a preparation of the board selection process further discussed below, comprises the flow of events shown in the activity diagram displayed in figure 11.26. Even though the general procedure captured by the interaction sequence is similar to the above-described ‘ordinary’ voting approach (hereinafter: voting process), that is, both loop through the list of finalized proposals (see figure 11.25), there are a number of minor differences. The, on first examination, most obvious is that the selection process, in contrast to the voting process, does not take into account the peculiarities of different phases, because it has no respective decision node and it has only one selection loop. This, however, is not to suggest that the phase differentiation is not important or neglected; rather, as only the results of the voting process are considered in the selection step and as the inheritance hierarchy of the two above-described voting concepts, i.e., the `Vote` and the `ComparativeVote`, allows to handle both concepts uniformly (see also the preliminary object model depicted in figure 11.10), the phase-specific differences, manifesting themselves in the specialization of votes, can be ‘hidden’ within the flow’s actions. In contrast to this presentational maneuver, there are some real, slight variations in the respective processes’ structures. Firstly, the preparatory operations the system carries out in the individual selection process not only entail a retrieval of all finalized proposals and the creation of a temporary selection list, but also a fetch of all votes that have been made by local citizens. Secondly, within the selection loop the system, possibly reusing the above-mentioned overview logic, presents not only the current iteration's proposal, but also, based on the list of local citizens' votes, a 'refineable' synopsis of their preferences, because board members are encouraged to take these opinions into account when making their selection decisions (see the discussion of the consultative, management-based decision-making in section 10.3). Thirdly, board members, in contrast to local citizens, have only two options to express their preferences: either they argue in favor of the option's inclusion or against it, that is, they suggest to exclude it. Although a concrete architecture might refine this latter aspect by extending the range of board members' options to express preferences, the individual selection process' nature is purely preparatory. More specifically, the latter's aim is, on the one side, to ensure that board members are informed and prepared before the group makes the final decision, and on the other side, to enable the system to focus debates within the board selection process as will be examined more thoroughly below.

However, before the exploration can turn to this second subprocess of the selection process, the final variation occurring in the closing stages of the voting process and the individual selection process deserves a brief remark. This fourth difference, similar to the first above-mentioned divergence, is actually an extension of the voting process. It accounts for, on the one side, the limited and known number of board members, and on the other side, the requirement that all board members should have explicated their individual preferences in regard to the inclusion and exclusion of options before the board selection process starts. To realize this latter constraint the individual selection process is not, as the voting process, canceled after a certain period of time, but the system checks if all board members have exercised the 'select alternative' use case as captured by the 'check if last board member' action. If the latter evaluates to `false`, then the system solely adds the user to the list of selectors—the voters counterpart; however, if this check evaluates to `true`, then the system automatically starts the board selection process, which will be discussed next.

Although the board selection process, whose details are displayed in the activity diagram shown in figure 11.27, is a group-oriented undertaking, it is nevertheless, at least as perceived in the present inquiry, initiated by an individual board member during, for example, a face-to-face board meeting. This shift from the virtual to the physical world in the second part of the selection process is based on the following rationale: the resolution of disputes and disagreements does not necessarily occur within formal communicative endeavors such as the ones that can be supported by ICT applications; rather, settlements are often achieved in informal sessions that accompany formal efforts (see the discussions of the first and third intervention entry point in section 10.3). However, the ability to virtualize the characteristics and features of informal encounters, such as, for example, sensory experiences in form of physical contact or just the bonding through the sharing of drinks is (still) limited (see Overby 2008, 2012, for a more detailed discussion about the potential virtualizability of processes). Nevertheless, ICT applications, in addition to their ability to enable communication across spatiotemporal boundaries, can help to focus the formal parts of communicative efforts, while leaving room for informal sessions.

The second part of the selection step, underpinned by this latter facet, explicitly accounts for the need to incorporate unmediated, communicative interactions between board members as well as the necessity to focus the discussion in certain directions. In regard to the latter, the system, in contrast to the above-described key scenarios, has a more extensive preparatory stage. As shown in the upper right area of the activity diagram displayed in figure 11.27, the system, inter alia, creates the following three lists based on the results of the individual selection processes carried out by all board members: (i) an inclusion list, which comprises those options that all board members want to include in the initiative's program, (ii) an exclusion list, which comprises those interventions that all board members want to exclude from the initiative's program, and (iii) a disagreement list, which, as indicated by the name, comprises those alternatives that, according to the results of the individual selection processes, i.e., the list of `SelectionResults`, do not belong to one of the former two lists. Each of these three lists provides the foundation for one of the three collection-based loops shown in the three quarters of the activity diagram depicted in figure 11.27 that follow the preparatory stage in the first quarter. The first of these loops is based on the disagreement list. Within this loop, in contrast to the previously discussed loops that automatically loop through the elements of their underpinning lists, the system starts each iteration with an overview and allows board members to select the iteration's focal disagreement item. The core activities in each iteration are, on the one side, the exploration of the selected item's details, which also include local citizens' preferences as well as the justifications that board members made in their individual selection processes, and on the other side, the more important task of achieving an agreement about the respective option's inclusion in or exclusion from the initiative's program. This latter activity is captured by the 'discuss' action in the board member's swimlane. This unmediated interaction culminates in a written justification of the concluding decision, which, in turn, is finalized by marking the iteration's focal intervention as either included or excluded. Submitting this information to the system causes it to carry out the following three activities: (i) update the status of the respective `AlternativeProposal`, (ii) add the `AlternativeProposal` to the list of processed alternatives, and (iii) remove the iteration's focal item from the collection underpinning the loop (see also footnote 350). This procedure, similar to the afore-mentioned loops, is repeated until all disagreements have been resolved, that is, until `disagreementList->isEmpty()` equals `true`. Although the operations of those loops that process the other two lists are similar to the one just described, they differ in certain, minor respects: on the one side, iterations are not controlled by board members, that is, the system iterates through the respective list automatically, and on the other side, they, because all board members agree about the status of options comprised in each list, do not involve the need to debate about the intervention's inclusion or exclusion. Correspondingly, both these loops solely present an alternative's details to board members, who, in an unmediated interaction, discuss the way in which to write the final justification. After the latter has been submitted to the system, the same three activities mentioned above are carried out; whereby the system, depending on the active loop, can set the inclusion/exclusion status of the `AlternativeProposals` automatically.

After all loops have been processed, the selection step enters the closing stage within which different post-selection actions such as, for example, the disclosing of the final selection results are carried out. In addition to this general, phase-independent action, the system also, as shown in the lower right area of the activity diagram displayed in figure 11.27, exercises phase-specific post-selection processes. For instance, in section 11.1 it was, at least briefly, pointed out that the development of indicator proposals and corresponding indicators entails the design of database schemas, the construction of data gathering applications, and the creation of surveys (see AD-IS-03 in annex C.2), which, if the indicator proposal has been selected to be maintained by the initiative, are now created, published, and distributed respectively. Although a concrete, derived architecture might refine and/or extend these post-selection processes, it has to be noted that the board selection process in the form described above only occurs in the indicator selection and the alternative selection phases. The problem identification phase, despite sharing the voting and the individual selection processes with the former two phases, has a different board selection process. More specifically: instead of selecting a set of indicator or alternative proposals, the goal of the board selection process in the problem identification phase is to select a single problem proposal that serves as focal problem for a decision-making process instance. Although the sequence of interactions is similar to the one displayed in figure 11.27, the variations of the problem identification are not incorporated into this flow of events to reduce the diagram's complexity (see AD-PI-04 in annex C.2 for the details of the board selection process in the problem identification phase).

As indicated in the foregoing discussion, the key scenarios presented in this final part of the key scenario selection step are not only the core of the final phase of the decision-making process, but they are, similar to most of the use cases explored in preceding parts, also involved in other phases such as, for example, the problem identification or the indicator selection phases; whereby the latter, because it is not part of the actual decision-making process, deputizes for the set of activities that are or might be carried out in preparation of such procedures. Together with the other explored use cases, especially the creation or editing of proposals and the scrutinizing of contributions as central activities in nearly all phases as well as more phase-specific endeavors such as, for instance, the creation of a problem structuring graph, the construction of an evaluation model, and the evaluation of alternatives, the key scenarios surveyed in the key scenario selection step provide an adequate cross section of those functional requirements that a DSS for community-driven SHD initiatives needs to integrate to support the communicative decision-making processes of such organizations. Before the explicated demands are mapped onto the technical components of the reference architecture (see section 11.6), the second to the last step of the reference architecture design cycle extends the foregoing discussion by a more thorough investigation of the pointed out quality attribute considerations (see section 11.5). However, this exploration of technical details is preceded by an examination of the more general architecture overview presented in the next step.

11.4 Architectural Overview

The description of the reference architecture development cycle in section 8.3 pointed out that this fourth step's central concern is the presentation of an architecture overview that, based on the key scenarios selected in the preceding step, is incrementally refined in subsequent design iterations. The current step's overview differs from the architectural candidate presented in the sixth step of the preliminary reference architecture development method by solely focusing on functional requirements, whereas the architectural candidate also incorporates key issue considerations. In other words, the specification of a design iteration's intermediate product in the method's sixth step is the result of the synthesis of the functional perspective taken in this step of the development approach and the next step's crosscutting concerns perspective. Although this double separation, that is, of intermediate results and perspectives, is sensible and might even be necessary to cope with the complexity inherent to the design of technical systems, it is, due to the involved repetitions, less suitable to function as structure for documenting the outcomes of the reference architecture development that is carried out as

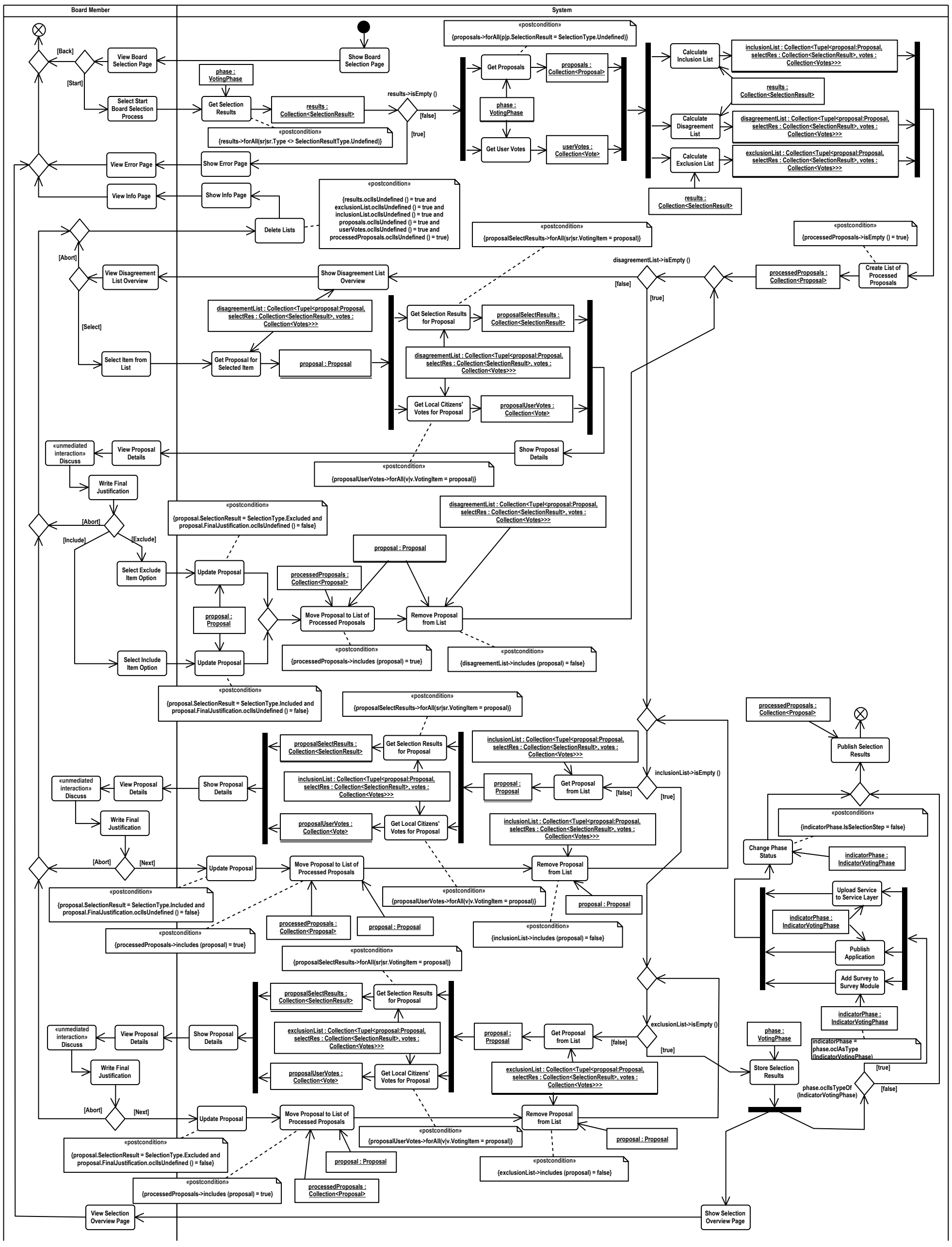

Figure 11.27: Key Scenario-Show Board Selection Process Page (AD-C-06)

second or extending part of the exemplary application of the method for the design of 'possible worlds'. Therefore, the following adapts a different format: whereas this section focuses on those activities of the reference architecture development method's fourth step that were carried out in the design cycle's first iteration, the discussion of the architectural candidate in section 11.6 concentrates on the output that was produced by those activities of the method's sixth step that were carried out in the last iteration of the present inquiry's 'second research project'. Correspondingly, intermediate results of incremental refinements in different iterations are not documented. This, in turn, suggests that the discussion of key issues in the subsequent section, which is usually carried out for each set of key scenarios guiding a single iteration, is, similar to the exploration of key scenarios in the preceding section, 'squeezed' into an aggregated summary. In short, the presently relevant facet of this rather lengthy remark in regard to the relationship of the last three steps of the reference architecture design cycle is that the remainder of this section focuses on the following three tasks carried out in the latter's first iteration (see section 8.3): (i) the selection of an application archetype that is able to provide a suitable basis for the development of a technical system that can integrate the extracted functional requirements, (ii) the identification of architectural constraints, possibly using the exsting body of knowledge to identify common contingently related elements in the domain, that might influence design decisions, and (iii) the identification of architectural patterns that refine the application archetype selected in (i).

In regard to the first task, the foregoing discussion and the exploration of community-driven SHD initiatives in section 10, indicate that applications derived from the reference architecture, on the one side, have to support the concurrent working of several users, who, in addition, are internally diversified on multiple dimensions (e.g., age, educational background, ICT affinity), and on the other side, should, due to the chronic lack of resources in civil society organizations, be easily maintainable and flexible enough to be adapted to the various demands that unfold and change along an initiative's life cycle. Although the differences between the typical application archetypes summarized in table 8.6 become more and more blurred[351], especially with the introduction of HTML5[352] that is scheduled to receive its World Wide Web Consortium (W3C) recommendation status at the end of 2014[353], the most suitable basis for the reference architecture, as already—at least implicitly—indicated in the discussion of key scenarios in the preceding step, tends to be a mixture of the service application and the web application archetypes, that is, a web application that offers its services to other, unknown applications via a service interface or layer. This suggestion rests on the following rationale (cf. Meier et al. 2009, pp. 266–267): on the one side, the service layer ensures to a certain degree that the technical system can be adapted, at least indirectly, to different and unfolding requirements by providing an interoperability interface that allows to integrate functionality in form of further technical systems that exchange data with the focal technical system. On the other side, the web application archetype is not only widely known[354], supported—often even without additional software besides a web browser—by

351. See for example Steve Jobs' reponse to Adobe's criticism in regard to the unavailability of Flash, one of the most common platforms for the development of rich internet applications, on several of Apple's products at: `http://www.apple.com/hotnews/thoughts-on-flash/`, accessed May 25, 2015.

352. For further details of HTML5 see `http://www.w3.org/TR/html5/`, accessed May 25, 2015 and `http://www.w3.org/html/wg/drafts/html/CR/`, accessed May 25, 2015.

353. For further details of the roadmap of HTML5, HTML5.1, and HTML5.2 see: `dev.w3.org/html5/decision-policy/html5-2014-plan.html`, accessed May 25, 2015.

354. A high degree of familiarity is, for instance, important if the evaluative function of reference architectures is taken into account (see section 8.3). As discussed in section 8.3, the reference architecture development method, based on the reinterpretation of the 'multiple models' principle proposed by Ambler (2002, pp. 32–33), suggests to

(almost) all platforms, but it is also comparatively easy to maintain, especially in respect to different versions if, despite the option to integrate functionality via the service layer, the technical system's architecture needs to or should be extended.

Unfortunately, basing the reference architecture design on the web application archetype has the disadvantage that only connected or online scenarios are supported. However, this tends to be less of a problem as carved out while carrying out the second above-mentioned task in this section. Before delving into this argument, it has to be pointed out that, taking the exemplary character of the 'second research project' in the present inquiry into account, the following discussion of the extraction of the common contingently related elements mainly serves illustrative purposes. It must not be mistaken with a thorough investigation of the domain; rather, it is the exploration of one single aspect that influences the above design decision. In contrast, a more comprehensive analysis might, for instance, examine the technological infrastructure used by civil society organizations that are comparable to the envisioned initiative to identify further relevant facets. Nevertheless, such a detailed study is out of the 'second research project's' scope, because the latter mainly servers to demonstrate that 'possible worlds' can function as a basis for the development of technical systems. Therefore, focusing on the one single facet that needs to be justified to counter a potential argument that concerns the missing support of offline scenarios by a reference architecture underpinned by the selected application archetype is sufficient to proceed with the design exercise as well as to illustrate how design decision-relevant data can be extracted from the existing body of knowledge (see also section 8.3).

The anticipated counterclaim points to the following issue: the reference architecture, due to the above selection, solely supports derived architectures that require users to be connected to the internet to participate in the decision-making process. Although the integration of the service layer mitigates this problem, because it allows to develop clients that can support offline scenarios, the constraint becomes even less serious if seen from another point of view. According to the graph shown in figure 11.28, the coverage of mobile-broadband subscriptions in 'developed' countries is not only continuously rising but is expected to reach a level of nearly 80% in 2014. In regard to the selected unit of analysis of the 'second research project', that is, urban localities in 'developed', democratic countries (see section 6.1), it tends to be save to assume that many (local) citizens have access to the internet even when they are not at home. Although there might be a difference between urban and rural localities in 'developed' countries, the data underpinning the graph displayed in figure 11.28, at least partially due to the challenges involved in demarcating both (see section 6.1), does not make this distinction. Nevertheless, there are reasons that support the assumption that the technological infrastructure ensuring the connectivity of local citizens tends to be better in urban localities than the one in rural areas (e.g., the economics of scale). This, in turn, suggests that the need to support offline scenarios in those contexts with which the present inquiry is

use, at least till a relatively stable state in the reference architecture design is reached, different application archetypes in parallel to be more flexible in regard to the incorporation of new functional requirements. Following this principle, the present inquiry designed a service-oriented architecture (SOA)-based variant with thick clients to support offline scenarios. However, this attempt was canceled after a few iterations: on the one side, the need to support disconnected scenarios tends to be become less important in the future as discussed more thoroughly below in this section, and on the other side, a SOA-based architecture, inter alia, tends to be less useful for evaluative purposes, because most articles that were scanned to identify common, contingently related elements in the domain and study related, existing technical approaches, describe web applications (e.g., Balram and Dragicevic 2009; Berry et al. 2011; Frez, Baloian, and Zurita 2012; Kelly et al. 2012; Simão, Densham, and Haklay 2009, and the literature referenced latter in this chapter). Nevertheless, a grain of this variant, as shown in figure 11.29, 'survived' in form of the reference architecture's service layer.

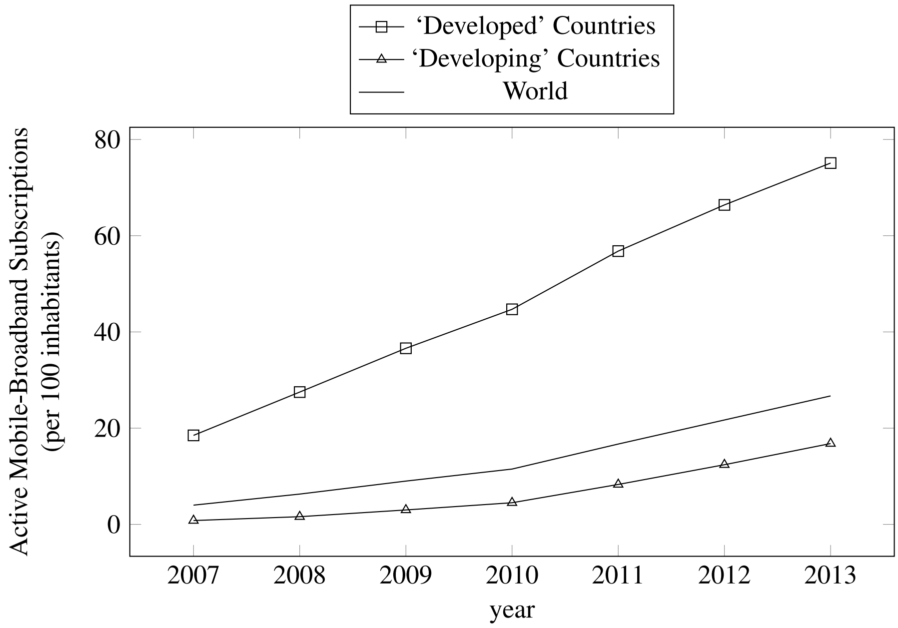

Figure 11.28: Active Mobile-Broadband Subscriptions (2007-2014) (data retrieved on 2014-06-23 from http://www.itu.int/en/ITU-D/Statistics/Pages/stat/)

concerned is relatively low. However, there is one exception to this rule: the initiative should offer alternatives to the web application-based participation in the decision-making process to engage those local citizens, who use the internet less frequently (e.g., the elderly). This might, for example, include the organization of adult education classes or dedicated study associations (see also the discussion of the second intervention entry point in section 10.3).

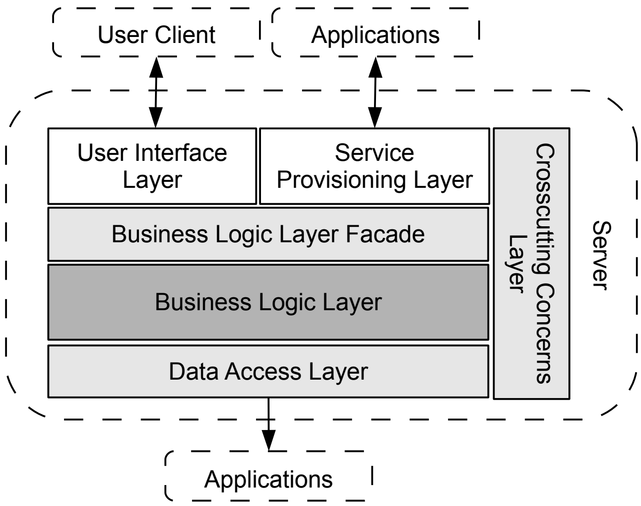

Figure 11.29: System Architecture-High-Level Overview

The third and final task that was carried out in the 'architecture overview' step of the reference architecture design cycle's first iteration is the selection of suitable architectural patterns to refine the chosen application archetype. From the common architectural patterns summarized in table 8.7, the web application archetype is frequently concretized through a combination of the client-server and the layered architecture patterns (cf. Meier et al. 2009, pp. 287–289)—both of which are schematically depicted in figure 11.29. Whereas the former divides the technical system into two interacting systems (i.e., user clients and a server), the latter suggests to group the server's[355] functionality into, traditionally, four different layers (cf. Bass, Clements, and Kazman 2013, pp. 205–210; Clements et al. 2011, pp. 87–103; Garlan and Shaw 1994, pp. 11–12): the presentation or user interface layer, the business logic or application layer, the data access or communication layer, and, as manifested in the key issues discussed in the next step, the crosscutting concerns layer. However, as indicated above, this traditional structure is extended by a fifth layer, i.e., the service layer, which provides an interface for remote applications to use the server's functionalities over the internet. Such remote applications, as will be discussed briefly in section 11.6, differ from 'regular' user clients, because they communicate with the server using extensible markup language (XML)-based messages instead of some other, more lightweight protocol.

Although the foregoing discussion is relatively broad and general, it is nevertheless the initial step in the actual design process, which becomes more concrete and related to functional requirements in latter iterations of the reference architecture development cycle. These incremental refinements, as indicated in the introduction to this section, are not included for presentational reasons. In other words, section 11.6 will solely present the final results, which, as indicated by the shades in figure 11.29, concentrate on the server's central element, that is, on the business logic layer. The specification of its structure and of related protocols, by implication, also requires to incorporate a brief exploration of the business logic layer-related functionalities of the data access and the crosscutting concerns layer, because the business logic layer requires both to provide its services. However, before the discussion turns to these architectural details, the next section presents the summary of key issues identified in the design cycle iterations carried out in this second research project.

11.5 Key Issues

The actual aim of this fifth step in the reference architecture development cycle is to extend the architectural overview's functional perspective by an investigation of the non-functional requirements imposed by the key scenario(s) selected for one iteration. As already pointed out in the preceding section, this incremental approach, despite being necessary in design practice, is unsuitable for documenting purposes. Therefore, the following, similar to the exploration carried out in the key scenario selection step (see section 11.3), will provide a summary of the key issue considerations emerging from the foregoing discussion. This description focuses on those three quality attributes that section 8.3 identified as at least partially addressable in the design of reference architectures[356]: reliability, security, and, in a broader understanding, performance (efficiency). Although all of these three key issue categories are important, the present inquiry does not approach all of them in the same way: on the one side, the integration of security and performance factors, as further discussed below, takes the form of devising technical means to improve both these characteristics of the reference architecture and, by implication, of concrete, derived architectures; on the other side, the reliability category is considered only on a more general, indirect level, that is, by decomposing the application into different modules or components. This, in turn, influences the reference architecture's reliability, because it reduces its complexity and enhances its testability—both

355. Variants that include so-called 'thick clients' might apply this structuring pattern also on the client side.

356. This, however, does not imply that the remaining quality attributes listed in table 8.9 are unimportant; rather, the abstract nature of reference architectures makes it difficult to integrate these concerns (e.g., usability).

of which are important ingredients for a reliable technical system. Whereas the complexity of derived architectures is reduced through the introduction of aggregation levels that allow to blend out lower-level details (see also the 'theoretical framework of complexity' and the 'ladder of abstraction' discussed in section 8.1), their testability is enhanced, because the specification of modules, interfaces, and protocols allows for easier testing of the technical system's components and their interactions, i.e., unit and integration testing respectively (see also section 5.2). In short, the remainder of this section concentrates on mechanisms to improve security and performance, whereby the former is the central focus of this discussion, because the abstract nature of reference architectures reduces the possibility to consider performance aspects in the design of business logic layer modules, which, in turn, is the reason why the present inquiry treats performance mainly as data access layer characteristic. As the data access layer, together with the crosscutting concerns layer, provides those services and functionalities that are required for the business logic layer to carry out its operations (see also the architecture's schematical sketch in figure 11.29), the examination, due to the hierarchical dependency, begins with the exploration of performance considerations.

Performance Considerations

The primary task in every endeavor that sets out to improve a technical system's performance is to avoid or reduce the number of those operations that consume comparatively expensive resources such as, for example, network or database connections. As shown in the high-level architectural sketch in figure 11.29, modules that use these kinds of resources are hidden from the business logic layer by being encapsulated in the data access layer. However, the 'mainly a data access layer characteristic' in this section's introduction, indicates that performance considerations are not confined to this part of the architecture. In fact, the following discussion first explores a mechanism that, inter alia, allows to enhance performance by changing the configuration of the business logic layer's components dynamically at runtime, before it briefly describes technical means that can reduce the resource consumption of the data access layer. Due to the closeness to the business logic layer as the core of the reference architecture development, the first part of the following examination, despite the above remark in regard to the treatment of performance considerations, is carried out with considerably more depth than the second, more data access layer-related part.

The use cases and key scenarios reviewed in section 11.3 explicated that the decision-making process is divided into different phases, which, in addition, contain several steps. Furthermore, it was also pointed out that this structure determines which activities the users of the technical system can carry out at a certain point in time. This, in turn, suggests that the technical system does not need all components all the time, because some services are available only in particular phases and/or steps. Correspondingly, the loading and unloading of needed and not required components respectively can improve the system's performance by reducing the amount of consumed resources (e.g., memory and/or processor time). Moreover, a module that supports such a process also contributes to the technical system's maintainability and, at least in certain respects, reliability. The latter is a double-edged sword, because dynamically loading and unloading components, on the one hand, allows to incorporate new, improved functionalities without modifying the remaining modules, but, on the other hand, might interrupt the operation of currently active components and/or infiltrate the system with malicious code. Whereas the former problem might be resolved or mitigated within the system, strategies to avoid malicious code require system-external security processes[357]. Assuming that such security measures are taken, the module that can realize the above-mentioned features is based on the component configurator pattern (cf. D. C. Schmidt et al. 2000, pp. 75–107), which, in turn, is constituted by the network of the following entities: (i) concrete components that realize certain system-specific functionalities, (ii) a `ComponentRegistry` that holds references of all currently activated components and that provides a single point of contact for component users to retrieve these references, (iii) a `ComponentConfigurator`, which, if triggered, loads and/or unloads components and stores references in the `ComponentRegistry`, and finally (iv) an `IConfigurableComponent` interface, that is, an interface that concrete components need to implement in order to be processable by the `ComponentConfigurator` and the `ComponentRegistry`. Although it might seem that all these entities belong to the business logic layer, the `ComponentConfigurator` and the `ComponentRegistry` constitute special cases that, using the distinction of Stafford (2003, p. 134), can be located in the application logic underpinning the business logic layer. In other words, they are part of a thin, separate layer that comprises general, domain-independent modules, instead of specific, problem domain-related components such as the ones entailed in the business logic layer.

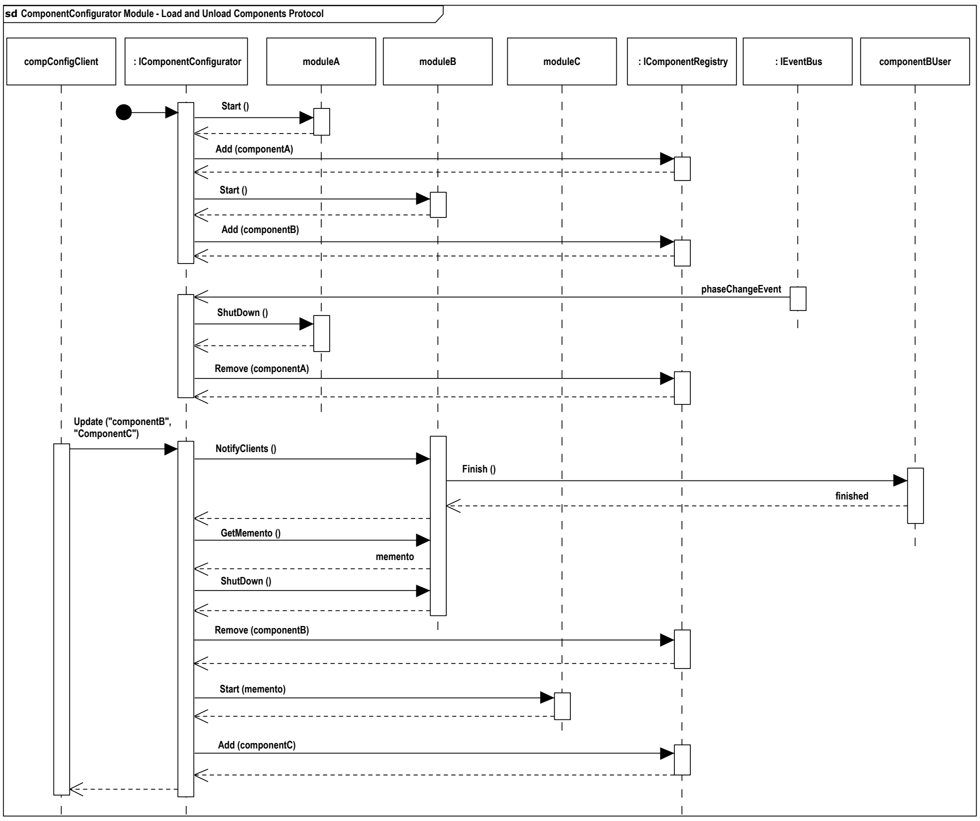

Figure 11.30: ComponentConfigurator-Loading and Unloading Modules (SD-CM-00)

Besides this packaging-related consideration, the currently more interesting aspect is the interaction protocol of the four above-mentioned entities that is shown in the sequence diagram depicted in figure 11.30. It displays the three, in regard to the foregoing description,

357. However, this security process can be validated by, for instance, a system-internal intrusion detection mechanism, which calculates the checksum of a component on startup and compares it with the valid checksum of tested version of this module stored in a protected data source. Nevertheless, this procedure depends on the inspection of modules and the maintenance of the data source that contains the checksums of successfully tested and authorized modules (see also Kienzle et al. 2002b, p. 82).

most important processes in which the `ComponentConfigurator` is involved. Firstly, the upper area of the sequence diagram indicates that the `ComponentConfigurator` is responsible for starting all components in the technical system's initiation phase. The former, based on a predefined script, starts all necessary components and adds them to the `ComponentRegistry` so that component users can retrieve the references of required instances. Secondly, the middle area of figure 11.30 reveals how the `ComponentConfigurator` can free resources by shutting down components that are no longer required. More specifically: it receives a message from an `IEventBus` instance, which, as discussed more thoroughly in the next section, is responsible for informing modules of the technical system about changes in the decision-making process, that is, about the initiation of phases and steps. The `ComponentConfigurator`, by inspecting the `IEventBus` instance's message, can determine which components are no longer required and which need to be started. Whereas the latter process is already captured in the first discussed interaction, the former sequence entails the shutting down of components and their removal from the `ComponentRegistry`. Finally, the third interaction sequence shown at the bottom of figure 11.30 displays the above-mentioned process in which components are updated to, for example, improve the performance of the overall system by replacing a module with a more efficient one. In this case the `ComponentConfigurator` notifies the going-to-be-replaced component that it has to inform its current clients that they cannot make new requests until further notice. If all currently active operations have been completed and all clients have sent their acknowledgements, the component returns control to the `ComponentConfigurator`. The latter then retrieves the component's `memento`, i.e., an object, based on the memento pattern (Gamma et al. 1995, pp. 283–291), that, without violating the rules of encapsulation, allows to transfer another object's internal state, before it shuts down the component and removes it from the `ComponentRegistry`. The procedure that starts the new component, as shown in figure 11.30, is similar to the first interaction sequence, but differs in that the new component is initialized with the `memento` retrieved from the replaced module. This `memento` is used in the initialization process to, inter alia, extract client references, which, in turn, allow to inform these clients that they, after updating their internal references, can make new requests. The rationale to prefer this update procedure over one that solely combines the first and second interaction sequences, is that this slightly more complicated process is able to reduce or mitigate the above-mentioned negative effects on a technical system's reliability. Although a concrete, derived architecture will probably replace the synchronous method calls with asynchronous interactions to improve the technical system's responsiveness, such an asynchronous variant involves the same set of (inter-)actions. To concentrate on the `ComponentConfigurator`'s core idea, the description used the easier to understand synchronous option. However, the asynchronous interaction protocol of the `EventBus` submodule discussed in the next section can serve as blueprint for revising the above-described sequences accordingly.

The second more traditional point to increase a technical system's performance is usually found in the data access layer, because retrieving data from and writing it to a database or a file system as well as connecting to and exchanging data with remote applications are among the most expensive operations that a system can carry out. The solution to reduce the involved costs is to avoid these kinds of operations as far as possible by, for instance, employing deferring, caching, and/or prefetching strategies such the ones described in the lazy load (cf. Buschmann, Henney, and Schmidt 2007a, pp. 511–512; Fowler 2003e), identity map (Fowler 2003d), resource pool, resource cache, eager acquisition, or partial acquisition patterns (cf.

Buschmann, Henney, and Schmidt 2007a, pp. 503–512, for the latter four patterns). Out of these patterns, the lazy load pattern is not only well-known, but it is also readily available in different data access layer-related frameworks such as, for example, hibernate[358]. The core idea of this pattern, although there are different variants, is that data is retrieved only when it is needed and as late as possible. A concrete realization of this pattern often loads only that subset of data that, on the one side, can be retrieved in one call to improve performance, and on the other side, is accessed relatively frequently to have the most often used data pieces directly available. The acquired data is then encapsulated in so-called intermediate objects, such as the virtual proxy described by Buschmann, Henney, and Schmidt (2007a, pp. 497–498), which, from the perspective of calling modules, take the form of regular domain objects (see section 11.6). If one of the modules of the business logic layer works with these objects and tries to access a piece of data that has not been loaded, the intermediate object loads the requested part from the underlying data source. This deferral strategy is often combined with an identity map-based repository (hereinafter: repository), which is a combination of the identity map (Fowler 2003d) and the repository pattern (cf. Bass, Clements, and Kazman 2013, pp. 230–231; Buschmann, Henney, and Schmidt 2007a, pp. 202–204; Clements et al. 2011, pp. 178–182; Hieatt and Mee 2003). In anticipation of the more thorough discussion in the next section, such a repository can described as a collection-like object that functions as single point of contact for all modules that need to retrieve and store domain objects. Although such a repository also frees calling modules from the need to maintain their own data access logic, which, in turn, can improve performance by developing specialized and fine-tuned code, the currently more important feature is that it, by incorporating the identity map, realizes a caching mechanism. More specifically: it stores all domain objects that at any point in the technical system's life cycle have been retrieved from the underlying data source in an internal collection. Only if a module requests a domain object that is not comprised in this list, the repository queries the underlying data source to acquire the data of the requested object. This ensures that every domain object is loaded only once, which, in turn, enhances performance by reducing the costs for establishing database connections and by shortening latency times. As the repository and its interaction protocols are also examined in the next section, the discussion, instead of refining this general characterization now, turns to the exploration of security considerations, that is, to the second category of key issues.

Security Considerations

As indicated in the architectural overview (see section 11.4), the reference architecture developed in this 'second research project' is based on the web application archetype. Generally, web applications, due to their connectedness to the internet, are vulnerable to a number of different types of attacks such as cookie poisoning, cross-site scripting, etc. Although complete security might never be guaranteed, it is nevertheless of ordinary importance that the DSS for community-driven SHD initiatives incorporates security mechanisms to provide an as high as possible level of security to protect the sensitive data of participants. However, devising an adequate array of protection instruments, especially weighting costs and benefits of the numerous possible techniques, is an enormous project that goes far beyond what can be discussed in the present inquiry; rather, it is a study on its own. Therefore, in respect to the

358. Hibernate is one widely used object-relational mapping tools, which is available for Java `http://hibernate.org/`, accessed May 25, 2015 and the .NET environment `http://nhforge.org/`, accessed May 25, 2015.

exemplary nature of the ‘second research project’ only a few of the standard security measures to protect web applications are reviewed in the following. For a more comprehensive overview of security processes and patterns see Eckert (2005), ISO (2009)[359], Kienzle and Elder (2002), Kienzle et al. (2002b), Kienzle et al. (2002a), and Schumacher et al. (2006).

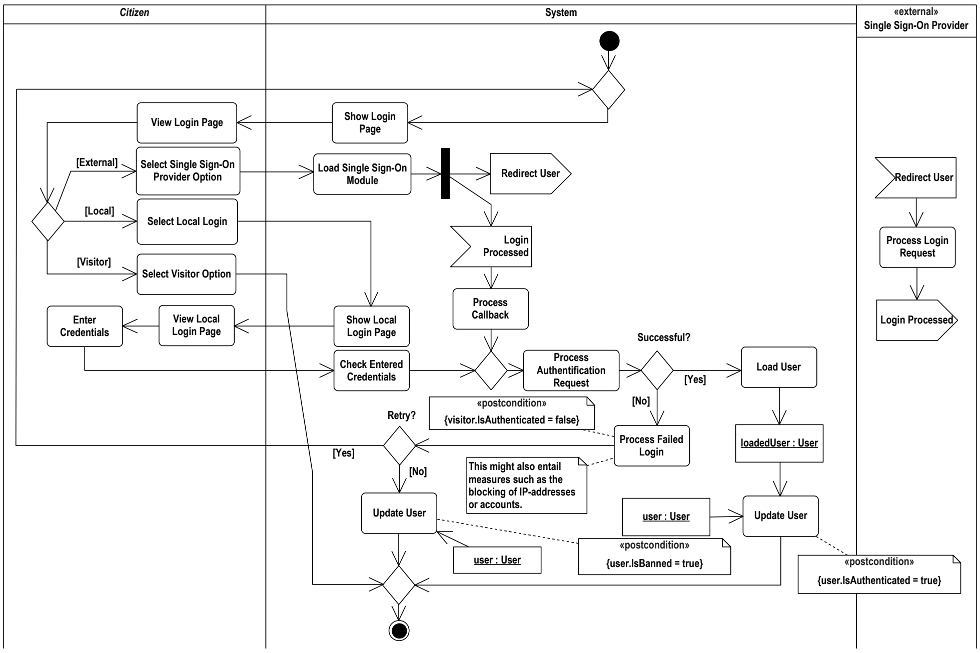

Figure 11.31: Key Issue-Show Login Page (AD-C-02)

The most fundamental security procedure that is realized in almost any web application is the authentication of a user’s identity to ensure that only those users who are allowed to view or edit certain data pieces as well as to exercise a particular system functionality can actually carry out these actions. One part of this non-functional requirement is captured by the ‘show login page’ activity diagram depicted in figure 11.31, which is the refinement of the respective call behavior in the ‘access dashboard’ activity diagram shown in figure 11.11. As indicated by the first decision node in the user’s swimlane, the reference architecture considers three different types of authentication: either (i) the user does not claim a specific identity and works with the system as a visitor, (ii) the user can let an existing single sign-on provider confirm her or his identity (see section 11.6), or (iii) the user proofs her or his identity by providing local credentials. In contrast to the first, the latter two authentication procedures, both realizing a variant of the authorization pattern (cf. Buschmann, Henney, and Schmidt 2007a, pp. 351–352; Schumacher et al. 2006, pp. 245–248), might, if the user could be authenticated successfully, lead to the creation of a security session (cf. Kienzle and Elder 2002, p. 11; Kienzle et al. 2002a, pp. 17–24; Schumacher et al. 2006, pp. 297–304). However, as the decision node at the bottom of figure 11.31 indicates, if login attempts fail repeatedly, the account that the user claims to be her or his is disabled to counter, for instance, brute force-based password guessing attacks, as suggested by the account lockout pattern (cf. Kienzle and Elder 2002, p. 11; Kienzle et al. 2002a, pp. 11–16).

On the other side, if the user has cleared this initial security hurdle, the system loads the user’s personal data to, inter alia, determine which of the roles identified in the discussion in section 11.1 the user can play. Although a concrete, derived architecture will probably replace

359. See also the other parts in the 15408 standard family.

the Boolean flags used to refer to different roles (see the preliminary object model shown, for example, in figure 11.2) with a more sophisticated mechanism, these flags nevertheless indicate which roles should or need to be distinguished in a suitable technical system. The process of translating these initial, security-related considerations then into a comprehensive security model is described by the role-based access control pattern (Schumacher et al. 2006, pp. 249–252), which itself refines the above-mentioned authorization pattern. One of the key steps described by this pattern is the definition of access rights for roles, whereby roles, as indicated by the boxes in figure 11.32, can be grouped into a hierarchical structure so that roles can inherit the rights granted to superordinate roles.

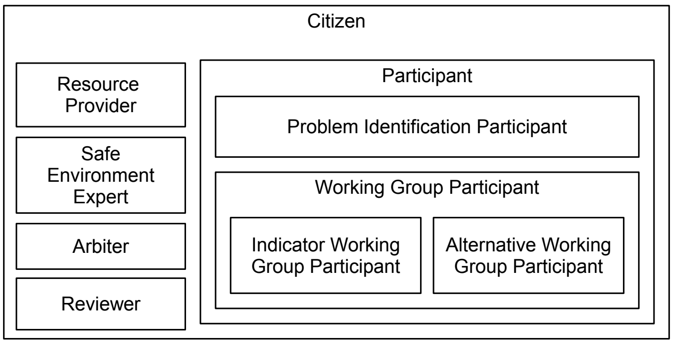

Figure 11.32: Roles Hierarchy of the Decision-Support System

The specification of associations between access rights and roles usually manifests itself in form of a list that comprises multiple role-resource-rights entries. Within table 11.2 such tripartite connections are illustrated through the assignment of rights to general roles in regard to those concept types that have been discussed in section 11.1. However, it has to be noted that this is only an abstract example that needs to be concretized to be useful in a technical system (e.g., the author role has to be replaced by a particular user instance). Nevertheless, the rows of table 11.2 summarize those access constraints that were defined in section 11.1 in a comparatively compact format. For example, the third row suggests that all citizens can view a published proposal, but that only the author and, if applicable, the other working group participants can edit it. Whereas all but the first row have already been discussed in the foregoing examination, the former refers to a protected object that has been mentioned only implicitly, i.e., the role registry. This registry is the module from which the system, as indicated above, retrieves the personal information of a user to determine which roles she or he can play, because it maintains the role-resource-rights list. The main interaction partner of this registry is the reference monitor (cf. J. P. Anderson 1972, pp. 16–17, 22–23), which is itself a component that mediates and validates the requests of clients to ensure that they can view and edit only those resources for which they have the necessary permissions (see also Schumacher et al. 2006, pp. 256–258). As both these technical constructs will be examined more thoroughly in the next section, the exploration of key issues now turns to another security mechanism, that, in contrast to the foregoing discussion's focus on access control, is primarily concerned with the integrity of data, which is not only important for security reasons, but also contributes to a technical system's stability and reliability.

As indicated in the `ComponentConfigurator` elaboration, technical systems are generally threatened by malicious code. Furthermore, web applications in particular are also

Table 11.2: Access Rights in the Decision-Support System

Protected Object	Status	View	Edit
Role Registry	[created]	Board Member	Board Member
Proposal	[created]	Author	—
	IsPublished	Citizen	Author+ Working Group Participant
	IsBeingScrutinized	Author+ Working Group Participant	—
	IsReleased[a]	Citizen	—
	IsClosed	Author+ Working Group Participant	Author+ Working Group Participant
	IsCommitted	Citizen / Author+ Working Group Participant[b]	—
	IsUnderReview	Citizen / Author+ Working Group Participant[b]	—
	IsReviewed	Citizen / Author+ Working Group Participant[b]	Author+ Working Group Participant
	IsFinalized	Citizen / Author+ Working Group Participant[b]	—
Resource Request	[created]	Author+ Working Group Participant	—
	IsPublished	Citizen	Author+ Working Group Participant
Resource	[created]	Resource Provider	—
	IsBeingScrutinized	Resource Provider	—
	IsPublished	Citizen[c]	Resource Provider
	IsProposalSpecific	Resource Provider+ Alternative Working Group Participant	Resource Provider
Volunteer Offering	[created]	Author	—
	IsPublished	Author+ Working Group Participants	Author
Model	[created]	Citizen	Scientist
Comment	[created]	Author	—
	IsBeingScrutinized	Author	—
	IsPublished	Citizen	—

a. Only `ProblemProposals` can have this status.
b. If the `Proposal` is closed, that is, `IsClosed` equals `false`, then only the author and, if applicable, working group participants can view the `Proposal`.
c. Only if the `Resource` is not proposal-specific, that is, if `IsProposalSpecific` equals `false`.

endangered by data that clients have sent to compromise the technical system's stability (e.g., denial of service attacks), to get access to data that they are not allowed to see (e.g., Structured Query Language (SQL) injection attacks), or to perform actions are they are not authorized to exercise (e.g., cross-site scripting). The security mechanism that offers a certain degree of protection against this kind of attacks is the incorporation of a module that realizes a service-side validation as described by the client input filter pattern (Kienzle et al. 2002a, pp. 30–35). The core idea of this technique is to check all data pieces that clients send for (malicious) code to avoid the above-mentioned attacks and for their validity in regard to other data integrity constraints to avoid application crashes (e.g., the format email addresses or of dates and the completeness of forms). As these validation functions are independent of a particular domain, there are a number of powerful, readily available libraries and frameworks that can be employed to realize this functionality[360]. The challenging aspect is therefore not the server-side validation's realization, but the way it can be integrated into the technical system without violating the separation of concerns. The solution to this issue is provided by the business logic layer facade, which, in turn, is based on the facade pattern (cf. Buschmann, Henney, and Schmidt 2007a, pp. 294–295; Fowler 2003i; Gamma et al. 1995, pp. 185–193). It solely provides a thin layer on top of the business logic layer as schematically depicted in figure 11.29. The beauty of this approach is that it not only offers a common interface for clients to access the various, encapsulated business logic layer modules, but that this interface simultaneously functions as the central anchor point for the seamless integration of modules that, similar to the validation module, realize crosscutting functionalities (e.g., caching, logging). It therefore, on the one side, frees components from the burden to implement functionalities that do not belong to their core responsibility, and on the other side, helps to reduce the duplication of code, which, in turn, enhances the technical system's maintainability. However, a facade's integration capacities are not confined to modules that realize crosscutting concerns; rather, they provide a flexible mechanism that makes a technical system extensible without requiring extensive changes in the code. As the presentation of the reference architecture's details in the next section reveals, the facade pattern is frequently employed on a more fine-grained level to take advantage of its many positive features.

However, before the discussion turns to the exploration of the architectural candidate, a brief remark in regard to a security mechanism that provides a second line of defense is inserted. This procedure complements the network-oriented approaches discussed above by a measure that helps to protect sensitive data even if attackers have breached the first line of defense or if they misuse their granted rights to get access to sensitive information. The technique that aims to address such issues is described in the information obscurity pattern (cf. Kienzle and Elder 2002, p. 11; Kienzle et al. 2002a, pp. 38–43; Schumacher et al. 2006, pp. 426–433). Its core idea is to encrypt all sensitive data, such as user passwords or session identifiers stored on clients, to protect these resources against unauthorized access or even modification. Similar to the afore-mentioned server-side validation mechanism, the burdensome facet of this pattern is not its realization as most development environments offer corresponding functionalities; rather, challenging are, on the one side, the identification of data that needs to be protected through comparatively expensive encryption and decryption procedures, and on the other side, the integration of the module that provides the respective

360. See, for example, the Spring.NET validation framework (`http://www.springframework.net/doc-latest/reference/html/validation.html`, accessed May 25, 2015) or the overview of Java-related frameworks at: `http://java-source.net/open-source/validation`, accessed May 25, 2015.

services into the domain-dependent application flow. In regard to the former, the preliminary object models briefly discussed in section 11.1 tend to contain only one piece of information that can be classified as sensitive, i.e., the user's password. However, it is common practice to store only the password's hash value in the underlying data source. Although this might also count as a variant of the information obscurity pattern, the extended object or domain models of derived architecture can comprise other data pieces that might be classified as sensitive (e.g., the bank account details of paying members or donors). On the other side, the second challenge can probably be resolved by the above-discussed repository or a dedicated facade that, similar to the business logic layer facade, provides an anchor point for the integration of modules that realize crosscutting concerns on top of the data access layer.

After this relatively brief and general overview of non-functional requirements unfolding around two important quality attributes that can be addressed in the design of reference architectures, the next section is going to present the architectural candidate that synthesizes the functional requirements discussed in section 11.3 and the key issue considerations pointed out in this section into a coherent architectural description that functions as blueprint for the design of concrete architectures, which, in turn, guide the development of technical systems that support the decision-making processes of community-driven SHD initiatives.

11.6 Candidate Solution

The coherent architectural description or more precisely the candidate solution presented in this sixth and final step of the reference architecture design cycle, is, as pointed out in section 11.4, the documentation of the result of all iterations that have been carried out within the 'second research project' of the present inquiry. However, this is not to suggest that the created reference architecture cannot be refined or extended using further key scenarios in additional iterations. Nevertheless, the devised candidate solution comprises a stable set of modules onto which the processes captured in the activity diagrams explored section 11.3 can be mapped, that incorporates the key issue considerations examined in the preceding section, and that has reached a level of granularity that, as summarized in table 11.1, characterizes a congruent reference architecture.

Figure 11.33 schematically depicts the general overview of this congruent candidate solution, which at the same time is also the first refinement of the high-level architecture overview displayed in figure 11.29. It shows, in addition to the previously discussed component configurator and the business logic layer facade, a number of modules that are examined more closely in the remainder of this section. Although the business logic layer and its modules are the central elements of this elaboration, the following exploration, using the dependency between layers as a structure or golden thread, starts with an analysis of the domain objects and crosscutting concerns layer, before it turns to the data access layer. Based on this preparatory work, the inquiry then delves into the reference architecture's core, that is, the business logic layer and its modules. After this, in contrast to the rather coarse-grained review of the two preceding layers, substantially more detailed study, a brief discussion of the two topmost layers, i.e., the user interface and the service layer, is inserted to complete the architectural overview as well as to finish the 'second research project'.

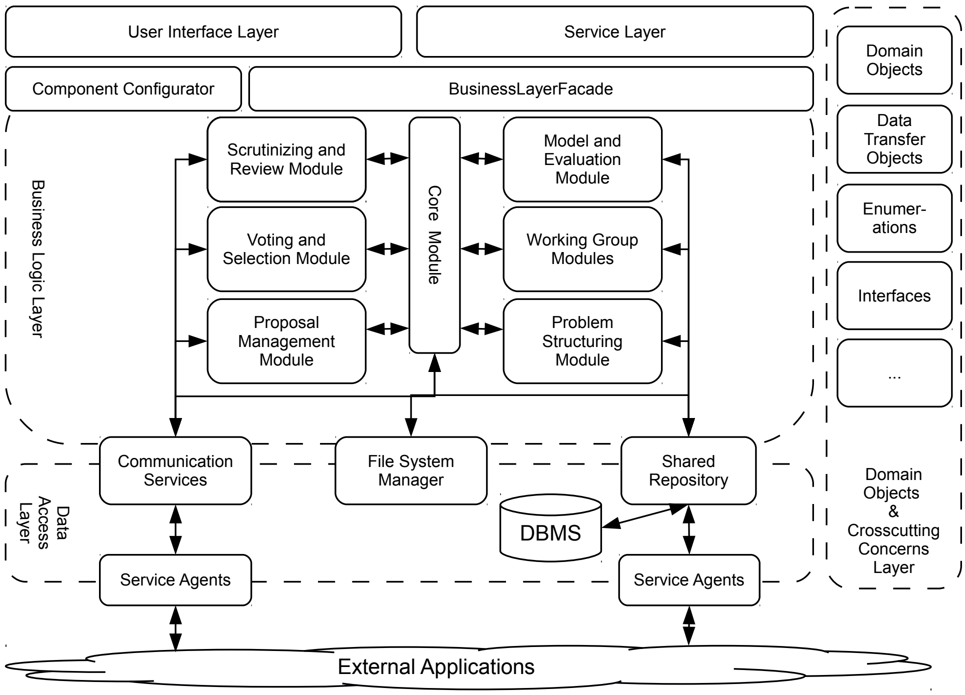

Figure 11.33: Reference Architecture-First Refinment

The Domain Objects and Crosscutting Concerns Layer

Although, as can be seen in figure 11.33, the reference architecture, for reasons explicated below, merges two usually separated 'sidecars' (Bass, Clements, and Kazman 2013, p. 209) or layers into the 'domain objects and crosscutting concerns layer', both have to be seen as logically independent structures, which, due to a shared commonality, are discussed together in the following. Sections 8.3 and 11.5 already pointed out that the crosscutting concerns part of this layer entails those modules whose functionality would otherwise be duplicated and dispersed throughout the technical system's architecture such as, for example, modules that realize security, caching, or logging mechanisms (cf. Meier et al. 2009, p. 205). Besides these aspects that, as discussed before, are integrated via the facades used within the reference architecture, the crosscutting concerns part, due to its independence from other layers, also provides access to shared resources. This more packaging-related feature applies to the three building blocks below the domain objects entity comprises in the domain objects and crosscutting concerns layer shown in figure 11.33: `data transfer objects`, `interfaces`, and `enumerations`. Whereas the latter is an object-oriented, in most programming languages available version of a set of unique values that are often used to control application flows (cf. B. Meyer 1997, pp. 657–659), the former two are higher level design patterns described by Fowler (2003b) and Fowler (2003j) respectively. However, before each of these two patterns is briefly discussed in relation to the present context, the second, closely related and more fundamental part of this layer, that is, the domain objects module, needs to be introduced. Correspondingly, the following examination starts with an analysis of the domain objects module and its underlying domain object pattern (cf. Buschmann, Henney, and Schmidt 2007a, pp. 208–210; Esposito and Saltarello 2009, pp. 130–132).

The latter pattern aims to address the problem of tight coupling between and the structural complexity of objects devised when mapping the application domain onto an object-oriented representation (cf. Meier et al. 2009, p. 169). It suggests, on the one side, that each functional responsibility in a technical system should be encapsulated within a domain object, sometimes also called business entity or object (e.g., Esposito and Saltarello 2009, pp. 131–132; Meier et al. 2009, pp. 167–172), that hides its service implementation behind an interface, and on the other side, that domain objects interact only via their interfaces to avoid the afore-mentioned issues as well as to evolve independently from each other. According to this specification and in reference to the architecture's first refinement shown in figure 11.33, all of the depicted modules can therefore be considered as domain objects. However, Buschmann, Henney, and Schmidt (2007a, p. 209) point out that the level of granularity might also be more fine-grained. Although, as discussed more thoroughly below, the reference architecture's modules are designed according to the above-described suggestion, the domain objects part comprises solely those objects that are exchanged between these modules. Based on the preliminary object models presented in section 11.1, suitable domain object candidates are, for example, the `User` concept or the different types derived from the `Proposal` concept. Putting the corresponding objects into a sidecar and, in addition, separating them from their interfaces reduces the structural complexity of the architecture and, by introducing a supplementary intermediary, makes those modules that work with such objects nearly independent from each other. However, the domain objects part, due to its intimate connection to the application logic, is, following from the former, actually very closely related to the business logic layer. Merging it and the crosscutting concerns layer, despite this tie, into one layer is not to suggest that both belong to the same logical packaging unit; rather, it is merely a presentational device that allows to focus the business logic layer discussion on the reference architecture's core elements. On the other side, devising a concrete domain model, which is, for example, the preferred choice for a workflow-oriented technical system (cf. Esposito and Saltarello 2009, p. 190), based on the preliminary object models discussed in section 11.1, is a task that belongs to the design of a derived architecture. This clarificatory remark, by implication, equally applies to the two design patterns mentioned in regard to the crosscutting concerns part of this layer, because both depend on a concrete domain model. Nevertheless, the following will briefly explore both patterns to have a comprehensive foundation for the examination of the reference architecture's remaining layers.

Firstly, the separated interface pattern is employed if the interactions between modules or domain objects violate an envisioned dependency structure by, for example, introducing mutual dependencies between modules or domain objects (cf. Fowler 2003j, p. 476). The suggested solution is to create different logical packages for interfaces and realizing modules (cf. Buschmann, Henney, and Schmidt 2007a, p. 282; Esposito and Saltarello 2009, p. 264). Although the term 'interface' might mistakenly be associated with the interface construct that many object-oriented programming languages offer, an abstract base class such as the deferred `Contribution` concept, see, for example, the preliminary object model depicted in figure 11.8, is also an interface that can be separated from concrete realizations such as the `AlternativeProposal` (cf. Fowler 2003j, p. 478; B. Meyer 1997, p. 30). Nevertheless, as the crosscutting concerns layer has no direct dependencies, it is the ideal place to store interfaces of modules that are used by different layers or multiple modules within one layer. For instance, the `IConfigurableComponent` interface, that is, the interface that all modules handled by the `ComponentConfigurator` and the `ComponentRegistry` have to implement, is stored in the crosscutting concern layer. In this way the separated interface not only decouples the realizing modules from the module that implements the mechanism to dynamically (un-)load components and vice versa, but also the business logic layer from the underpinning, domain-independent application layer (see section 11.5). However, as the `ComponentConfigurator` is the intermediary or 'third package' that ties together interfaces and their realizations (cf. Fowler 2003j, p. 478), there is still a dependency between the application layer and the domain logic. Resolving this coupling, in turn, requires additional measures such as a plugin infrastructure, which will be discussed later in this section.

Secondly, the data transfer objects (DTOs) pattern (Fowler 2003b), a pattern frequently employed in the development of distributed technical systems, addresses the problem that a client often requires only a portion of the data comprises in a server's domain object or that the desired information is dispersed across different domain entities (see also Buschmann, Henney, and Schmidt 2007a, pp. 418–419). The proposed solution is to create a 'behaviorless'[361] object that can carry all necessary data and to transmit this object instead of too large or multiple domain entities. A variant of DTOs, the local DTOs, can also be used within a technical system if data needs to be transferred between modules in a multi-threaded application (Fowler 2004a). In short, DTOs might either be used to transport data between different threads (e.g., layers) or to exchange data between different technical systems. In reference to the functional requirements discussed in section 11.1, such DTOs might, for example, be used in the alternative design phase. In particular, the data pieces comprised in instances of the `AlternativeProposal`, the `AlternativeSpecification`, and the `AlternativeEvaluation` concepts might be transmitted in form of DTOs to meet the peculiarities of different described scenarios (see also the preliminary object model displayed in figure 11.8): whereas a citizen who explores proposals to participate in a working group might not need to see the currently active working group participants as specified in the `AlternativeProposal` instance, the reviewer of an alternative needs to inspect the information stored in those `AlternativeProposal`, `AlternativeSpecification`, and `AlternativeEvaluation` instances that together constitute the alternative to be reviewed. On the other side, DTOs can also be used to transfer data back from clients to the server as this increases the readability of methods by reducing the number of arguments that need to be passed along calls. However, as will be explored more fully in the detailed discussion of the business logic layer, using DTOs as transportation medium between layers is not the only available option. For instance, another quite different approach is described in the two step view pattern (Fowler 2003k). It suggests that the business logic layer of web applications that need to support different web page appearances or clients should return an unformatted, possibly XML-based string that user interface layers transform into a client-specific representations (or which might be sent by the service layer to remote clients). Nevertheless, these two ways of exchanging data between layers (and systems) are not totally incompatible; rather, it is, for example, possible to use an unformatted, logical representation to transport data from the business logical layer to the user interface layer and DTOs for the other way. Although some of the sequence diagrams that specify the interaction protocols of business logic layer modules make use of this mixed approach, a concrete architecture, due to the focus of the 'second research project', can also employ one of the 'pure' proposals or it might even take a completely different road (see Buschmann, Henney, and Schmidt 2007a; Fowler 2003g; Hohpe and Woolf 2004, for overviews of respective options).

361. The term 'behaviorless' in this case means that a DTO does not have any methods other than methods for getting and setting the values of its attributes, that is, it does not contain any business logic.

The Data Access Layer

In addition to the domain objects and crosscutting concerns layer, the business logic layer also depends on a data access layer and its functionalities to provide its services. Although there are circumstances in which a dedicated data access layer is not required but can be merged into the business logic layer and/or its entities, literature (strongly) recommends its implementation in technical systems that are based on the just discussed domain model pattern (cf. Esposito and Saltarello 2009, pp. 251–252). Its main purpose is to provide a data source-independent interface, i.e., it should decouple the object-oriented business logic layer as well as the domain objects module from varying structures employed by different data sources as well as from code that is used to access the latter (cf. Esposito and Saltarello 2009, p. 251; Meier et al. 2009, pp. 96–97). In other words, it encapsulates and hides mechanisms that are required to work with the underlying database(s) (cf. Buschmann, Henney, and Schmidt 2007a, pp. 538–539), to operate on the file system, and to exchange data with remote services such as gateways (cf. Fowler 2003c), brokers (cf. Bass, Clements, and Kazman 2013, pp. 210–212; Buschmann, Henney, and Schmidt 2007a, pp. 237–239), and requestors (cf. Buschmann, Henney, and Schmidt 2007a, pp. 242–243). However, the data access layer not just conceals technical realizations, but it, as indicated in the reference architecture's first refinement (see figure 11.33), offers dedicated interfaces through which business logic layer modules can carry out the respective activities. The following discussion, starting with the shared repository, examines each of these three intermediaries more closely.

Beside the already discussed performance issues that might occur on this level (see section 11.5), one challenging aspect of providing a data source-independent interface is the bi-directional transformation of data structures used within different data sources and the afore-mentioned domain objects. One of the solutions that the design pattern literature suggests in this respect is the data mapper (cf. Fowler 2003a; Buschmann, Henney, and Schmidt 2007a, pp. 540–541) or, more specifically, the metadata mapper (Fowler 2003f). Based on the reflection capabilities provided by most modern programming languages (see Buschmann et al. 1996, pp. 293–219; Buschmann, Henney, and Schmidt 2007a, pp. 197–199, for introductions of the general concept), such a metadata mapper either uses files or, if supported by the concrete development environment, attributes to map, for example, domain objects onto the tables of a relational database and vice versa. As this is a frequently occurring task in the development of technical systems, there are many products such as, for instance, the in section 11.5 mentioned hibernate, that offer ready-made solutions to realize such procedures.

In this section is was also indicated that, due to the comparatively high costs of data retrieval and transformation, data access layers traditionally include repositories, i.e., identity map-based (Fowler 2003d) 'caches' for instances of created and retrieved objects (cf. Esposito and Saltarello 2009, pp. 309–310). However, repositories, in addition to the realization of caching functionality, can also integrate different data sources—even remote ones—into a virtual repository that, as briefly touched in section 11.1, enables users to, for example, explore different `AlternativeProposal` repositories in one unified environment (see also Esposito and Saltarello 2009, pp. 291–292; Li et al. 2011, pp. 1754–1759). In short, the repository not only serves as anchor point for the integration of crosscutting concerns, but it also allows, using the functionalities of the service agents discussed below, to transparently combine remote and local data to provide a shared (virtual) repository. Despite these important functions, the shared repository's main purpose is to free business logic layer modules from the need to implement database-related code by offering a collection-like object with which modules can interact in the usual way. Although this sufficiently abstracts from database access logic, by including module-specific registries (cf. Fowler 2003h), the reference architecture adds additional intermediaries on top of the repository. A registry, in contrast to a repository, does not store objects itself but index data that indicates where to find objects; however, it might, as in the present case, also realize more sophisticated search capacities. This can be illustrated based on the sequence diagram depicted in figure 11.34, which shows the interaction protocol of registries and the shared repository using an add and a get example.

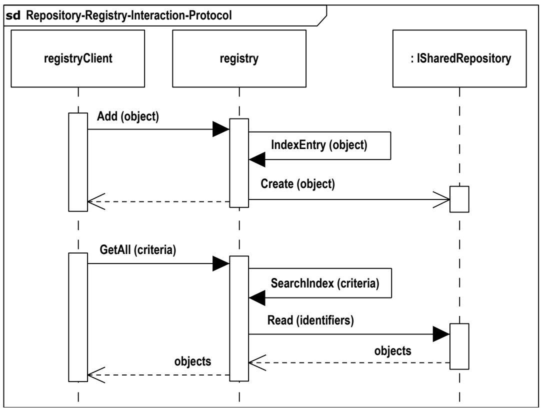

Figure 11.34: Repository-Registry Interaction Protocol (SD-CM-00b)

The upper area of the sequence diagram illustrates the interactions that are carried out if a registry client, usually one of the module's submodules, adds an object to one of the module-specific registries. It shows that the registry, before asynchronously adding the object to the shared repository, indexes the obtained object. This procedure simplifies the retrieval of objects from the repository as illustrated in the lower part of figure 11.34. Based on the created index, the registry can determine the identifiers of those objects that satisfy the passed search criteria, which, in turn, are used to retrieve the respective objects from the shared repository. This layer on top of the shared repository prevents the latter from becoming too crowded with module-specific methods, which, in turn, reduces the number of changes required to add modules, and it provides a second anchor point for the integration of module-specific, data-related functionalities shared by a module's submodules (e.g., logging).

The second interface offered by the data access layer is the communication services module, which, in turn, is derived from the idea of service agents described by Meier et al. (2009, p. 189). The module's main purpose is to decouple business logic layer modules from code that is necessary to access resources in remote locations via the internet. This includes, for instance, the data exchange with the afore-mentioned single sign-on providers, but also other utility services, which, in contrast to the data services integrated into a virtual repository, mainly offer functions such as the sending of e-mails or short messages. Furthermore, as implicitly indicated in section 11.3 and more fully explored in the succeeding discussion of the business logic layer, the communication services module also allows to asynchronously communicate with web application clients to, for example, inform them about updates in the problem structuring graph or to strengthen the collaborative efforts of indicator and alternative working groups. Realizing these and further functionalities, is, similar to the technological underpinning of the shared repository, supported by several libraries that provide readily available solutions for nearly all these tasks. For example, whereas the Apache Axis framework[362] simplifies the data exchange with Web services in Java, Microsoft's Windows Communication Foundation[363] provides comparable and further features in .NET. Moreover, (almost) all modern software development platforms comprise capabilities to set up and maintain different types of lower-level, network-based data exchanges. However, as the reference architecture, due to its technology-agnostic nature, deliberately abstracts from such considerations, the discussion now turns to the third and final interface offered by the data access layer, that is, the file system manager module.

The name already suggests that this module is responsible for decoupling the business logic layer from code that is required to work with the underlying file system. As such operations are standardly support by (almost) all modern development platforms, they might as well be directly integrated into business logic layer modules. However, the idea to add an additional layer of abstraction is based on the following rationale: some files, similar to database entries, might contain sensitive or application critical data (e.g., configuration information) that needs to be protected by encryption and decryption procedures (see also Schumacher et al. 2006, pp. 350–354, for a discussion of the file authorization pattern). Therefore, channeling all file system-related requests through the file system manager allows to integrate such security mechanisms transparently in the application flow. However, the anchoring features of the file system manager or a comparable module, similar to the aforementioned intermediaries, are not confined to security techniques but encompass all other relevant crosscutting concerns such as, for example, logging procedures to support audits.

After this rough and general sketch of the data access layer, which, together with the previously discussed domain objects and crosscutting concerns layer, provides the basic services for the business logic layer, the presentation of the candidate solution is now ready to examine the reference architecture's core and the 'second research project's' central result: the domain-dependent modules that underpin those technical systems that aim to support the decision-making processes of community-driven SHD initiatives.

The Business Logic Layer

The business logic layer, as indicated in section 11.5 as well as the reference architecture's first refinement (see figure 11.33), conceals its inner structure and processes through an encapsulating business logic layer facade. This facade, in turn, functions as a unified interface for clients that interact with one of the business logic layer's seven modules. The details of each of these modules as well as their interaction protocols are explored more thoroughly in the following. However, due to the inevitable space constraints some of the UML component and sequence diagrams underpinning this discussion (see section 8.3), similar to the preliminary object models and activity diagrams used to capture the functional requirements (see section 11.1), cannot be shown in their entirety. Therefore, all diagrams have an associated identifier that allows to locate the respective diagram in annex D.2[364]. Despite this representational limitation, the discussion of the business logic layer's further refinement starts with its central entity, which, as shown in figure 11.33, is the `Core` module. It provides services

362. For details see: `http://axis.apache.org`, accessed May 25, 2015.

363. For details see: `http://msdn.microsoft.com/en-US/library/dd456779.aspx`, accessed May 25, 2015.

364. In regard to the identifier itself the following convention applies: the general structure of sequence diagram identifiers is SD-<Category>-<Number>; whereby the category part is used to denote the module to which the respective sequence diagram belongs (i.e., CM = Core module, PMM = ProposalManagement module, SRM = ScrutinizingAndReview module, VSM = VotingAndSelection module, WGM = WorkingGroup module, PSM = ProblemStructuring module, or MEM = ModelAndEvaluation module). On the other side, the number part is a unique identifier that distinguishes all diagrams that belong to one of the outlined categories.

to and coordinates the interaction of all modules examined afterwards. This includes the `ProposalManagement` module, the `ScrutinizingAndReview` module, the `VotingAndSelection` module, the `WorkingGroup` module, the `ProblemStructuring` module, as well as the `ModelAndEvaluation` module, which, as the seventh module of the business logic layer, completes the architectural description of the candidate solution's focal entity.

The `Core` module is the central component of the DSS devised to support the communicative decision-making processes of community-driven SHD initiatives. In contrast to the remaining modules, the `Core` module does not provide domain-specific functionalities; rather, its main focus, similar to the above-mentioned `ComponentConfigurator` rests on more general infrastructure mechanisms, which, however, are intimately related to and integrated in the business logic layer's processes and do not have, as in the `ComponentConfigurator`'s case, an application-level orientation. This, in turn, implies that the `Core` module, as shown in the reference architecture's first refinement (see figure 11.33), is involved in (nearly) all scenarios reviewed in section 11.1. The services contributed to these interaction sequences, as indicated in figure 11.35, are realized through the coordination of six, encapsulated components: a `Manager` submodule, a `StateRegistry` submodule, a `ContributionMediator` submodule, a `LockManager` submodule, a `SecurityAndIdentityManagement` subsystem, an `EventBus` submodule, and a `WorkflowSystem` subsystem. The following discusses each of these constituents in turn.

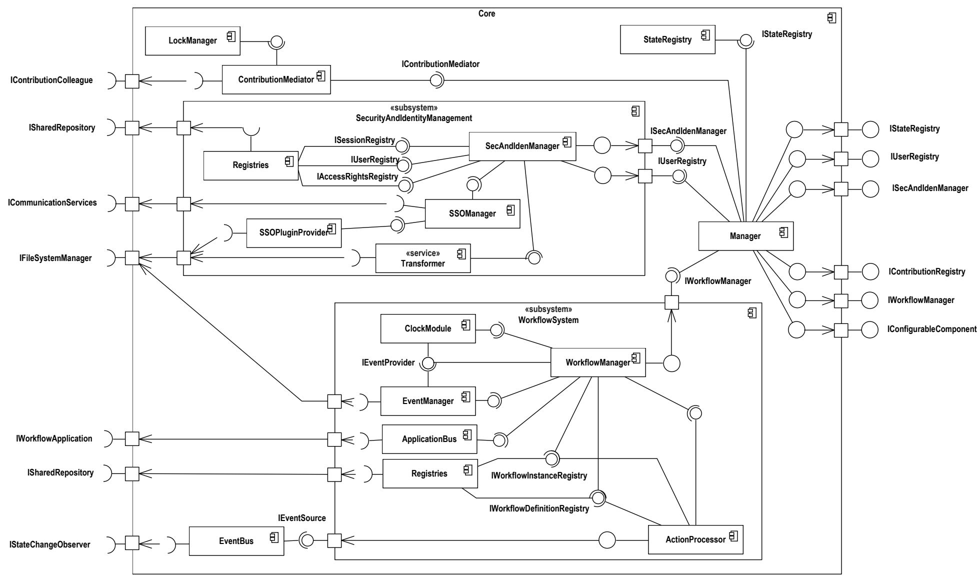

Figure 11.35: Refinement of the Core Module

As indicated in figure 11.35, the `Manager` submodule, on the one side, serves as the module's central interaction point, i.e., it decouples the `Core` module's remaining components from their clients, and on the other side, provides an `IConfigurableComponent` interface realization so that the `Core` module can be handled by the `ComponentConfigurator`. Whereas the interactions involved in the latter function have already been discussed in section 11.5, the former feature is not only comparable to the business logic layer facade on a more fine-grained level, but it is also underpinned by a similar rationale: adding this extra layer of abstraction allows (i) to change the interaction flow in a manner that is transparent to clients and (ii) to anchor crosscutting concern mechanisms such as the reference monitor (see section

11.5). However, the reference monitor, examined more thoroughly below, is only one example that is representative for the way crosscutting concerns in general can be incorporated into the technical system without burdening subsystems and submodules with responsibilities that do not belong to their core processes. Nevertheless, due to the illustrative nature of the 'second research project', other crosscutting concerns such as logging or caching, despite being integrable in a similar way, are not further discussed in the following. Moreover, the interactions of the `Manager` submodule, due to its transparent nature, are not explicitly examined. Yet, the forwarding of requests and replies after hooked in crosscutting concern procedures have been executed is implicitly covered by the protocols specified below.

The `StateRegistry` submodule realizes a registry variant that differs slightly from the afore-mentioned `ComponentRegistry`. More specifically: it is a singleton-based, globally accessible object that other subsystems and (sub-)modules can use to retrieve information about the currently active phase and/or step (see also sections 8.3 and 11.1 for details of the singleton pattern). It therefore fulfills one part of the responsibility that was attributed to the various specializations of the `Phase` concept within the 'create requirements model' step of the reference architecture design cycle (see also the preliminary object models shown in section 11.1). However, many of the submodules discussed in the following are, by a mechanism explained below, informed about state transitions and, as indicated in section 11.1, realize an 'objects of states' pattern for those parts that need to adapt to the different context by changing phase-/step-dependent behavior. Therefore, in the present case solely the `Manager` submodule and its equivalents in other modules as well as the business logic layer obtain state information from the `StateRegistry` submodule. As these getting and setting interactions, in turn, are relatively straightforward, the protocol, similar to the one of the `Manager` submodule, is not discussed explicitly, but addressed en passant while reviewing other, related protocols.

The `ContributionMediator` submodule is a combination of an attenuated registry and a mediator, which, in turn, is one of the entities involved in the interplay described by the mediator pattern (cf. Gamma et al. 1995, pp. 273–282). Taking advantage of the `Contribution` interface's fundamental nature (see also section 11.5), the `ContributionMediator` submodule inherits from the registry to be used as a business logic layer-wide central point of contact to retrieve objects as pointed out in the data access layer discussion (see also Fowler 2003h, p. 485) and from the mediator the responsibility to decouple different 'colleagues' that should not know each other (Gamma et al. 1995, p. 273). Although colleagues are module-specific registries, the `IContributionColleague` interface, that is, the interface of the `ContributionMediator` submodule's counterparts, is realized by the respective reference architecture component's `Manager` submodule, which, as indicated above, channels and intercepts communication processes. On the other side, the `Manager` submodule of the `Core` module, instead of realizing the `IContributionColleague` interface, offers an implementation of the `IContributionRegistry` interface (see figure 11.35), which, in turn, is used by other modules to interact with module-specific registries via the `ContributionMediator` submodule. In addition to this cooperation, the `ContributionMediator` submodule also directly interacts with the `LockManager` submodule (see also figure 11.35). Both together aim to prevent that the data integrity issues briefly touched in section 11.5 emerge. More specifically, the `LockManager` submodule maintains a lists of locks that those clients that want to retrieve objects via the `ContributionMediator` submodule need to acquire to ensure that data cannot become inconsistent through concurrently performed changes. The first comment

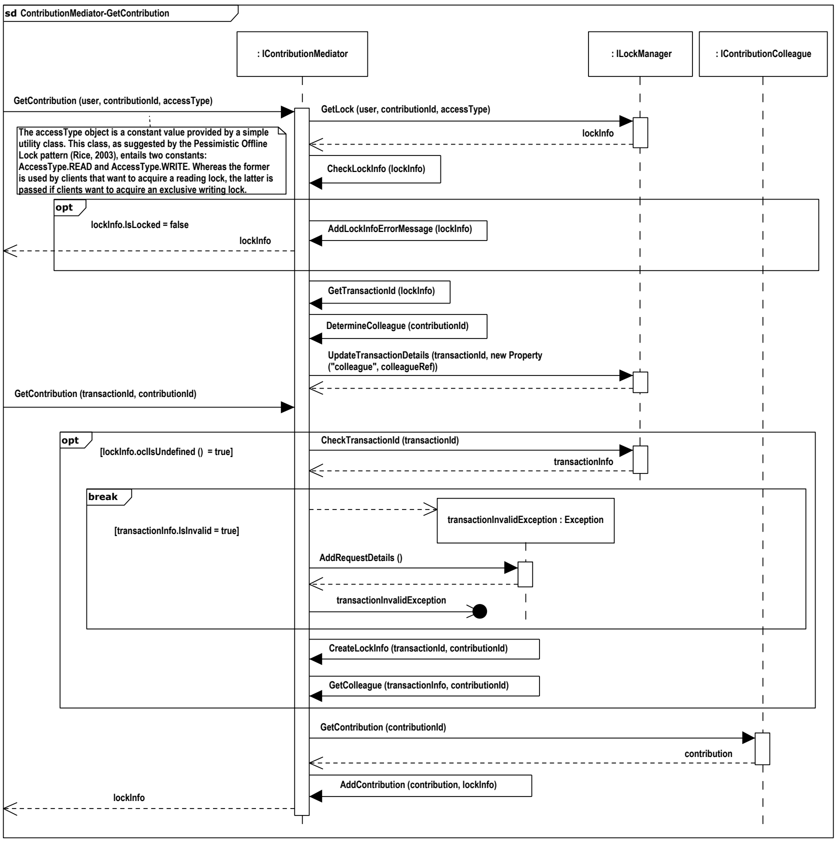

Figure 11.36: ContributionMediator-Get Contribution Protocol (SD-CM-01)

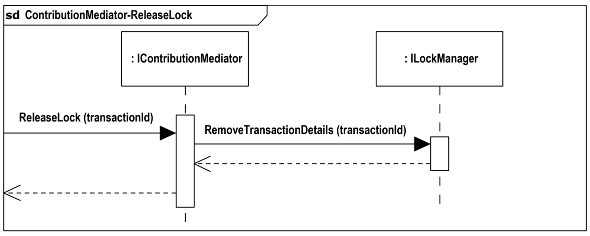

Figure 11.37: ContributionMediator-Release Lock Protocol (SD-CM-02)

in the sequence diagram displayed in figure 11.36 indicates that such a lock can take two different forms (cf. Rice 2003b, pp. 427–428): it is either an exclusive write lock, which cannot be established if another component already acquired a lock, or a read lock, which cannot be enacted if another component has exclusive writing rights. As this mechanism works properly only if there is one and only one list and therefore one `LockManager` submodule, Rice (2003b, p. 429) suggests to realize the latter according to the singleton pattern.

The two central protocols of the `ContributionMediator` submodule and its two collaborators are the 'get contribution' and the 'release lock' interaction sequences specified in the diagrams shown in figures 11.36 and 11.37 respectively[365]. In regard to the former,

365. The `ContributionMediator` submodule and its collaborators also perform additional operations such as the creation or updating of contributions. As these interactions are similar to the ones shown in the protocol displayed in figure 11.34, the latter serves as blueprint for a specification of these relatively straightforward activities. Therefore, the following can concentrate on the 'get contribution' and 'release lock' sequences.

the two input gates shown in the sequence diagram depicted in figure 11.36 indicate that the `ContributionMediator` submodule is involved in, inter alia, the following two intertwined scenarios: firstly, it enables clients to obtain a contribution without having it locked earlier, and secondly, it also supports those clients that, by providing the respective identifier, rightfully request a contribution for which a lock has been established before—either by the very client or on its behalf (e.g., a workflow initiated application as described below). Although only those two retrieval procedures are shown, a concrete, derived architecture might extend the `ContributionMediator` submodule's set of offered functionalities by, for instance, a mechanism that returns all contributions of a particular type that fulfill a certain condition as illustrated in one of the subsequently discussed protocols. However, such interactions are not only implementation-specific details that depend on the requirements of a factual technical system, which, in turn, are reflected in, inter alia, the concretization of the `IContribution-Colleague` interface, but they differ only slightly from the protocol shown in figure 11.36. Therefore, such refinements are omitted, on the one side, to reduce the complexity of the diagram, and on the other side, to discuss the peculiarities of a broader range of different scenarios in this 'second research project'. After this clarificatory remark and in line with the latter reason, the following now briefly examines the two specified interaction sequences.

Firstly, the first input gate of the shown version of the 'get contribution' protocol prescribes that clients need to provide the following three parameters to initiate the retrieval procedure: (i) the contribution's identifier, (ii) an instance of the user associated with the request, and (iii) a flag that specifies the desired access type, which, as mentioned above, is either an exclusive write lock (i.e., `AccessType.WRITE`) or a read lock (i.e., `AccessType.READ`). If the `Manager` submodule forwards such a call to the internal `ContributionMediator` submodule, the latter first tries to establish the required lock by sending the respective request to the `LockManager` submodule. The `LockManager` submodule, for its part, replies with a `lockInfo` object that indicates if the lock could be established and, assuming the former is affirmative, which identifier was assigned to the opened transaction. On the other side, if the locking attempt was unsuccessful, then the `lockInfo` object, as illustrated in the first opt fragment in figure 11.36, can be used to transfer information such as, for example, which other clients hold access rights that conflict with the requested lock, back to the client. Although disclosing such information can enable useful application flows, it might, on the other side, also raise security issues, which, in turn, require a deeper investigation of measures to protect the technical system against a misuse of the revealed information. This detour, however, is out of the present inquiry's scope. Nevertheless, taking it as given that the lock could be established, the `ContributionMediator` submodule's two tasks after checking the `lockInfo` object, are to extract the transaction identifier from the latter and, based on its internal index and the contribution identifier (see also section 11.5), to determine from which of the module-specific registries it can obtain the requested resource. This information is then used to update the transaction session. Leaving the preparatory work of the other 'get contribution' variant comprised in the second opt fragment aside for a moment, the `ContributionMediator` submodule's final tasks are (i) to retrieve the requested contribution from the identified `IContributionColleague` interface realization, (ii) to add the contribution to the `lockInfo` object, and (iii) to return the latter to the client.

Although these three activities are also carried out if the client enters the interaction sequence via the second input gate, their execution has to be preceded by an initialization procedure. This process, partially captured by the second opt fragment's condition, is necessary, because no `lockInfo` object was retrieved as well as because it is unknown if the passed transaction identifier belongs to a (still) valid transaction session. As indicated in figure 11.36, a check of the latter is answered with a `transactionInfo` object, which, if the associated transaction session is valid, comprises not only the information required to create a `lockInfo` object that can be returned to the client, but also, as entailed in the previously described interaction sequence, the information from where to retrieve the requested contribution. However, if the transaction identifier does not belong to a (still) valid transaction session, then a `transactionInvalidException` is thrown or broadcasted as shown within the break fragment (see OMG 2011b, pp. 249–250; Rumbaugh, Jacobson, and Booch 2004, p. 203, for details of the broadcasting mechanism). Although the object-based process of acquiring locks could also be realized by throwing exceptions instead of encapsulating the failure in the return object, the unavailability of a lock, in contrast to the broken contract reflected by an invalid transaction session, is something that clients should expect. In other words, throwing an exception instead of returning the `lockInfo` object conflicts with the underlying purpose of exceptions—it might even be considered as an exception antipattern (cf. Venners 1998).

Before turning to the specification of the second protocol a brief remark in regard to the potential bottleneck emerging from the acquisition of locks, especially reading locks, needs to be inserted. Although it might be desirable and necessary to ensure that a contribution cannot be modified while a user examines it (e.g., the scrutinizing and review of proposals), applying this procedure too strictly, on the other side, might hinder working groups to make progress, if, for example, multiple citizens subsequently acquire reading locks to study a published proposal. This issue is the driving force behind the division of phases into steps and the functional requirement captured by the 'close proposal' use case. Although both these mechanisms help to mitigate the problem, it, nevertheless, might be sensible that a concrete, derived architecture realizes certain flows of events such as, for instance, the exploration of published proposals, without the acquisition of locks; even if this implies to accept that the presented data might not be up-to-date. One possible avenue that the designers of concrete architectures can take to refine the interaction in this direction is the introduction of a new access type (e.g., `AccessType.DIRTY`). However, the following does not explore these, from a reference architecture perspective, low-level details any further.

Secondly, the essential counterparts of the 'get contribution' protocol are those interactions that are carried out to remove the locks established in the above-described process (see also footnote 365 for a comment in regard to other related functions). The steps involved in this sequence are specified in the 'release lock' protocol. As can be seen in figure 11.37, the protocol is comparatively simple: the `ContributionMediator` submodule solely forwards the transaction identifier passed by a client to the `LockManager` submodule, which, in turn, removes the transaction session from its internal list. In anticipation of the discussion of the remaining reference architecture modules (see figure 11.33), the 'release lock' protocol is initiated at different occasion: on the one side, resources are locked and unlocked if the phases and/or steps of the outlined decision-making process change. For example, the relatively strict, time-dependent organization of the problem structuring phase can be realized through automatically established write and read locks. However, on the other side, the two most basic cases for executing the protocol are the completion of a transaction by the client and, albeit with qualifications, the invalidation or timing-out of user sessions. The latter event needs to be qualified, because there are at least two situations that require a special treatment:

(i) if a derived architecture makes use of the option to support disconnected scenarios (see section 11.4), then the time-spans for valid user sessions need to be prolonged or handled separately from those of connected scenarios; and (ii) if locks are assigned to safe environment experts, reviewers, and/or arbiters, then the transaction session might not be 'associable' with an active user session, that is, the, for instance, reviewer is currently not logged in, and it needs to survive more than one user session, to, for example, ensure that the proposal is not modified until the scrutinizing, review, or arbiter task is completed. Whereas the former derivation (i) is out of the 'second research project's' scope, the latter case (ii) requires a dedicated mechanism that covers these peculiarities. Later in this section, more specifically under the heading of the `ProposalManagement` module, a suitable approach is presented.

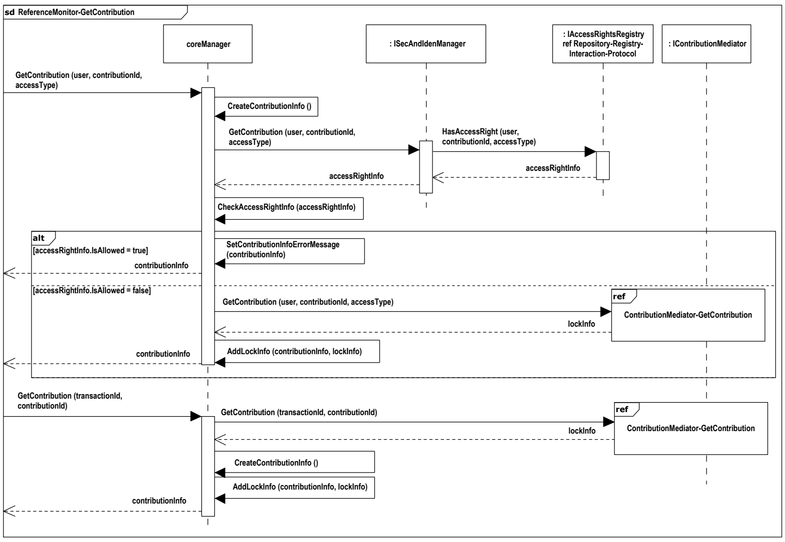

Figure 11.38: ReferenceMonitor-Get Contribution Protocol (SD-CM-04)

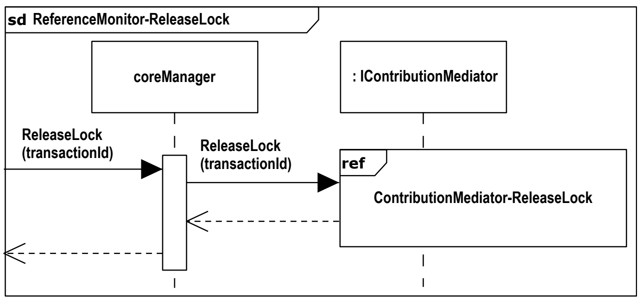

Figure 11.39: ReferenceMonitor-Release Lock Protocol (SD-CM-05)

Although both above-described protocols are able to resolve the explicated integrity issues, the transaction concept is in itself insufficient to address the identified security considerations (see section 11.5 for both discussions). Incorporating these latter features requires to embed both transaction-based interactions in the protocol of the reference monitor. As can be seen in the sequence diagrams depicted in figures 11.38 and 11.39, the reference monitor is a collaborative effort of the `Manager` submodule and the `ISecAndIdenManager` interface realization. Whereas the former is responsible for intercepting requests to the `IContributionRegistry` interface implementation and redirecting them to the module offering the `ISecAndIdenManager` interface, the latter, discussed more thoroughly as part of the `Se-`

curityAndIdentityManagement subsystem, determines if the requesting client, or more precisely the passed user instance, is entitled to access the resource in the way indicated by the accessType parameter. Similar to the afore-mentioned protocol, the interaction sequence shown in figure 11.38 has two input gates, each of which supports one of the two previously described scenarios; yet, in contrast to the foregoing discussion, the specified processes do not overlap, because clients that provide a valid transaction identifier, by implication, have at least the right to view the resource. However, if access rights are modified while a transaction is ongoing, the presented application flow assumes that those transaction sessions that are incompatible with the changed set of rights are deleted. This implies that, as indicated above, a transactionInvalidException might be thrown if access rights are revoked. To fail gracefully, a derived architecture might therefore incorporate the reference monitor in the sequence shown at the bottom part of figure 11.38. On the other side, the 'release lock' protocol of the reference monitor, as revealed by the ref fragment displayed in figure 11.39, solely forwards the request to the ContributionMediator submodule, which, in turn, executes the sequence specified in the above 'release lock' protocol. Thus, the exploration of the Core module's constituents can now turn to the SecurityAndIdentityManagement subsystem, which, inter alia, comprises the ISecAndIdenManager interface realization that was mentioned in the above-described reference monitor 'get contribution' collaboration.

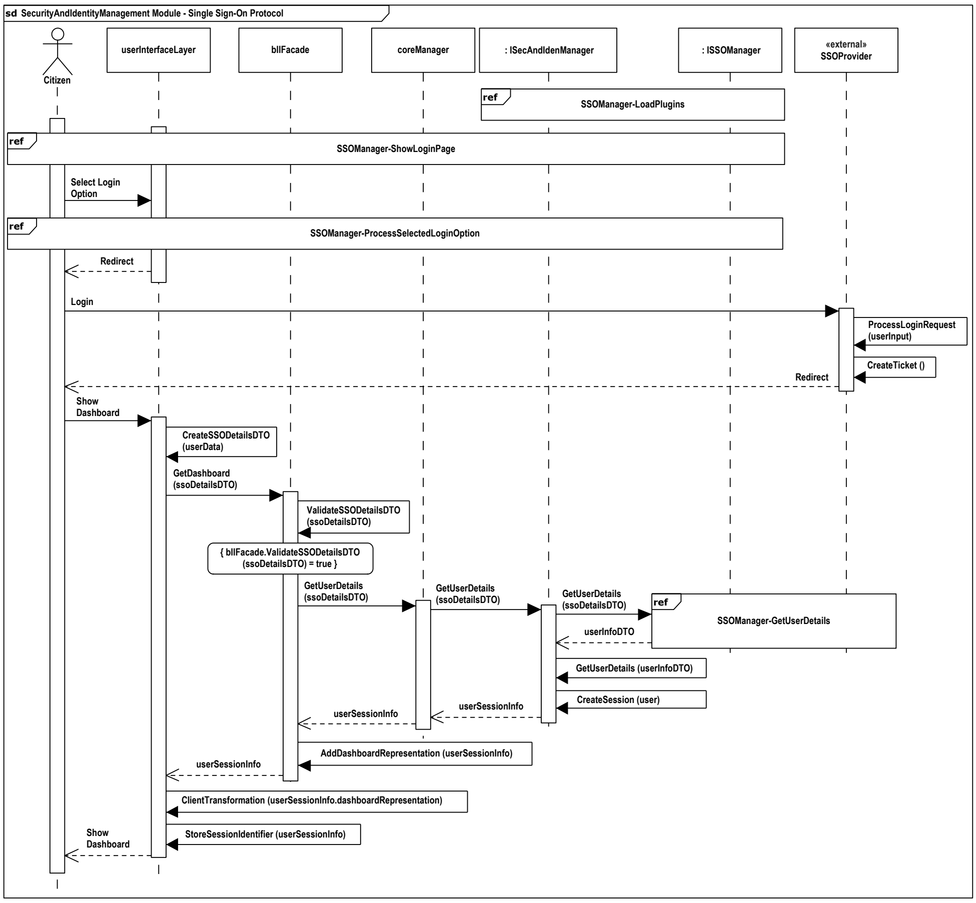

Figure 11.40: SingleSignOnManager-Protocol of Interactions (SD-CM-06)

In addition to the authentication and, based on the former, security session functionalities offered by virtue of this interface, the subsystem also provides information about users in its role as `IUserRegistry` interface realization. However, as this capacity, equally applying to the other interfaces offered by the `Registries` submodule, does not differ fundamentally from the above-described procedure of retrieving contributions from module-specific registries, the following can concentrate on the subsystem's authentication services. In section 11.3 it was already indicated that users cannot only 'prove' their identity using local login credentials, but that the module offering the `ISecAndIdenManager` interface, using the `SSOManager` submodule's abilities, allows users to refer the technical system to a trustworthy third party that confirms their identity, i.e., to an existing single sign-on provider such as, for instance, Google[366], which builds upon OpenId[367], or Facebook and its Facebook Connect[368] (see also Sani and Rinner 2011, p. 150, and AD-C-02 in annex C.2). As the latter process, whose details are shown in figure 11.40, incorporates and extends the former by including a remote technical system, the following discussion can be further confined to this, from the perspective of a reference architecture, more interesting protocol without leaving the local login part of the `SecurityAndIdentityManagement` subsystem's interaction sequences unspecified. In other words, designers of concrete, derived architectures can use the remote login protocol examined below as a blueprint for the less complex local login procedure.

Besides the dynamic details of the interaction sequence specified in figure 11.40, from a structural stance, the `SSOManager` submodule is the central entity in this context. It coordinates all activities related to the remote authentication; whereby 'coordinating' suggests that the `SSOManager` submodule does not realize this functionality by itself. On the contrary, it uses dedicated modules that encapsulate the code necessary to exchange data with remote technical systems. As the two central concerns of the reference architecture's design are the technical system's flexibility and extensibility (see section 11.1), the single sign-on mechanism is ideally not 'hard coded', but realized based on the plugin pattern (cf. Esposito and Saltarello 2009, pp. 267–268; Rice and Foemmel 2003, pp. 499–503). Although the following discussion has a specific focus, it also serves as placeholder for other parts of the reference architecture that, such as, for example, the `WorkingGroup` module examined below, make use of a plugin infrastructure as well. Nevertheless, within the presently explored authentication procedure the plugin pattern is concretized through, on the one side, several modules, each implementing the `ISingleSignOnPlugin` interface, that allow to communicate with trusted third parties, and on the other side, the `SSOPluginProvider` submodule that, using the `IFileSystemManager` interface realization (see section 11.5), loads the former modules from the file system and integrates them into the application flow.

The protocol specifying the interactions of these two central elements of the plugin infrastructures are shown in figure 11.41, which, in turn, also serves as a refinement of the first ref fragment comprised in the sequence diagram displayed in figure 11.40. The aim of this, from the perspective of the authentication procedure, initialization phase is to find out which single sign-on plugins and, by implication, login options are available. It shows that the `SSOPluginProvider` submodule, after having determined the technical system's plugin directory using platform-specific configuration functionalities such as .NET's `app.config` or Java's `Properties class` mechanisms[369], retrieves all files within this directory from the `IFileSystemManager` interface realization. Based on the, in the data access layer discussion

366. For details see: `https://developers.google.com/accounts`, accessed May 25, 2015.
367. For details see: `http://www.openid.net`, accessed May 25, 2015.
368. For details see: `https://developers.facebook.com/docs/facebook-login`, accessed May 25, 2015.
369. This entry in a configuration file is one of the prime examples of data that needs to be encrypted, because attackers might change the directory path to load malicious code that logs users login credentials.

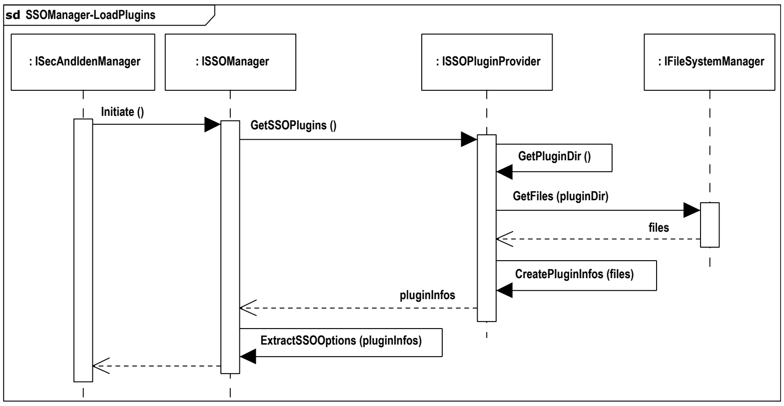

Figure 11.41: SingleSignOnManager-Load Plugins (SD-CM-07)

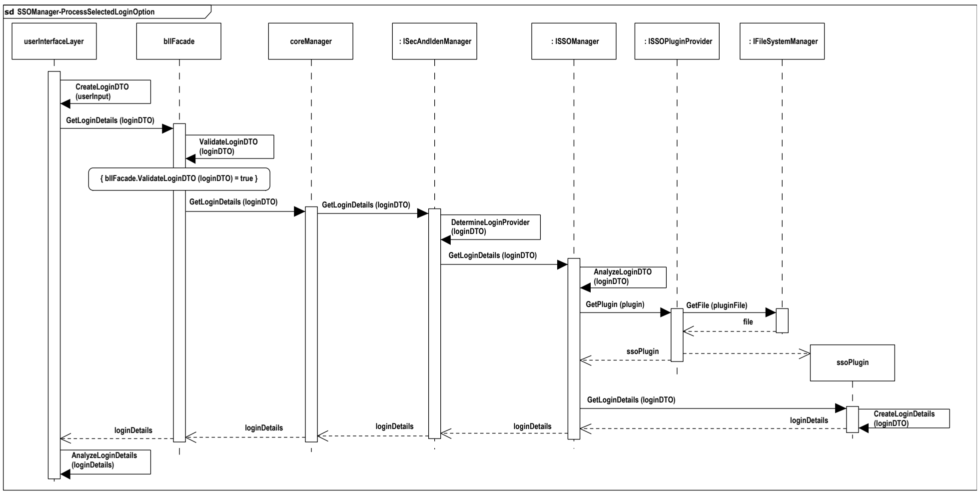

Figure 11.42: SingleSignOnManager-Process Selected Login Option (SD-CM-09)

briefly mentioned, reflection capabilities of the respective runtime environment, the returned list is then inspected to identify those files or more specifically platform-specific entities that implement the `ISingleSignOnPlugin` interface. The `SSOPluginProvider` submodule's final activities are to extract the metadata (e.g., name and description) from suitable modules and return these data pieces in the form of `pluginInfos` to the `SSOManager` submodule. The latter uses this list, for example, to create the login overview page that is presented to the user in the second ref fragment displayed in figure 11.40 (see also SD-CM-08 in annex D.2). As the involved steps differ only slightly from other user interface layer operations discussed in the following and, in addition, are only peripherally related to the plugin mechanism, their details are not shown; rather, the review of the remote authentication procedure directly jumps to the subsequent interaction sequence, i.e., to the activities that process the citizen's selection.

The respective specification in the sequence diagram displayed in figure 11.42 shows that the `userInterfaceLayer` creates a `loginDTO` out the user's input and that this DTO is then handed over to the business logic layer facade, which, as done in all following protocols, is represented by the `bllFacade` life line. The latter, before forwarding the `loginDTO` to the `coreManager`, that is, to the `Manager` submodule instance of the `Core` module, performs, as discussed in section 11.5, a server-side validation. The state invariant, i.e., the rectangle with round edges, indicates that the `ValidateLoginDTO` check needs to return `true` for the following interactions to be a valid trace (see OMG 2011b, pp. 514–515; Pilone and Pitman 2005, chap. 10.5; Rumbaugh, Jacobson, and Booch 2004, pp. 603–605, for more details of state invariants and traces). Although the remainder of this section explicates some more concrete mechanisms that allow the technical system to fail gracefully if such checks are negative, these extensions of the application flow are generally omitted to enhance the comprehensiveness of diagrams, that is, the protocols shown in the following mainly use state invariants instead of more specific recovery or exception handling procedures.

Nevertheless, if the `loginDTO` has passed the generic server-side validation, it is forwarded to the `ISecAndIdenManager` interface realization, which, on its part, determines from which module to get the requested login details. Even though, as indicated above, the protocol specification concentrates on the remote authentication of users, the `DetermineLoginProvider` operation provides the anchor point to hook in the local login procedure, which probably involves a sequence of interactions in which those credentials provided via a returned login view are compared with locally stored user login information to verify a user's identity. However, in the presently explored case the result of the `DetermineLoginProvider` check indicates that the login provider is a trusted third party, which, in turn, induces the `ISecAndIdenManager` interface realization to forward the `loginDTO` to the `SSOManager` submodule. The latter then extracts the selected provider from the passed parameter and instructs the `SSOPluginProvider` submodule to instantiate the respective `ssoPlugin`, i.e., the `ISingleSignOnPlugin` interface-implementing module that not only comprises all required information (e.g., redirection address, type and format of parameters), but also the code for handling all provider-specific activities such as, for instance, the creation of single sign-on request or, as described below, the validation of issued tickets. The `loginDetails` created by this instance is then passed back to the `userInterfaceLayer` that, based on a performed analysis, is able to redirect the user to the single sign-on provider's login page.

Within this, from the reference architecture's view, external process, the single sign-on provider creates a ticket and, based on the data that the `ssoPlugin` weaved in the request, redirects the user back to the focal system (see the interactions in the lower part of figure 11.40). Not only to verify the user's identity, but also to retrieve some portion of data about the user, the `SSOManager` submodule again induces the `SSOPluginProvider` submodule to create the provider-specific `ssoPlugin`, which, in turn, carries out both actions (see SD-CM-10 in annex D.2). Given that the ticket presented by the user is valid, the `ssoPlugin` transforms the retrieved user data into a `userInfoDTO`, which it then returns to the `ISecAndIdenManager` interface realization. The latter, using the data contained in this DTO, identifies the local user representation in the module offering an implementation of the `IUserRegistry` interface and creates a new user session as captured by the `CreateSession` operation (see also figure 11.35). This latter process entails at least the following three activities: (i) the creation of a unique identifier such as, for example, a Universally Unique Identifier (UUID) (cf. ITU 2012), that is associated with and assigned to the session, (ii) the storing of the updated session in the `ISessionRegistry` interface realization, and (iii) the inclusion of the session identifier in the `userSessionInfo` that is returned to the `bllFacade`. After the `bllFacade` has further extended the data content of this object by adding a user-dependent representation of the dashboard, it returns the `userSessionInfo` to the `userInterfaceLayer`. The latter, on its part, transforms the dashboard representation into a client-specific format and, more importantly, stores the session identifier in, for example, a cookie.

The second activity is particular significant, because it allows technical systems to be stateless, which, in turn, enhances their scalability. The mechanism that supports this feature is specified in the protocol displayed in figure 11.43. Although not part of the depicted process but shown in the sequence diagrams discussed in the remainder of this section, the `userInterfaceLayer` passes along the user's session identifier with each request it issues against the `bllFacade`, which, omitting the forwarding of the `coreManager`, then tries to obtain the corresponding user instance from the `ISecAndIdenManager` interface realization. However, before the latter queries the module that provides an implementation of the `IUserRegistry` interface, it checks if the passed session identifier belongs to a valid session. If and only if a valid session can be retrieved from the `ISessionRegistry` interface instance, then, based on the user identifier extracted from the returned `sessionInfo`, the user representation associated with the session is fetched from `IUserRegistry` interface realization. If, however, no valid session exists (e.g., the session timed-out), then the `ISecAndIdenManager` interface instance, similar to the above described get contribution protocol, throws or broadcasts a `sessionInvalidException` as depicted in the break fragment.

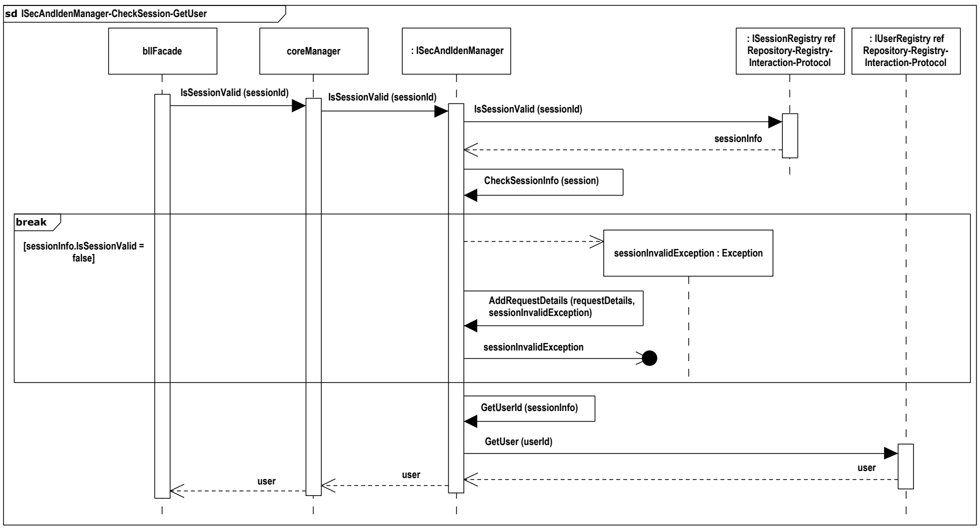

Figure 11.43: SecAndIdenManager-CheckSession-GetUser (SD-CM-06b)

Before turning to the discussion of the second to the last entity comprised in the `Core` module, it has to be noted that the exploration of protocols, due to the exemplary nature of the 'second research project', has been confined to those interaction sequences that have to be specified to lay an adequate foundation for the protocols examined in the remainder of this section. However, although it is just a minimal set, the reviewed processes, nevertheless, are (among) the core services that the `SecurityAndIdentityManagement` subsystem needs to provide for the designed reference architecture. This, on the other side, suggests that the designers of concrete, derived architectures have to extend the functionalities described above by standard procedures such as, for instance, the creation and deletion of accounts.

The `EventBus` submodule, as one of the two not yet explored entities of the `Core` module, is a component that realizes a variant of the publish-subscribe pattern (cf. Bass, Clements, and Kazman 2013, pp. 226–229; Buschmann et al. 1996, pp. 339–341; Buschmann, Henney, and Schmidt 2007a, pp. 234–236; Clements et al. 2011, pp. 174–178; Hohpe and Woolf 2004, pp. 106–110), which, in turn, is based on what Gamma et al. (1995, pp. 293–303) termed the observer pattern (see also Buschmann, Henney, and Schmidt 2007a, p. 407). Its primary purpose is to propagate events retrieved from a module that implements the `IEventSource` interface to interested parties or, to use the pattern literature terminology, observers. As indicated in figure 11.35, the infrastructure solely distributes state changes issued by the `WorkflowSystem` subsystem to inform the remaining modules of the reference architecture about the initiation of decision-making phases and/or steps. Therefore, the concretization of the publish-subscribe pattern manifested in the `EventBus` submodule, in contrast to the discussion in the pattern literature, is comparatively simple and does not need to make use of, as suggested by Hohpe and Woolf (2004, p. 139), adapters, command objects, or messages (Buschmann, Henney, and Schmidt 2007a, pp. 412–413, 438–439; Gamma et al. 1995, pp. 139–150, 233–242; Hohpe and Woolf 2004, pp. 145–146) that are usually employed to realize more complex interactions between components decoupled through a bus infrastructure (see Meier et al. 2009, pp. 29–30; Juric and Pant 2008, pp. 40–41, for possible scenarios). The two central protocols of the `EventBus` submodule are depicted in the sequence diagram shown in figure 11.44. Whereas the upper part illustrates how modules that implement the `IStateChangeObserver` interface, in the designed reference architecture the `StateChangeListener` submodules comprised in all state-dependent modules, register with the `EventBus` submodule, the lower part explicates how issued state changes are distributed to registered observers. More specifically: the `EventBus` submodule uses the update method that observers provide in their nature as `IStateChangeObserver` interface realizations to pass all received `stateEvents` to each registered observers. This, in turn, suggests that observers have to analyze the type of the event and, if the event is of interest, execute those actions that are scheduled to be performed in regard to this very event. However, it, on the other side, implies that observers might be updated although they cannot process the respective event. Latter in this section a filter-based variant that avoids this unnecessary overhead is presented based on the suggestion of Hohpe and Woolf (2004, pp. 237–242).

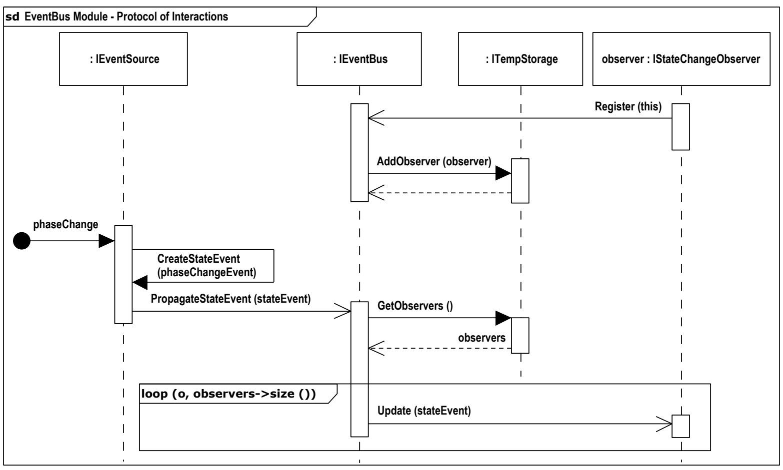

Figure 11.44: EventBus-Protocol of Interactions (SD-CM-11)

The final component of the `Core` module refinement shown in figure 11.35, is the `WorkflowSystem` subsystem. Its structural composition and behavioral specification are based on the workflow management system reference model proposed by Hollingsworth (1995), which, despite its age, is still used as guiding framework for the establishment of workflow standards by the Workflow Management Coalition[370] (see also Georgakopoulos 2004, pp. 16–17; Grefen and Vries 1998). The subsystem's primary purpose is to provide an infrastructure for executing workflows, which, in turn, allow to coordinate the activities of the reference architecture's components in a, from the stance of the respective modules, transparent manner. The two central functionalities the `WorkflowSystem` subsystem offers in this context are, on the one side, the initiation of new workflows (see figure 11.45), and on the other side, the updating ongoing workflows if, for instance, tasks within a workflow have been completed (see figure 11.46)[371]. These two services are realized through the collaborative efforts of five submodules, which are encapsulated by the `WorkflowManager` submodule. The latter, similar to the above-mentioned `SecurityAndIdentityManagement` subsystem variant, is the central point of contact that decouples the `WorkflowSystem` subsystem's constituents from their clients and vice versa. It transmits, for instance, events that initiate new or update ongoing workflows to the `EventManager` submodule. The `EventManager` submodule, on its part, is a composite component that receives events from connected `IEventProvider` interface realizations. In addition to the external events transmitted by the `WorkflowManager` submodule, the `ClockModule` submodule, also offering an implementation of the `IEventProvider` interface, fires time-dependent events such as, for example, the ones required to initiate a phase or a certain step in a phase as shown in the activity diagrams AD-IS-02, AD-PI-02, AD-PS-02, AD-AD-02, and AD-AS-02 in annex C.2. No matter which of these two components issued an event, the `EventManager` submodule, using as indicated in the sequence diagram shown in figure 11.45 a mapping file retrieved from the `IFileSystemManager` interface instance, translates it into a structure that can be processed by the `ActionProcessor` submodule. The latter, in turn, either creates a new workflow using the workflow definitions stored in the `IWorkflowDefinitionRegistry` interface instantiation[372] or it identifies that workflow instance in the `IWorkflowInstanceRegistry` interface realization that undergoes a transition. In both cases the `ActionProcessor` submodule retrieves a `taskInfo` object from the `workflowInstance`, which represents the task to be executed next—if any. As specified in the protocol shown in figure 11.46, if the `taskInfo` contains the information that the workflow is completed, then the `ActionProcessor` submodule removes the instance from the `IWorkflowInstanceRegistry` interface realization and returns control to the `WorkflowManager` submodule. If, however, there are further tasks that need to be carried out, the `taskInfo` is used to create an `actionEvent` that not only describes which of the modules offering an implementation of the `IWorkflowApplication` interface has to perform the next task, but it also comprises a `taskData` map that allows to exchange serializable, workflow-related data between different `IWorkflowApplication` interface implementations. Identifying and invoking the respective module as well as delivering the `taskData` are the `ApplicationBus` submodule's core responsibilities. The latter, similar to the above described `EventBus` submodule, is a variant of the publish-subscribe pattern that decouples

370. See also the Coalition's website at: `http://www.wfmc.org/`, accessed May 25, 2015.

371. Further services that the designers of derived, concrete architectures need to integrate into the `WorkflowSystem` subsystem are functionalities such as, for instance, the definition and editing of workflows.

372. As indicated in section 11.1, the `IWorkflowDefinitionRegistry` interface realization contains, inter alia, the following workflows: workflows to initiate the different phases (i.e., the indicator selection, problem identification, problem structuring, alternative design, and alternative selection phases), several proposal-related workflows (i.e., create, close, edit, commit, finalize), a message sending workflow, as well as the adding of contributions (e.g., problem structuring elements, resource requests, resource offers, comments, volunteer requests). All these workflows, although not explicitly modeled as such, were described in section 11.1 (see also annex C.2). However, as indicated before, a concrete realization will probably add additional workflows such as, for instance, the creation of accounts, the deletion of proposals, etc. For an introduction to and an overview of techniques used to model concrete workflows see Juric and Pant (2008, pp. 62–68).

the `WorkflowSystem` subsystem from applications that are invoked within workflows; yet, in contrast to the `EventBus` submodule, the `ApplicationBus` submodule does not broadcast events, but updates or invokes exactly that module realizing the `IWorkflowApplication` interface that can perform the workflow instance's currently active task. This sketch of the `WorkflowSystem` subsystem's functionalities will be refined through the discussion of the embedding protocols of the reference architecture's remaining components.

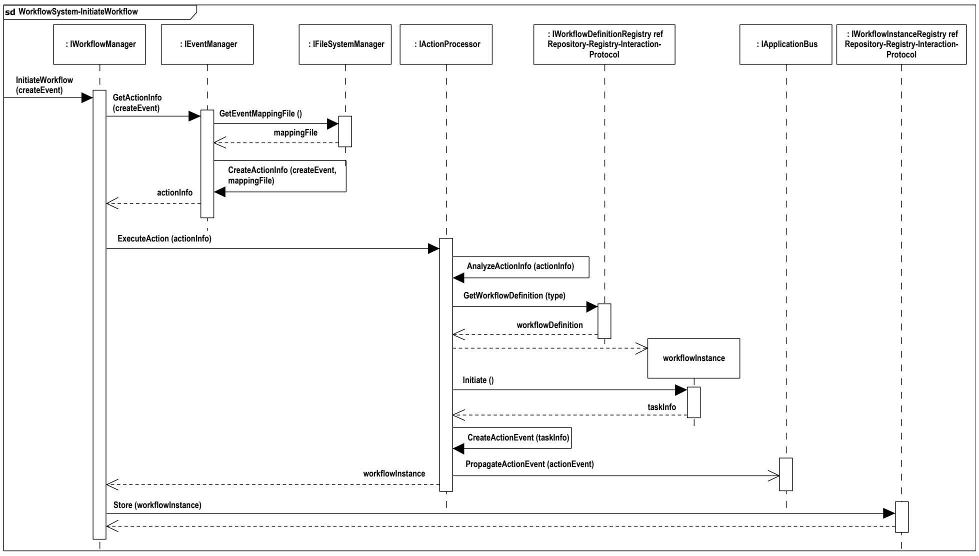

Figure 11.45: CoreComponent-Initiate Workflow Protocol (SD-CM-12)

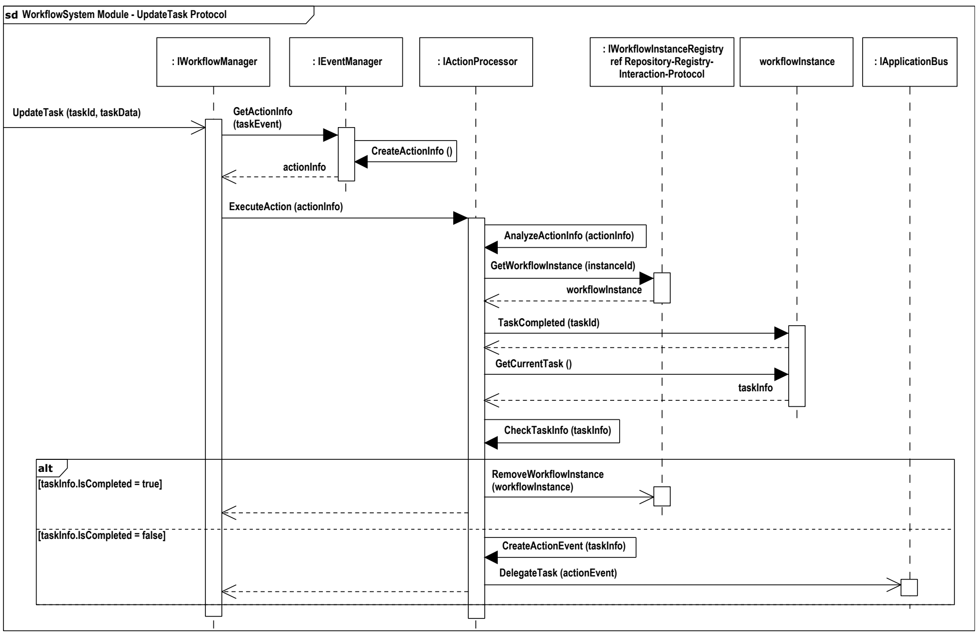

Figure 11.46: CoreComponent-TaskEvent Protocol (SD-CM-13)

The Proposal Management Module is a multi-phase component that handles all activities related to the management of the various `Proposal` concept specializations discussed in section 11.1 (e.g., the creating, storing, and updating of proposals). Although it also offers a realization of the generic `IProposalManager` interface to allow user interface clients to gain access to the module's services, its core interaction partners are the above-described `ContributionMediator` submodule and the `WorkflowSystem` subsystem. Interactions with the former manifest themselves in (a) the integration of the module exposing the `IContributionRegistry` interface to retrieve contributions from registries located in other modules and (b) the offering of an implementation of the `IContributionColleague` interface to enable other modules to retrieve `Proposal` and `Comment` instances form the respective, encapsulated registries. On the other side, the `ProposalManagement` module is integrated into the `WorkflowSystem` subsystem's processes via two already mentioned components: firstly, the `IWorkflowApplication` interface implementation to incorporate the `ProposalManagement` module's functionalities into workflows, and secondly, the `WorkflowSystem` subsystem's `IWorkflowManager` interface realization to update workflows if tasks are completed.

Besides these modules and their interfaces as well as those that were already discussed before, the module's refinement shown in figure 11.47 indicates that the `ProposalManagement` module includes a `TempStorage` submodule, a `Transformer` submodule, a `Validator` submodule, a `StateChangeListener` submodule, a `CreatorFacade` submodule, and a `Creator` submodule. The following discusses each of these constituents in turn.

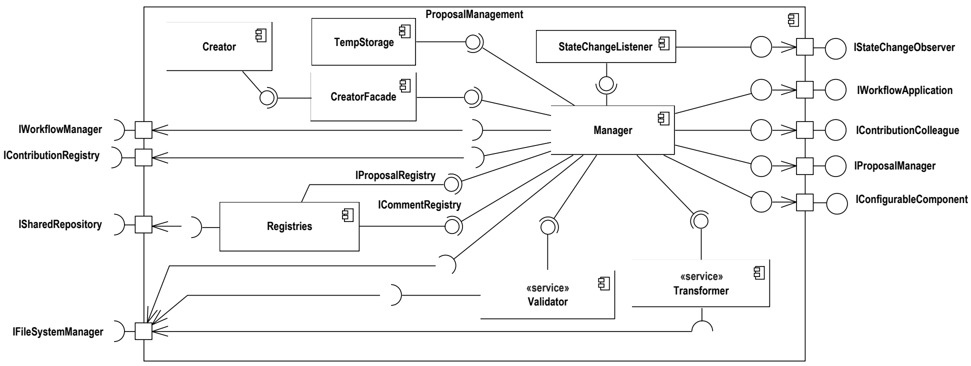

Figure 11.47: Refinement of the ProposalManagement Module

The `TempStorage` submodule is a local storage that the `Manager` submodule uses to temporally store contributions such as, for instance, proposals that have been created but not yet been scrutinized by a safe environment expert. Only after the `Manager` submodule—in its role as an `IWorkflowApplication` interface realization—receives the information that the contribution is safe, it adds the latter to the respective registry instance, which, in turn, makes the contribution available to other modules and stores it in the connected `ISharedRepository` interface implementation (see section 11.5). This, on the other side, suggests that the `Manager` submodule, by exposing the `IContributionColleague` interface, not only forwards inquiries to and replies of the encapsulated registries, but it also has to be able to intercept 'get contribution' requests issued by the module responsible for handling scrutinizing tasks to redirect them in a way that contributions are retrieved from the `TempStorage` submodule. However, as these interaction sequences, equally applying to those of the `Validator` submodule and the `Transformer` submodule discussed next, are (almost) independent of the current domain and might even be realized differently in a concrete, derived architecture (e.g., the `TempStorage` submodule as a `Manager` submodule-internal collection), the following explores these processes only implicitly while examining some of the, from the stance of a reference architecture, more significant protocols.

Both, the Validator submodule and the Transformer submodule, are service components, that is, they are stateless modules that solely provide functionalities to other components (cf. OMG 2011b, p. 705). Whereas the Validator submodule adds a domain-specific validation layer on top of the security-related validation of the business logic layer facade, the Transformer submodule is used to convert module-specific instances into different representations such as an XML-based structure. The latter thereby addresses some facets of the issues mentioned in the compatibility quality attribute discussions in sections 8.3 and 11.5. More specifically, an XML-based representation of Proposal instances is one suitable option to realize the afore-mentioned two step view pattern described by Fowler (2003k), which itself is an extension or variant of the template view and the transform view patterns (cf. Buschmann, Henney, and Schmidt 2007a, pp. 345–348). As already indicated in the exploration of the domain objects and crosscutting concerns layer, this pattern is, inter alia, employed in cases in which multiple output formats need to be supported. Its underlying idea is to split the construction of a representation into two stages (cf. Fowler 2003k, p. 365): firstly, the going-to-be presented object structure is converted into an unformatted, logical representation, and secondly, the result of the former step is translated into the specific format required or demanded by a particular client. Whereas the first step is carried out by the Transformer submodule, the second step is part of those functionalities that client-specific presentation layers offer. As Fowler (2003k, p. 366) suggests, one straightforward way to concretize this pattern is to use the transformation capabilities of the Extensible Stylesheet Language (XSL). Employing this technology not only enhances the system's maintainability, because Extensible Stylesheet Language Transformation (XSLT) files can be dynamically loaded from the file system, which, in turn, allows to modify them without the need to change and recompile application code, but XSLT files, presupposing that the reader is acquainted to their functional 'programming style', are easy to understand and widely known. Applied to the Transformer submodule's responsibilities, the XML conversation of module-specific types can be implemented as a deferred method of the class onto which the Contribution concept is mapped or as, for example, supported by Java and .NET in form of attributes that, after they have been added to the concrete domain objects, are extracted and evaluated using the reflection capacities of the respective development environment. Although a derived, concrete architecture might also incorporate this functionality into the DTOs exchanged between the business logic layer and the user interface layer, the subsequently discussed sequence diagrams, each specifying the protocols of different business logic layer modules, mainly employ the afore-mentioned mixed approach.

The fourth constituent of the ProposalManagement module is the StateChangeListener submodule, which, by providing an IStateChangeObserver interface implementation, is the counterpart of the above-described EventBus submodule (see also the protocol specification depicted in figure 11.44). As indicated in the Core module discussion, the StateChangeListener submodule's main functions, equally applying to similar components in other modules, are to wait for updates propagated by the EventBus submodule, to analyze these events in regard to the module's peculiarities, and to forward suitable events to the Manager submodule. The latter, in response, then initiates the substitution of phase- or step-dependent behavior as illustrated by the CreatorFacade submodule discussed next.

The last two components comprised in the ProposalManagement module, that is, the CreatorFacade submodule and the Creator submodule (see figure 11.47), are responsible for the construction of proposal and comment instances. The rationale to introduce this, in contrast to a direct instantiation of concrete types, complex creation mechanism is a reaction to the phase-dependent nature of the various `Proposal` specializations discussed in section 11.1. It allows to base all module-internal, proposal-related processes on that domain object interface onto which the abstract `Proposal` concept is mapped (see also section 11.1), which, as indicated in the separated interface pattern described above, frees the `ProposalManagement` module's submodules, at least to certain degrees, from the need to distinguish different, phase-dependent proposal variations. This, on the other side, requires that the `CreatorFacade` submodule, similar to other comparable, phase-sensitive submodules[373], is able to change the creation process by replacing phase-specific `Creator` submodules in response to those forwarded events that the `StateChangeListener` submodule receives from the `EventBus` submodule. To realize this requirement two approaches suggested in the design pattern literature have to be combined (cf. Gamma et al. 1995, pp. 87–95, 107–116; Buschmann, Henney, and Schmidt 2007a, pp. 467–468, 525–526, 529–530): the factory method and the objects for states pattern. The former, often confused with the abstract factory pattern[374], aims to decouple clients from the creation of concrete instances. The general structure of this pattern prescribes that there is an abstract creator, i.e., the `Creator` submodule, and an abstract product, i.e., the architecture-specific type corresponding to the abstract `Proposal` concept (see the preliminary object models shown in section 11.1). Both these entities interact as follows: the `Creator` submodule, besides inheriting some common functionality, provides a deferred `CreateProposal` method that concrete `Creator` submodules overwrite to return phase-specific proposals instances, which, in turn, have to be specializations of the abstract product, that is, the pattern's second prescribed element. As the `CreateProposal` method solely returns instances in their role as abstract products, it is completely transparent to clients which `Creator` submodule performed the construction and which abstract product variation was created. Although this allows to hide the details of the proposal creation procedure from clients, this mechanism does not address the issues unfolding from changes of phases and/or steps. To add this functionality the structure needs to be synthesized with the one laid down by the object for states pattern, which is closely related to the strategy pattern described by Gamma et al. (1995, pp. 315–324). Applied to the present context, the pattern suggests to translate the phase-dependent behavior of the proposal production into a set of concrete `Creator` submodules, whereby each of these components is responsible for one particular phase (cf. Buschmann, Henney, and Schmidt 2007a, pp. 467–468). Although there are different approaches, the reference architecture relates this set of phase-sensitive factories to the changes of phases by introducing the `CreatorFacade` submodule as the central point of contact to create new proposal instances and by burdening this submodule with the responsibility to substitute concrete `Creator` submodules if phase changes occur. The corresponding protocol of the phase-adaption process of the proposal construction, which implicitly incorporates the structure of above-described pattern, is depicted in figure 11.48.

The interaction sequence shows that, as already pointed out in the `EventBus` submodule discussion, the `IStateChangeObserver` interface realization, i.e., the `StateChangeListener` submodule, analyzes the propagated state change and, if it is of interest to the `Pro-`

373. Although, for example, the `IProposalRegistry` interface realization and other submodules might incorporate a similar mechanism as the one described in the following, the remaning exploration will not explicitly discuss these variations. The designers of concrete, derived architectures can use the procedure described below as a blueprint for the introduction of the corresponding mechanism in other phase- and/or step-dependent submodules.

374. The abstract factory pattern, in contrast to the factory method pattern, is not concerned with the creation of single instances but with families of types.

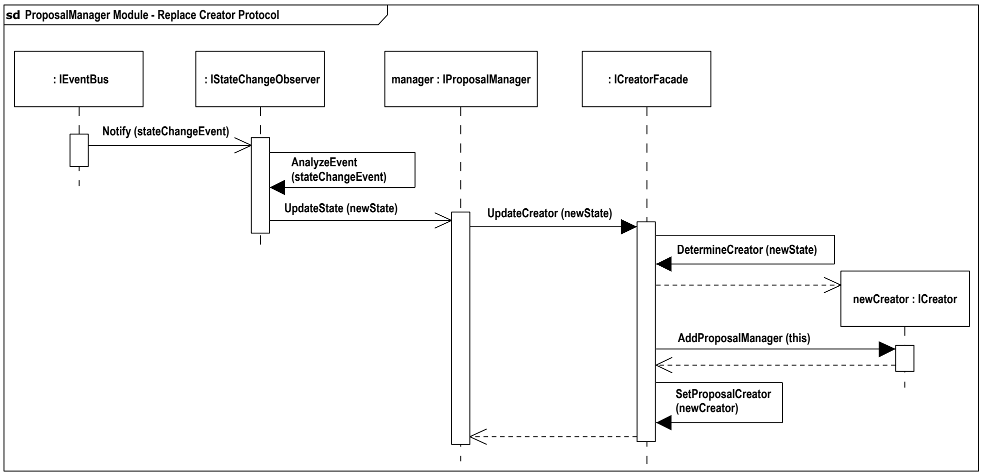

Figure 11.48: ProposalManager-Replace Creator Protocol (SD-PMM-08)

`posalManagement` module, forwards this information to the `IProposalManager` interface instance. The `Manager` submodule, in turn, induces the `CreatorFacade` submodule to update the currently active `Creator` submodule. Including a reference of the former in the instantiation of the latter is purely illustrative and solely indicates that the new `Creator` submodule might need access to certain services (e.g., an `IFileSystemManager` interface realization to load configuration or template files). Within a derived architecture this placeholder is ideally substituted by the above-described memento or even a more fine-grained constructor signature. Nevertheless, the `CreatorFacade` submodule sets the `newCreator` instance as the currently active factory and directs all create proposal requests to this instance. As the following discussion, which primarily serves to present a boarder overview of the afore-mentioned modules' interactions, reveals such requests are mainly issued by the `WorkflowSystem` subsystem. More specifically, the `WorkflowSystem` subsystem's `ApplicationBus` submodule uses the module offering an implementation of the `IWorkflowApplication` interface, which is added to the `ApplicationBus` submodule during the initialization of the `ProposalManagement` module, to induce the `IProposalManager` interface instance to carry out proposal-related actions. The sequence diagram depicted in figure 11.49 shows three of such activities. This selection by no means implies that the `ProposalManagement` module does not provide further services; rather, these exemplary processes comprise all relevant specifications to function as a blueprints that the designers of concrete, derived architectures can use to devise those protocols that underpin other functionalities.

As the sequence diagram displayed in figure 11.49 exposes, the `workflowSystem` instance asks the `Manager` submodule, in its role as an `IWorkflowApplication` interface realization, to carry out a certain task. Due to the generic nature of the `WorkflowSystem` subsystem, the `Manager` submodule first has to identify the concrete request by extracting a `taskInfo` object from the passed `taskData` as illustrated by the `GetTaskInfo` operation, before it can initiate the appropriate procedure to complete the task. Within figure 11.49 this decision is captured by the alt fragment. If the `taskInfo` is unknown, the `Manager` submodule starts a new workflow in which unknown commands are handled (see also the sequence diagram shown in figure 11.45). On the other side, if the `taskInfo` is known, which in the present case means that it is equivalent to a value of the `Enumeration` associated with the `ProposalManagement` module, then one of the interaction fragments' conditions evaluates

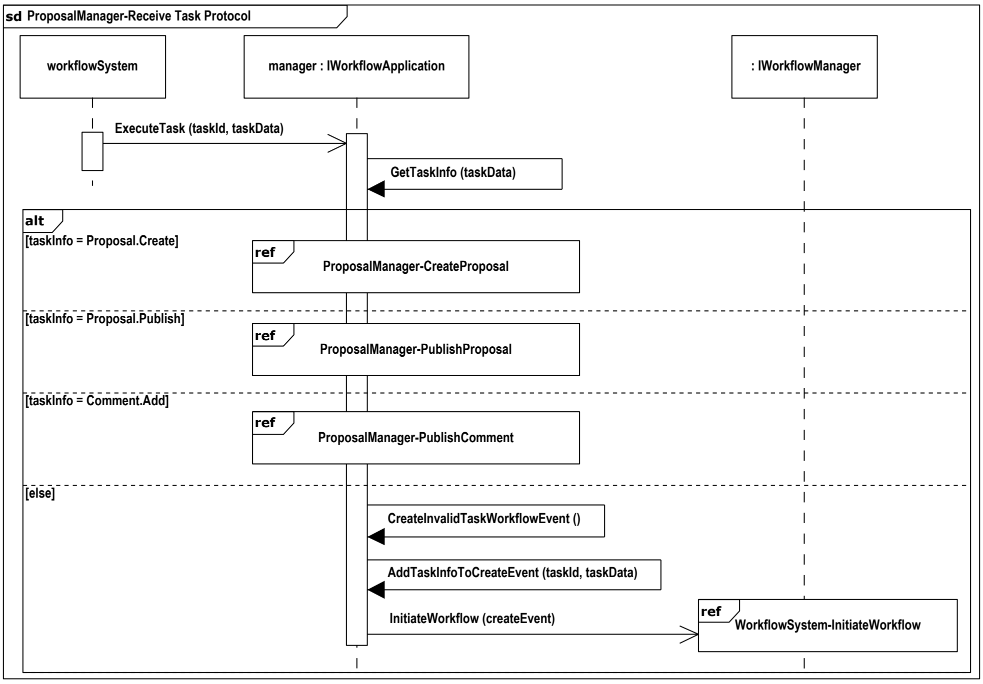

Figure 11.49: ProposalManager-Receive Task Protocol (SD-PMM-00)

to `true` and the process of the corresponding, referenced sequence diagram is triggered.

For example, the protocol of creating a proposal is depicted in figure 11.50. It extends the 'initiate workflow protocol' shown in figure 11.45 by specifying one of the first steps that lead to the creation and publication of a proposal. In order to execute the assigned task, the `IWorkflowApplication` interface realization gets the `proposalDTO` from the passed `taskData` and validates it using the above-mentioned `Validator` submodule. If the `proposalDTO`'s data does not meet the requirements imposed on proposals, the `IWorkflowApplication` interface realization, similar to the unknown command procedure described before, initiates a new workflow in which this derivation from the expected process path is handled. If the data comprised in the `proposalDTO`, on the other side, fulfills all specified conditions, the interaction sequence in the alt fragment's second part is carried out, that is, the `CreatorFacade` submodule, or more specifically the currently active `Creator` submodule, is induced to produce a proposal instance based on the `proposalDTO`. Whereas the created instance is put into the afore-mentioned `TempStorage` submodule, its identifier is added to the `proposalInfo` object, which, in turn, becomes part of the `taskData` object that, together with the task identifier, is passed back to the `workflowSystem` to update the respective workflow. As indicated in section 11.1, the workflow's probable next step is to assign a scrutinizing task to one of the available safe environment experts. Assuming that this check, whose details are explored more thoroughly later in this section, attests that the content is safe, one of the following workflow activities is to publish the proposal. The protocol of this interaction sequence is displayed in figure 11.51. It shows that if the `Manager` submodule, in its role as `IWorkflowApplication` interface realization, is informed that the particular proposal is considered to be safe, then the `Manager` submodule gets the respective instance from the `TempStorage` submodule, updates its status, and adds it to the `IProposalRegistry` interface realization.

After this procedure the proposal receives the status of being published, which, as indicated before, implies that citizens can explore the proposal's details as well as that the author

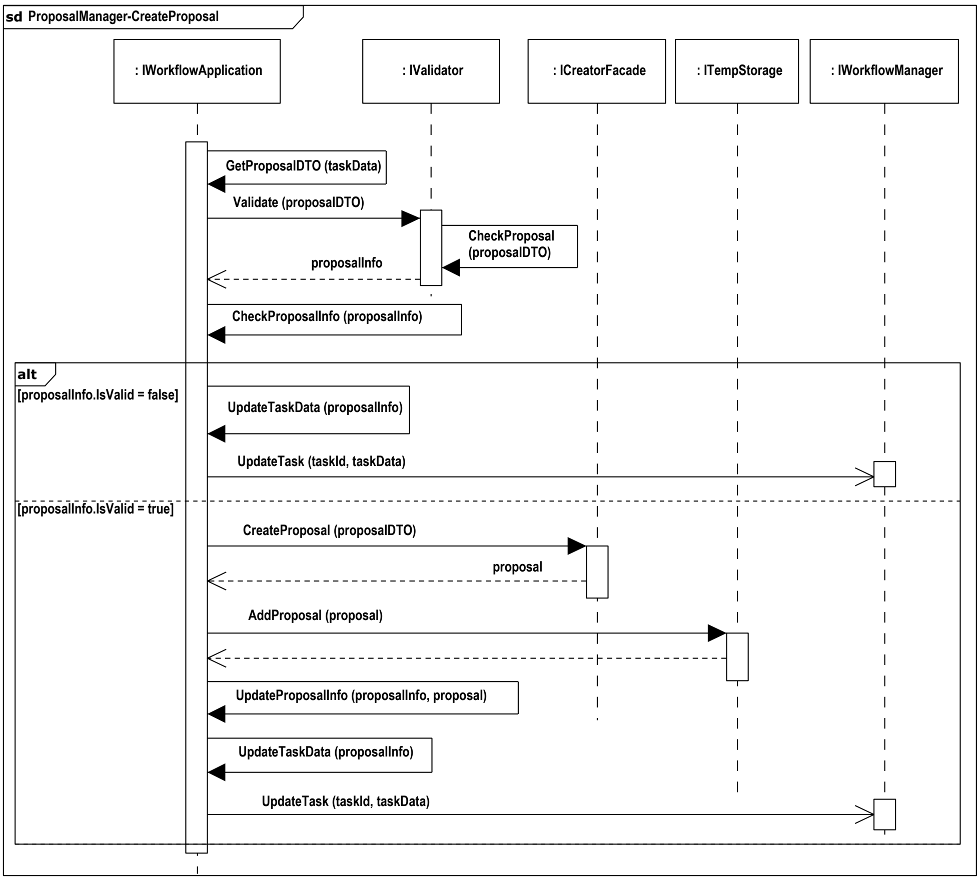

Figure 11.50: ProposalManager-Create Proposal Protocol (SD-PMM-01)

and, if appropriate, other working group participants can edit, close, commit, and finalize the proposal. The specifications of the latter three activities are, similar to the interaction sequence shown in figure 11.51, workflow-based processes that, from the perspective of the `ProposalManagement` module, mainly involve an update of the respective proposal's status. Further steps included in the corresponding workflows such as, for instance, the assignment of a review task in the 'commit proposal' protocol are handled by modules discussed in the following. In contrast, the editing of a proposal does not initiate a new workflow; rather, it involves, as displayed in figure 11.52, an http-based interaction sequence that is commonly used in web-based applications. More specifically: if the user selects the 'edit proposal' option, the business logic layer not only performs the obligatory security-related checks, validates the passed `proposalId`, and determines if the proposal is editable (see section 11.1), but it also induces the `Manager` submodule, as part of the 'prepare proposal edit page' operation (see SD-PMM-04 in annex D.2), to acquire a write lock for the respective proposal (see section 11.5). If the user has the required rights, that is, if she or he is the author or, if applicable, a working group participant, and if no conflicting locks are already established, the `ProposalManagement` module creates the requested edit page and stores it in the `TempStorage` submodule. The business logic layer, after updating the user's session to include the returned `transactionId`, uses the latter to retrieve the logical representation of the proposal edit page and forwards it to the user interface layer. This layer, in turn, transforms the unformatted representation into a client-specific format and displays it to the user, who now can modify the proposal's details. As specified in the protocols SD-PMM-05 and SD-PMM-06 in annex D.2, the storing of these changes is a relatively straightforward procedure, which entails the following activities: (i) the creation of a `proposalDTO` out of the user input, (ii) the validation of this DTO, (iii) the updating of the stored proposal instance, and (iv) the releasing of the write lock. In other words, the interaction sequence, similar to the 'add comment' protocol (see SD-PMM-07 in annex D.2), resembles or comprises elements of the already discussed 'process selected login option' and the 'release lock' protocols (see figures 11.42 and 11.37 respectively). Therefore, the exploration omits an examination of these details and instead turns to the discussion of the reference architecture's next module.

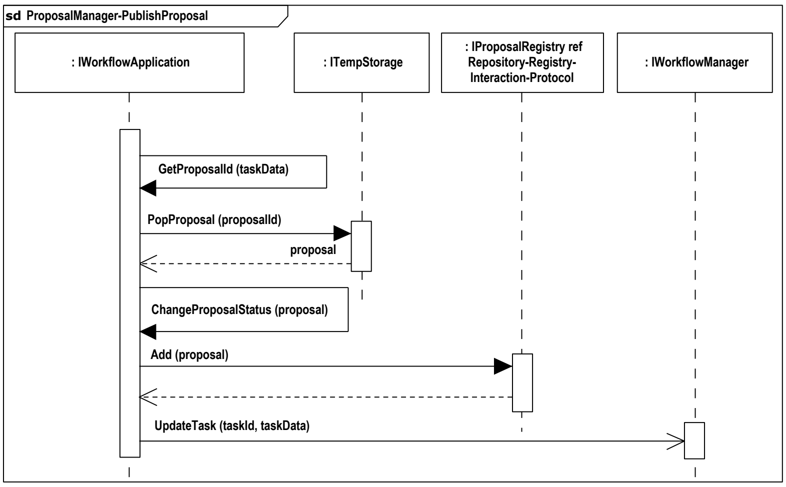

Figure 11.51: ProposalManager-Publish Proposal Protocol (SD-PMM-02)

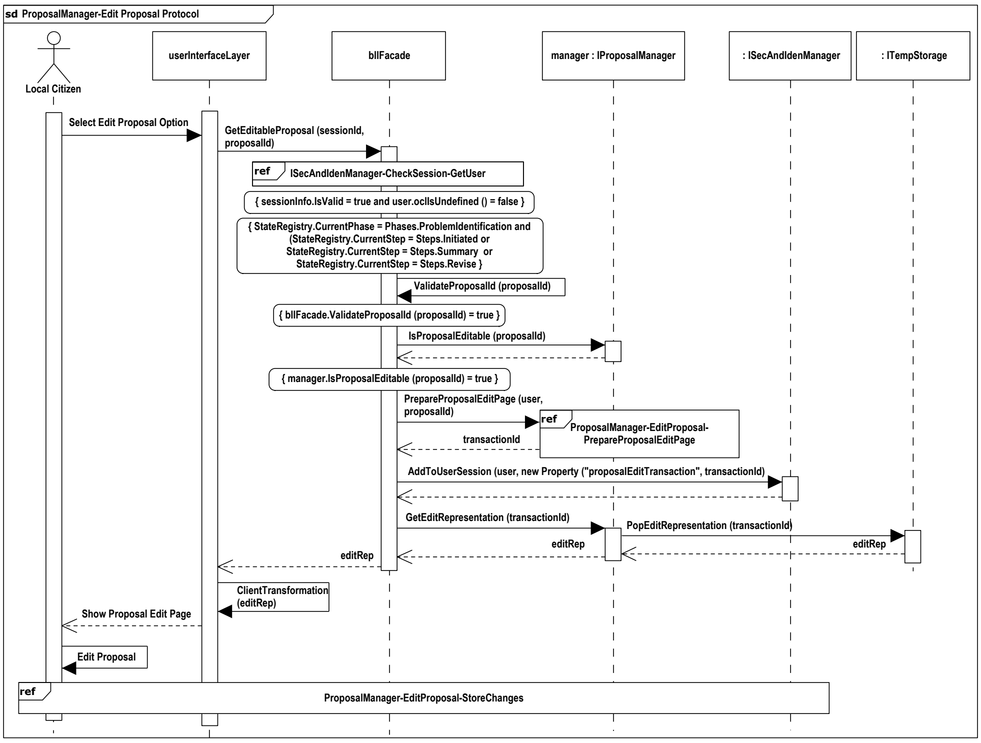

Figure 11.52: ProposalManager-Edit Proposal Protocol (SD-PMM-03)

The Scrutinizing and Review Module is a relatively compact component, whose main responsibility is to realize the match safe environment, reviewer, and arbiter use cases discussed in section 11.3 (see also AD-C-10, AD-C-11, and AD-C-12 in annex C.2). As already indicated in the foregoing discussion, these three scenarios are workflow-based processes, that is, the module's `Manager` submodule, in its role as `IWorkflowApplication` interface realization, receives scrutinizing, review, and arbiter tasks from the `WorkflowSystem` subsystem and assigns them to suitable individuals. To provide these services, the `Manager` submodule needs to coordinate the interactions of the four remaining submodules shown in figure 11.53: the `Registries` submodule, the `Transformer` submodule, the `Validator` submodule, and the `Matchmakers` submodule. Whereas the functionalities of the former three components, equally applying to the `Manager` submodule, are similar to the ones offered by those submodules that have been examined before, the `Matchmakers` submodule has not yet been analyzed. The following therefore focuses on this entity, whereby the exploration of its details is embedded in the specification of the module's three core processes.

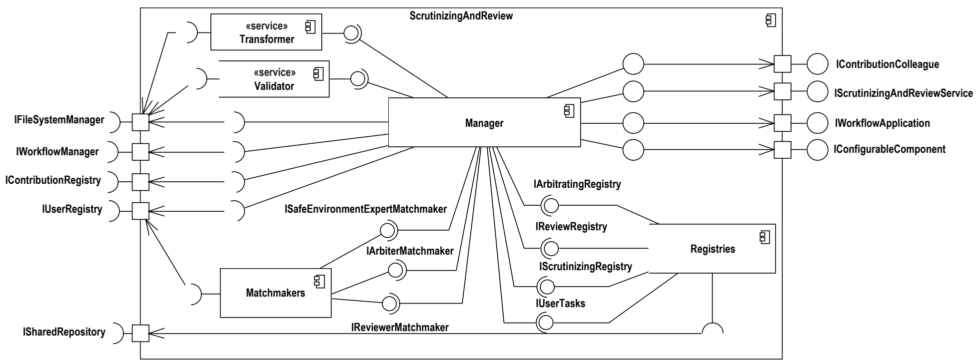

Figure 11.53: Refinement of the ScrutinizingAndReview Module

However, as the three procedures are similar to each other, the central interaction sequences of the `ScrutinizingAndReview` module can be illustrated using the 'match reviewer' request as the exemplary blueprint for the other two scenarios. The protocol shown in figure 11.54 suggests that the `Manager` submodule, realizing the `IWorkflowApplication` interface, receives a new task from the `workflowSystem` instantiation (see also figure 11.50). After it has extracted the necessary data from the passed `taskData` object, it tries to acquire a read lock for the respective contribution (see also section 11.5). If the first attempt fails, the `Manager` submodule—symbolized by the `Wait` operation—pauses a certain period, before it retries to establish the lock. As indicated in the comment in figure 11.54, this polling consumer behavior might also be delegated to a separate submodule that, together with the reference monitor (see section 11.5), realizes a variant of the afore-mentioned publish-subscribe or observer pattern: instead of actively waiting to create the lock, the `Manager` submodule queues a 'get read lock' request. If the lock becomes available, the reference monitor establishes the lock and notifies the submodule that it can obtain the desired contribution. The submodule then reinitiates the 'match reviewer' process.

No matter in which way the read lock is acquired and the contribution itself is retrieved, the next task of the `Manager` submodule is to fetch the contribution's author object from the `IUserRegistry` interface realization, because the author representation, together with the contribution, needs to be passed in the request that induces the component offering an implementation of the `IReviewerMatchmaker` interface to find a suitable reviewer. The in-

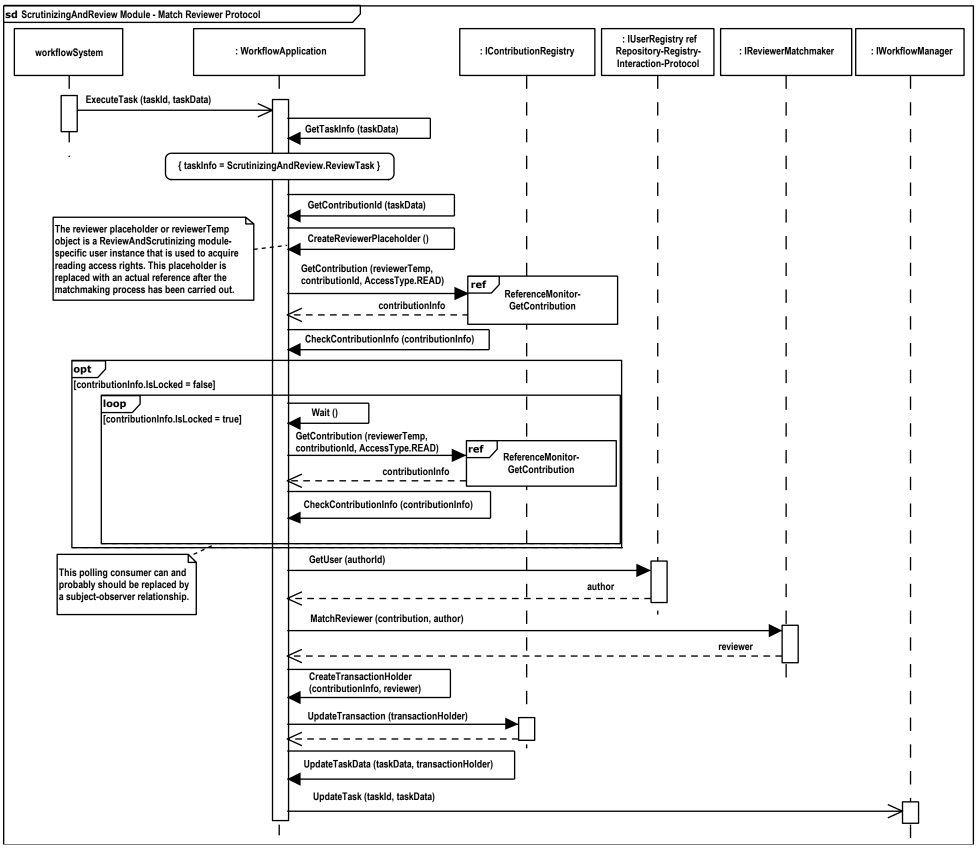

Figure 11.54: ScrutinizingAndReview Module-Match Reviewer Protocol (SD-SRM-01)

ternal processes of this submodule depend on the criteria that are used to match reviewers. One obvious factor that has to be incorporated in the selection algorithm is the reviewer's expertise, that is, the individual should ideally be as competent as the author in the contribution's domain—similar to the scientific peer review procedure. Furthermore, in regard to the development of a glocal identity and the interactions between different groups within the locality, other elements such as group memberships might also be considered in the matching routine. However, the concrete set of criteria depends on the particular locality and the aims that the community-driven SHD initiative tries to achieve within it. Nevertheless, taking it as given that a suitable individual has been identified, the `Manager` submodule's next activity in the protocol is to assign a new review task. This involves, on the one side, the creation of a `transactionHolder` instance, which, as mentioned before, is associable with the reviewer and, in its role as owner linked to a transaction session that needs to survive multiple user sessions, allows to distinguish the transaction session from those that are bound to a particular active user session, and on the other side, the replacing of the `reviewerTemp` by the `transactionHolder` instance as captured by the `UpdateTransaction` operation. The `Manager` submodule's final actions are then to add the `transactionHolder` to the `taskData` object and to update the corresponding workflow. The activity diagram AD-C-12 (see annex C.2) indicates that the latter, after the 'match reviewer' protocol has been executed, informs the author and, if applicable, other working group participants as well as the reviewer about the process' status, before it waits for the reviewer to complete the assigned task by writing a review. This activity, in turn, is carried out using a client that constitutes what in the workflow management system literature is often referred to as a worklist application, that is, an interface between automated business processes and human beings carrying out workflow tasks. The sequence diagram depicted in figure 11.55 specifies the corresponding protocol.

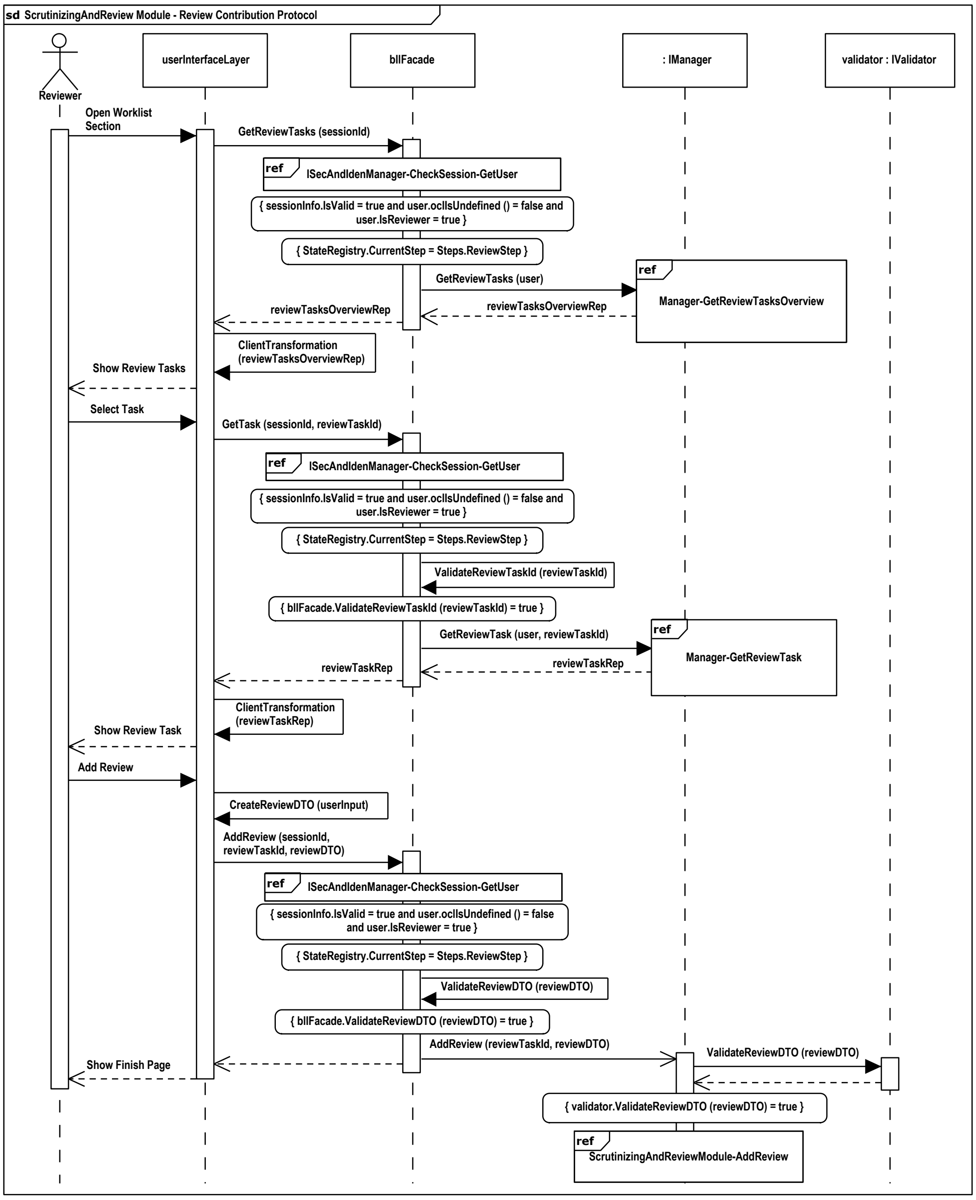

Figure 11.55: ScrutinizingAndReview Module-Review Contribution Protocol (SD-SRM-02)

It prescribes that the system, if a user, in this case a reviewer, has selected the ‘open worklist section’ option, first performs the obligatory session and role checks. Taking it as given that the specified state invariants are fulfilled, the system’s next activity is to present an overview of the user’s review tasks (see figure 11.56). After the user has picked one of the listed items, the system creates a representation of the respective review task’s details and, as displayed in the lower part of the protocol specified in figure 11.55, offers the opportunity to directly add a review of the associated contribution (see figure 11.57). If the user decides to write the requested review, the system then, as indicated in the refinement of the third referenced sequence diagram depicted in figure 11.58, submits the latter to be stored by the `ScrutinizingAndReview` module’s `IReviewRegistry` interface realization and, as illustrated in the embedding protocol (see figure 11.55), shows a finish page to the user.

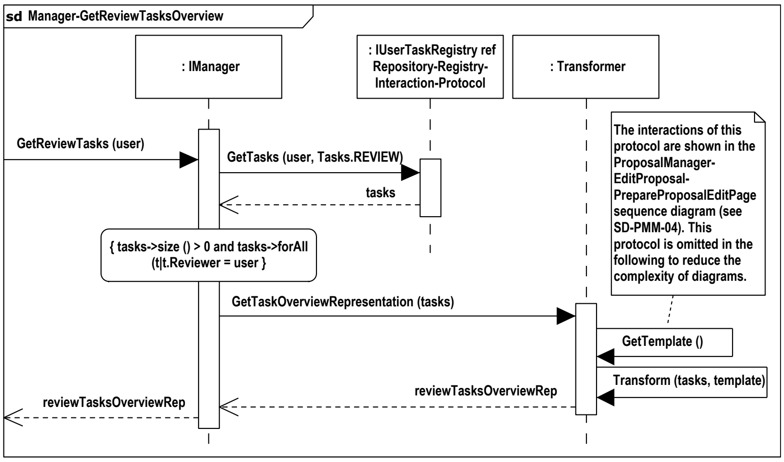

Figure 11.56: Manager-Get Review Tasks Overview Protocol (SD-SRM-03)

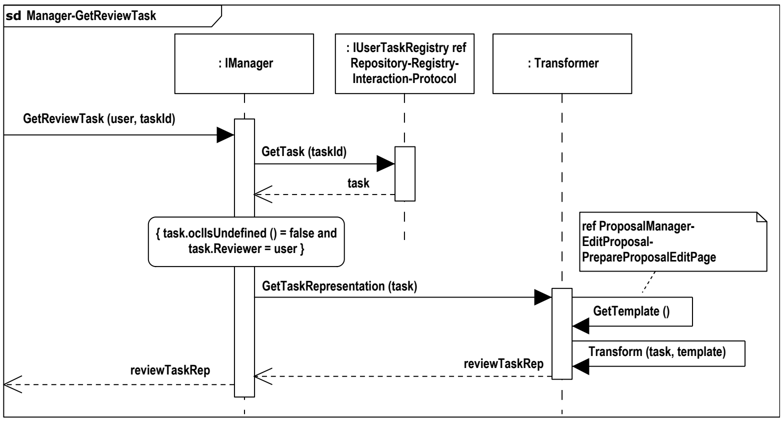

Figure 11.57: Manager-Get Review Task Protocol (SD-SRM-04)

Before the discussion now turns to the next module, the following briefly examines the refinements of the three referenced sequence diagrams to complete the specification of the 'review contribution' protocol. The first two processes, that is, the presentation of the overview of review tasks as well as of the details of a selected review task, are explored together, because they involve a nearly identical set of steps. More specifically: the `Manager` submodule retrieves either a list of review tasks or a single review task from the `IReviewRegistry` interface realization and induces the `Transformer` submodule to create an unformatted, logical representation out of the(se) instance(s). To carry out this request, the latter, using the module offering an implementation of the `IFileSystemManager` interface, first loads the appropriate XSLT file from the file system as captured by the `GetTemplate` operation[375]. It then performs, possibly drawing on one of the two afore-mentioned XML-related transformation capacities of contributions, the first conversion of the two step view pattern, which results in the unformatted, logical representation that, omitting the involved forwards, is passed to the user interface layer as shown in the embedding protocol.

375. The `GetTemplate` operation hides this interaction sequence, that is not shown in figures 11.56 and 11.57, to reduce the descriptions' complexity. However, a more detailed specification of the procedure is depicted in the sequence diagram SD-PMM-04 in annex D.2.

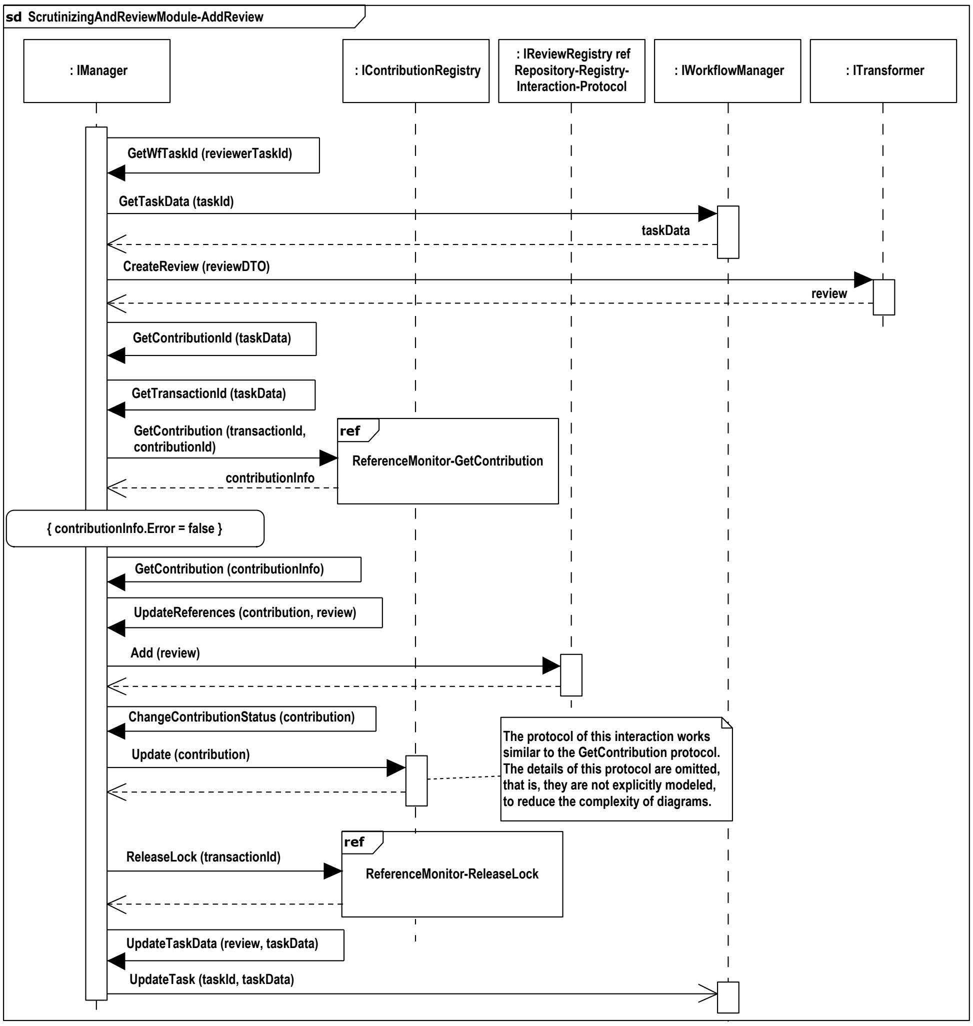

Figure 11.58: Manager-Add Review Protocol (SD-SRM-05)

Finally, the third referenced sequence diagram, that is, the ‘add review’ protocol specified in figure 11.58, presupposes, on the one side, that the logical representation constructed in the process shown in figure 11.57 not only entails the task’s details, but also a form that allows the user to add a review as depicted in the embedding protocol, and on the other side, that the reviewer actually writes and saves the review. Only if these latter activities are carried out and the system has performed its obligatory security checks, which include a validation of the `reviewDTO` created out of the user input, the interaction sequence prescribed by the protocol is executed. Its central aim is to create a review instance and add it to the `IReviewRegistry` interface realization. This process, as shown in figure 11.58, entails the following activities of the `Manager` submodule: firstly, it derives the workflow identifier from the `reviewTaskId` object that the `bllFacade` passed along with the `reviewDTO`; secondly, it uses the workflow identifier to the retrieve the corresponding `taskData` object from the `WorkflowSystem` subsystem’s `Manager` submodule; thirdly, it induces the `Transformer` submodule to create a review instance out of the `reviewDTO`; fourthly, it fetches, after having extracted the contribution identifier and the transaction identifier from the `taskData` instance, the contribution from the module offering an implementation of the `IContributionRegistry` interface (see also SD-CM-01 and SD-CM-04 in annex D.2). Assuming that this action has worked as expected, the `Manager` submodule's next two activities are to get the contribution from the retrieved `contributionInfo` as well as to link the review to the contribution and vice versa. Although this latter task, as done in the preliminary object models shown in section 11.1, can be realized by direct references, the designer of a derived architecture might also, to further decouple different modules, decide to extend the functionality of the `IContributionRegistry` interface implementation to maintain a list of such relationships. Nevertheless, given that the linking information is stored, the `Manager` submodule adds the `review` instance to the `IReviewRegistry` interface realization, which, in turn, stores it, via the module offering an implementation of the `ISharedRepository` interface, in the system's database. Before the `Manager` submodule finally updates the workflow associated with the review task, it releases the lock established for the reviewed contribution (see also figures 11.37 and 11.39). This last activity of the 'add review' protocol not only completes the examination of the `ScrutinizingAndReview` module, it is also the point at which the more general discussion of multi-phase, step-independent components, turns to more specific modules, which, with the exception of the `ProblemStructuring` module, are primarily concerned with single steps in the decision-making process' phases.

The Voting and Selection Module aims to support those operations that are associated with the voting on and the selection of proposals (see the activity diagrams depicted in figures 11.25, 11.26, and 11.27). The rationale to integrate the functionalities supporting both processes into one single component is derived from the separation of concerns principle and the intimate relationship of both steps, i.e., the voting always precedes the selection and the selection is based on voting results. This, on the other hand, suggests that the `VotingAndSelection` module needs to react to changes of phases and to alternating steps. Although this latter requirement extends those that are imposed on the `ProposalManagement` module, both components, in general terms, are nevertheless dedicated modules that aim to handle all activities related to their respective focal types (i.e., votes and selections as well as proposals), which, in turn, is a commonality that manifests itself in a similar set of submodules as the comparison of figures 11.47 and 11.59 reveals.

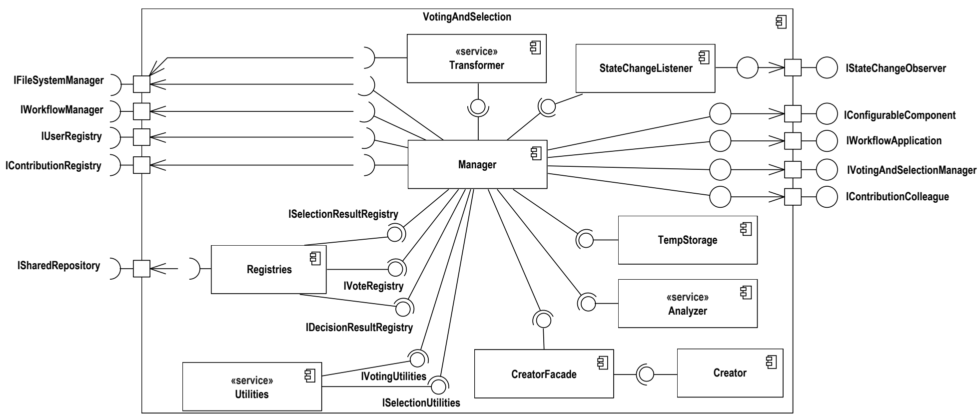

Figure 11.59: Refinement of the VotingAndSelection Module

However, this comparability not only applies to the set of constituents, but also to the services that the modules and their submodules such as the `CreatorFacade` submodule as well as the `Creator` submodule, the `TempStorage` submodule, the `Utilities` submodule, the Registries submodule, the Transformer submodule, and the StateChangeListener submodule provide[376]. Nevertheless, instead of Proposal instances, the VotingAndSelection module's focal types are derived from the Vote and SelectionResult concepts as shown in the preliminary object models of the voting phases examined in section 11.1. Although this difference has an effect on, for example, the Transformer submodule, which is now responsible for creating two different unformatted, logical representations, these divergences, at least from a reference architecture design perspective, are minor and negligible. The Analyzer submodule, in contrast, constitutes a real variation to the ProposalManagement module. The former, by analyzing those votes that a local citizen has made in one specific voting session, is used to point out 'inconsistencies', which, in turn, help the user to refine her or his explicated preferences (see also Kersten 2000, p. 46). Without going into all its details, the integration of this submodule in the voting process—one of the three central protocols of the VotingAndSelection module discussed in the following—is illustrated in the sequence diagram shown in figure 11.60.

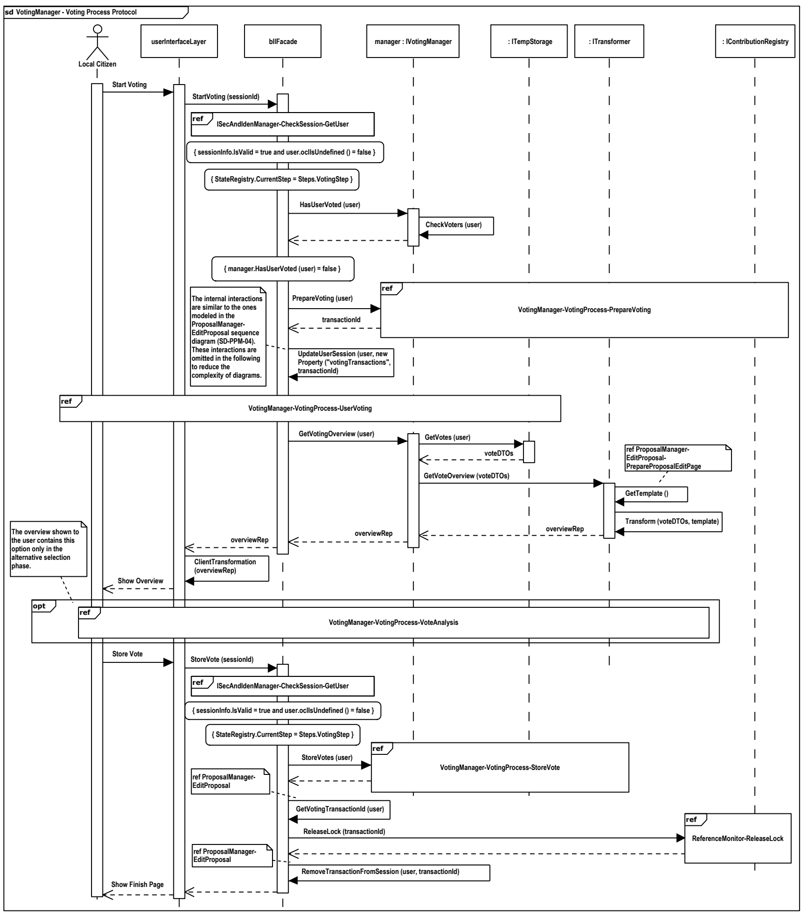

Figure 11.60: VotingManager-Voting Process Protocol (SD-VSM-01)

The specification, besides the obligatory security and prerequisite checks, shows that the

376. Nevertheless, the retrieval of contributions from the IContributionRegistry interface realization is less complex than the afore-mentioned interaction sequences (see the protocols in figures 11.36 and 11.38), because the voting step and the selection step have a special status: proposals considered in these two steps should not be editable. To fulfil this requirement, the WorkflowSystem subsystem automatically releases all existing writing locks on proposals and at the same time, to prevent that new writing locks are created, establishes corresponding reading locks. The latter, similar to the reading locks required for scrutinizing, review, and arbiter tasks, differ from ordinary transactions as they are granted to voters and selectors in general, that is, they are not associated with a user session.

system's first task in the voting process is the preparation of a local citizen's voting session. This procedure is captured in the protocol displayed in figure 11.61. The shown interaction sequence is similar to the 'get review tasks overview' and the 'get review tasks' protocols examined in the foregoing discussion (see figures 11.56 and 11.57 respectively). The 'prepare voting process' protocol, nevertheless, differs, despite the varying scope, in two respects: on the one side, it, as suggested by the passed `FINALIZED` property (see also figure 11.34), gathers all finalized proposals, and on the other side, it is, as indicated by the alt fragment, a process that, depending on the currently active phase, can take two different paths. More specifically, whereas votes on proposals in the alternative selection phase, due to the incommensurability of multi-attribute interventions, refer to a pair of contrasted alternative proposals, in other phases local citizens vote on isolated options (see also the discussions at end of chapter 10 and in section 11.3). Hence, the former case differs from the latter by including a task that induces the `Utilities` submodule to create a list of proposal pairs. However, both paths are similar in that the `Transformer` submodule creates a list of logical representations and that the `Manager` submodule stores this list in the `TempStorage` submodule.

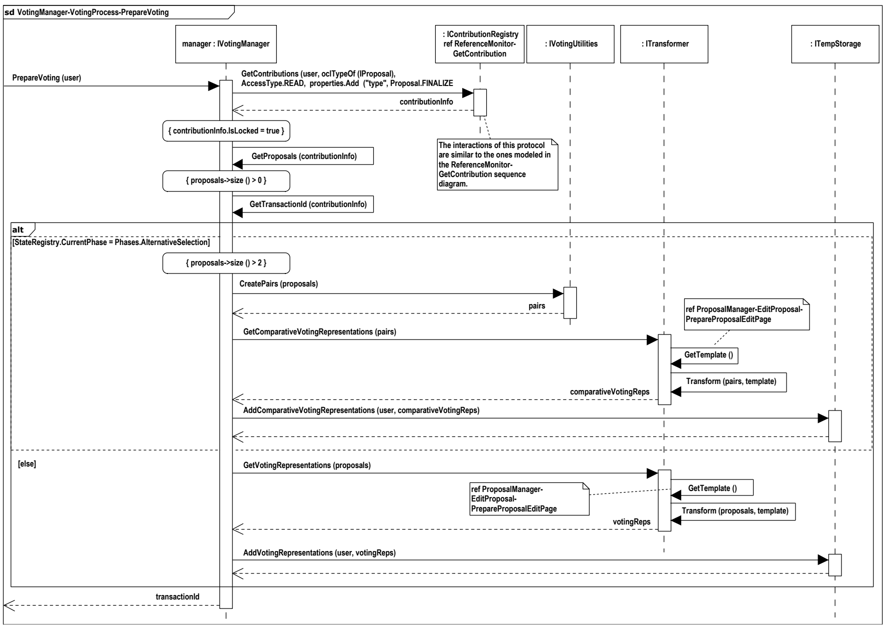

Figure 11.61: VotingManager-Voting Process-Prepare Voting Protocol (SD-VSM-02)

The next referenced sequence diagram in the 'voting process' protocol is the actual user voting. As shown in figure 11.62, the procedure involves a loop that, as indicated by the opt fragment's condition, iterates through the list of unformatted, logical representations generated in the preparatory step by, firstly, converting the XML-based format of the voting option into a phase-dependent and client-specific view, and secondly, storing the `voteDTO` created out of the user's input—given that the user session and the DTO have passed the obligatory security and validation checks respectively—in the `TempStorage` submodule. The rationale to introduce this intermediary step instead of directly transforming the `voteDTO` into the type derived from the `Vote` concept and adding it to the `IVoteRegistry` interface realization rests on the constraint that only completed voting sessions should be stored permanently. This requirement is fulfilled if the loop shown in figure 11.61 has reached its break condition and if the other, below examined interactions specified in the voting procedure (see figure 11.60) have been carried out. If these activities have been performed, then the storing phase, which includes the process described in figure 11.63, is executed as the final phase of the 'voting process' protocol.

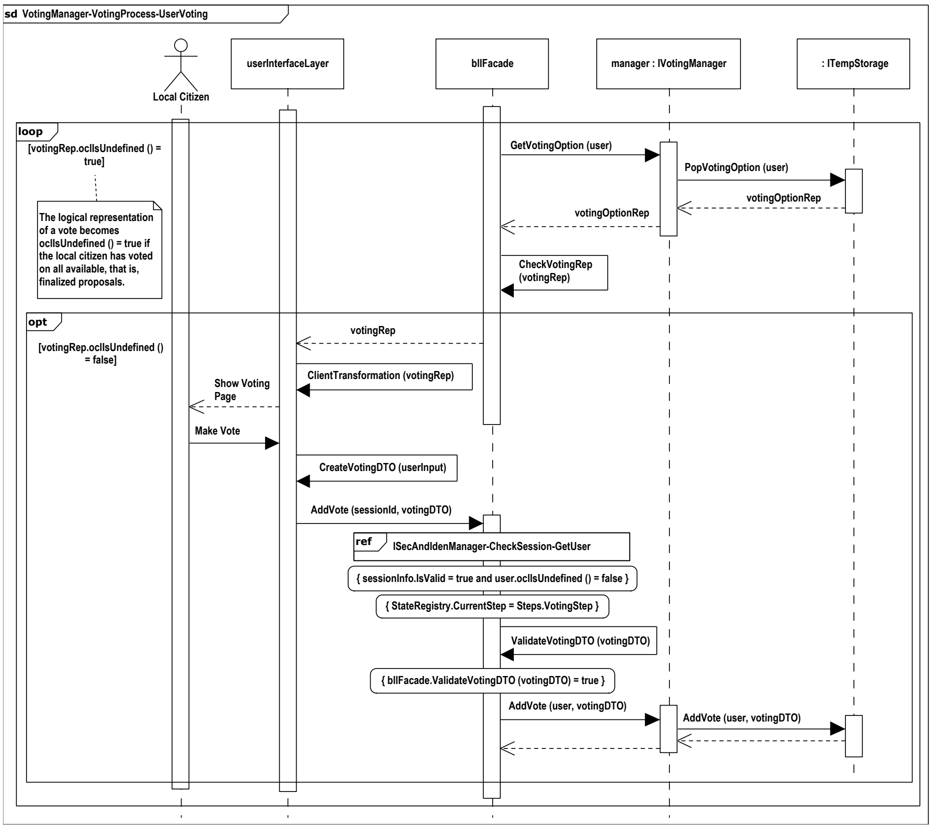

Figure 11.62: VotingManager-Voting Process-User Voting Protocol (SD-VSM-03)

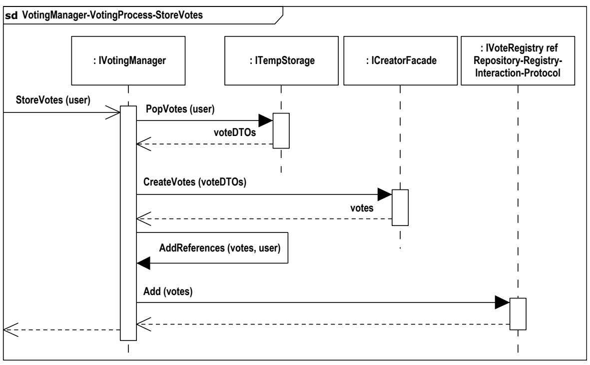

Figure 11.63: VotingManager-Voting Process-Store Vote Protocol (SD-VSM-05)

However, in between the overview presentation directly following the voting of a local citizen (see figure 11.60) and the storing of votes, the user can make use of the system's analyzing services. As indicated by the comment associated with the opt fragment shown in the 'voting process' protocol depicted in figure 11.60, this opportunity is restricted to the alternative selection phase, because the isolated votes of an ordinary voting approach, due to their unrelatedness, cannot be analyzed for inconsistencies (see also the discussion at the end of chapter 10). Without going into the—from a reference architecture design perspective—

too concrete details of the analysis algorithm, the sequence diagram depicted in figure 11.64 provides a relatively general description of how the `Analyzer` submodule and its potential functionalities can be incorporated into the comparative voting procedure.

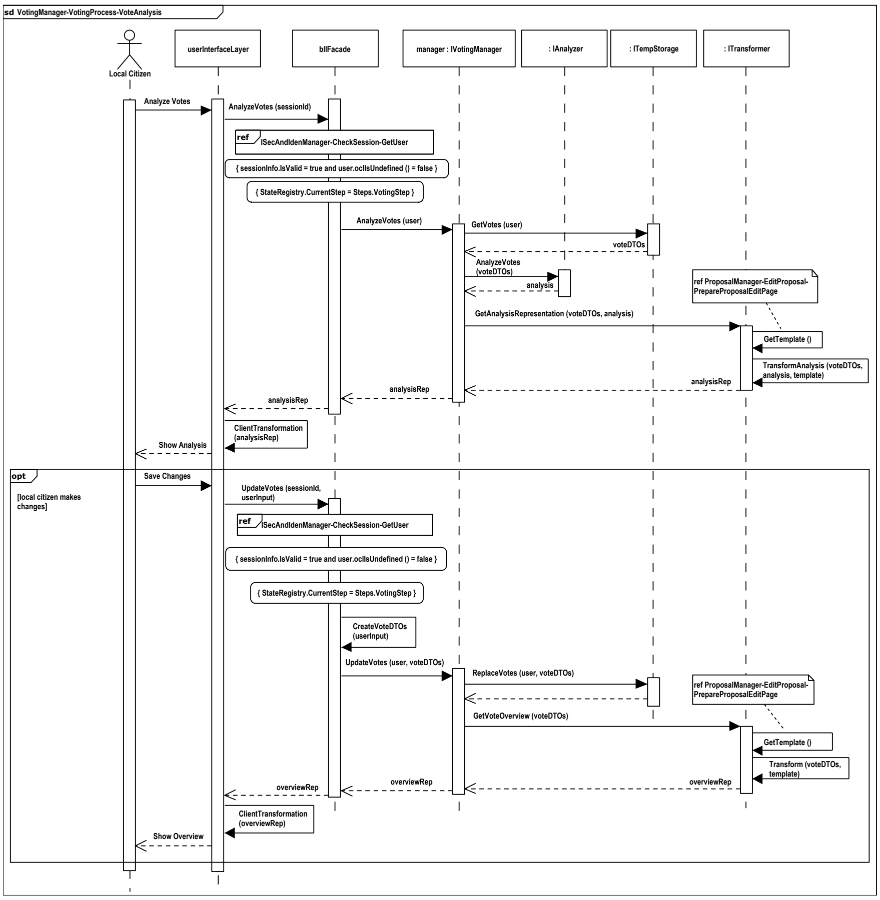

Figure 11.64: VotingManager-Voting Process-Vote Analysis Protocol (SD-VSM-04)

In addition to the voting of local citizens, the `VotingAndSelection` module also supports the selection of alternatives by board members. This process, as discussed at the end of the preceding chapter and in section 11.1, is divided into an individual and a group phase. Within the former each of the initiative's board members indicates which of the available interventions she or he prefers to be realized. These individual opinions, in turn, prepare the basis for the group selection phase in which the DSS uses the explicated preferences to focus the group discussion on the removal of disagreement. As a comparison of the sequence diagrams depicted in figures 11.60 and 11.65 reveals, the interactions of the individual stage are similar to the ones of the 'voting process' specified above; in fact, they constitute a binary variant of the ordinary voting approach (see also the discussion at the end of chapter 10). Therefore, the following omits the exploration of this facet of the selection process (see SD-VSM-07, SD-VSM-08, and SD-VSM-09 in annex D.2 for further details) and instead directly turns to the board selection phase depicted in figure 11.66.

Although this second part of the selection process is a group-based undertaking, the specification reveals that it is, for example, during a board member meeting, initiated by an individual user, who is responsible for leading the decision-making process' final debate. Besides the obligatory security and status checks, the first tasks of the DSS, comparable to the ones

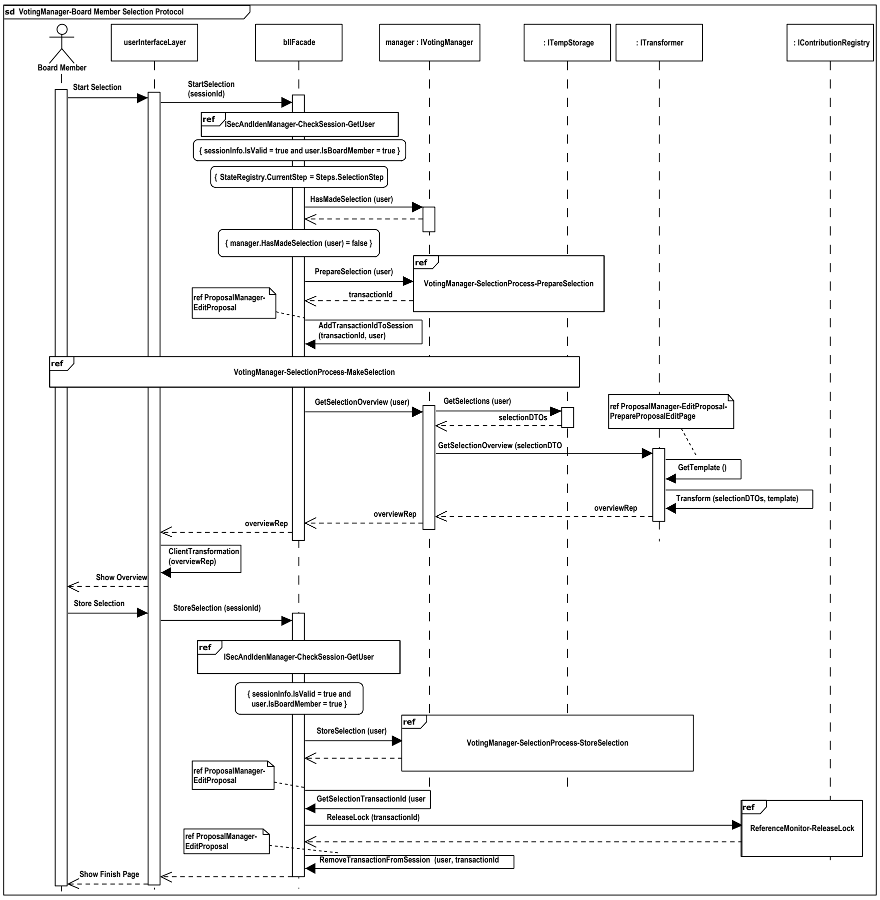

Figure 11.65: VotingManager-Selection Process Protocol (SD-VSM-06)

it carries out to set up the above described voting process (see figure 11.61), are preparatory in nature (see SD-VSM-11 in annex D.2). More specifically: the system creates, based on an analysis of the board members' explicated preferences, three different lists—an inclusion, an exclusion, and a disagreement list—that provide the foundation for the protocol's core. The latter manifest itself in the three referenced sequence diagrams shown in the middle of figure 11.66 (see also AD-C-06 in annex C.2). In contrast to the second and third interaction sequence, which process the sets of options about which agreement in regard to the entailed alternatives' inclusion and exclusion, respectively, in the initiative's program exist, the first of the shown ref fragments comprises actions that deal with those interventions that cannot be put in either the inclusion or the exclusion list, that is, with the disagreement list. In regard to the above-mentioned purpose of the DSS, the currently interesting facet of the selection process' group phase is therefore part of the 'process disagreement list' protocol. The latter's details are specified in the sequence diagram depicted in figure 11.67.

The protocol indicates that the semi-automated interaction sequence entails a loop that is executed until decisions for all interventions in the disagreement list have been made (see the opt fragment's condition in figure 11.67). However, the order in which items are processed is not predetermined or random; rather, board members select an iteration's focal item from the overview created by the `Transformer` submodule as shown in the alt fragment's else section. To support this choice by, for instance, sorting the options in regard to their degree of (dis-)agreement, designers of concrete, derived architectures might hook in a consensus mea-

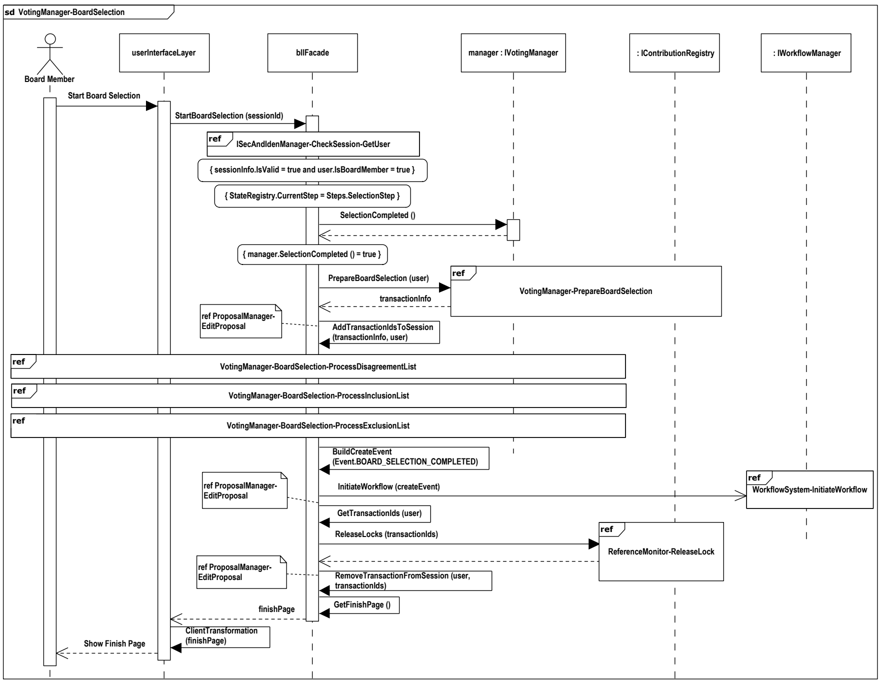

Figure 11.66: VotingManager-Board Selection Protocol (SD-VSM-10)

suring tool, i.e., an enhanced version of the `Analyzer` submodule, before the DSS constructs the overview (see Boroushaki and Malczewski 2010, for a description as well as a prototypical implementation of a web-based application that belongs to this category). Besides this possible extension, the protocol's opt fragment prescribes that board members carry out the following activities after selecting a focal item: they should, firstly, investigate the focal item's details and discuss them in an unmediated, communicative interaction (see SD-VSM-13 in annex D.2 for the view's generation), and secondly, make a final decision about the alternative's inclusion in or exclusion from the initiative's current program portfolio (see SD-VSM-16 in annex D.2 for the corresponding technical processing). The refinements of both entailed ref fragments are not explored any further, because they are similar to the interaction sequences already discussed above (see figures 11.57 and 11.63 respectively). Instead the examination, assuming that decisions for all interventions comprised in the disagreement list have been made, returns to the second and third part of the embedding protocol's core activities, i.e., to the processing of the inclusion and the exclusion list (see figure 11.66).

As both these parts have in common that all board members agree on the respective interventions' statuses, the sequences of prescribed actions, despite working on lists that contain differently assessed alternatives, are not only similar to each other, but also to the above described process (see the diagrams shown in figures 11.68 and SD-VSM-15 in annex D.2). However, the uncontested nature of options in the remaining lists has the effect that the unmediated, communicative interaction, instead of partially being concerned with the removal of disagreement, can concentrate on the elaboration of rationales that explain the board's concluding choices. As indicated by the workflow initiated after the board selection process is completed (see figure 11.66), the final justification, in turn, is then published to inform local citizens about how their preferences and comments have influenced the selection process.

Before the elaboration of the group selection protocol and with it the examination of the `VotingAndSelection` module closes, it has to be pointed out that the board selection in the

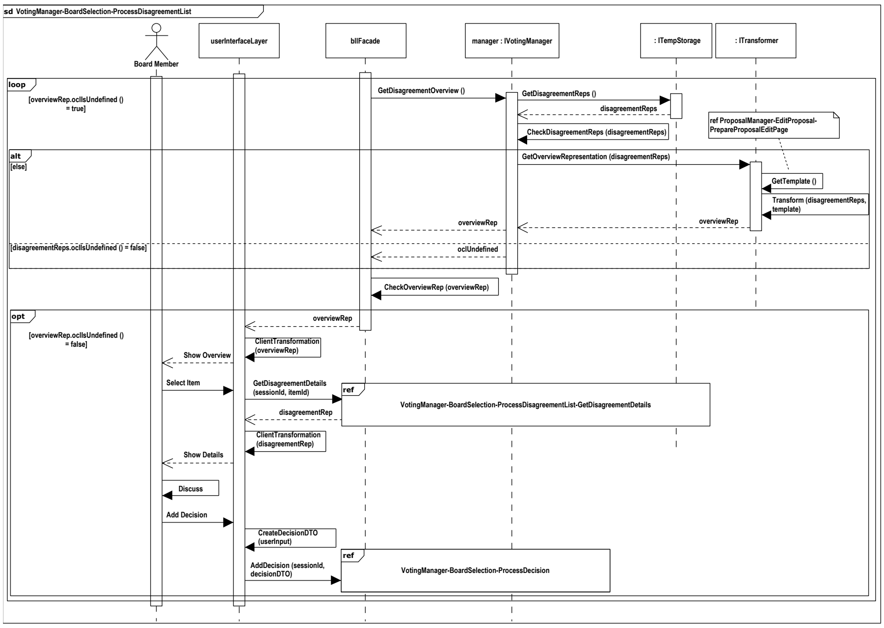

Figure 11.67: VotingManager-Board Selection-Process Disagreement List Protocol (SD-VSM-12)

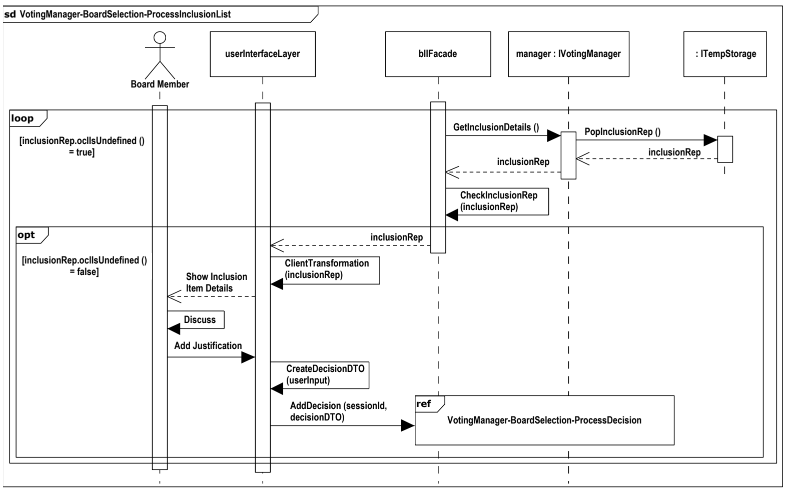

Figure 11.68: VotingManager-Board Selection-Process Inclusion List Protocol (SD-VSM-14)

problem identification phase differs slightly from the above described interaction sequence, which is, for example, employed in the decision-making process' indicator or problem selection phases. In contrast to the latter two, the former phase is more restrictive in regard to the selection outcome, because each decision-making process instance must have only one guiding focal problem (see the discussions at the end of chapter 10 and section 11.1). This, in turn, requires to change the processing of the disagreement and the inclusion lists according to the flow of actions outlined in the activity diagram AD-PI-04 shown in annex C.2: whereas the former loop now either excludes options or moves them to the inclusion list, the break condition of the latter loop is changed from 'all options have been processed' to 'all but one option have been excluded', that is, all but the proposal describing the focal problem have been moved to the exclusion list. As the processing of the latter list does not change, the exploration now can turn to the reference architecture's next module.

The Working Group Module provides the infrastructure that enables citizens in the indicator selection and the alternative design phases to elaborate on their working group proposals (see sections 11.1 and 11.3): it not only supports their asynchronous activities (e.g., sharing documents, exchanging messages, coordinating group work), but it also allows them to collaborate synchronously (e.g., collaborative editors, video conferences, group awareness services). To account for the variety of potential functionalities (see, for instance Balram and Dragicevic 2009, p. 1963; Cullen-Unsworth et al. 2012, p. 259; Hill et al. 2012, pp. 2, 10), which in literature are often discussed under the headings of groupware or Computer-Supported Collaborative Work (CSCW) environments (cf. Avgeriou and Tandler 2006; Bafoutsou and Mentzas 2002; Cruz et al. 2012; Mentzas and Bafoutsou 2005; Teege 1996), the key design principle of this component is its modifiability. The afore-mentioned plugin pattern is a suitable basis for realizing a flexible and extensible mechanism that, utilizing, for example, the adapter pattern (cf. Gamma et al. 1995, pp. 139–150), can offer services of third-party applications via a local interface. Within the component diagram depicted in figure 11.69, this pattern manifests itself in the `ApplicationBus` submodule, which, in turn, is comparable to the `ApplicationBus` submodule of the `WorkflowSystem` subsystem.

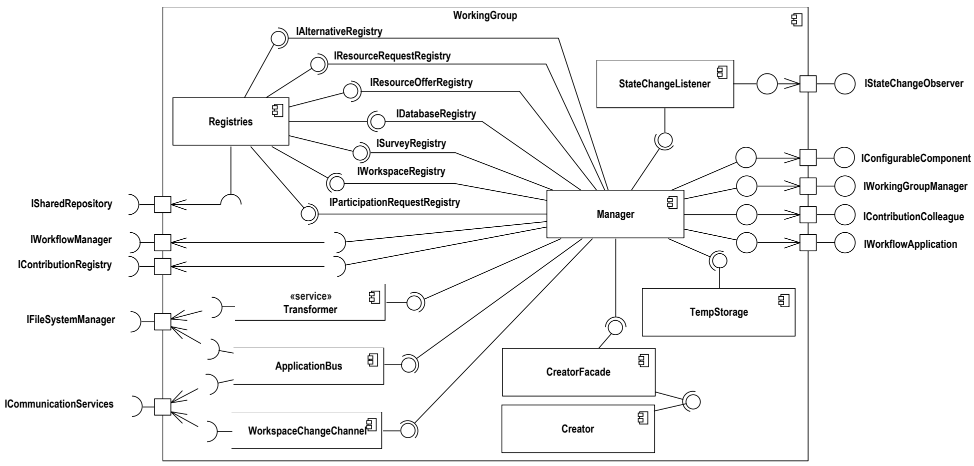

Figure 11.69: Refinement of the WorkingGroup Module

Similarly, most of the other submodules also have already discussed counterparts in other modules. This, in regard to the refinement shown in figure 11.69, applies to the `Registries` submodule, the `StateChangeListener` submodule, the `TempStorage` submodule, the `CreatorFacade` submodule, as well as the `Creator` submodule. The following will therefore concentrate on the single, not yet examined entity, i.e., the `WorkspaceChangeChannel` submodule. Its responsibilities include, inter alia, the task of informing currently active clients about changes in a workspace to support synchronous interactions between working group participants. In other words, the `WorkspaceChangeChannel` submodule realizes a variant of the above described publish-subscribe pattern. However, in contrast to the channel that is used to propagate state changes, the `WorkspaceChangeChannel` submodule, following the suggestion of Hohpe and Woolf (2004, pp. 237–242), incorporates an event filter to allow for a more fine-grained update of observers, that is, only those clients whose collaborative workspace has been changed through the actions of other working group participants are informed about respective modifications. The integration of this submodule into the `WorkingGroup` module's protocols will be reviewed more thoroughly below using the collaborative editing of a proposal as blueprint for other synchronous interactions. Yet, before the discussion turns to this exploration, the preparatory, upstream processes are worth an examination. The most central of these is the emergence of workspaces. The sequence diagram depicted in figure 11.70 shows the corresponding 'create workspace' protocol, which itself is part of the create (working group) proposal workflow, whose specification is displayed in figure 11.50 (see also the preliminary object models presented in figures 11.2 and 11.7).

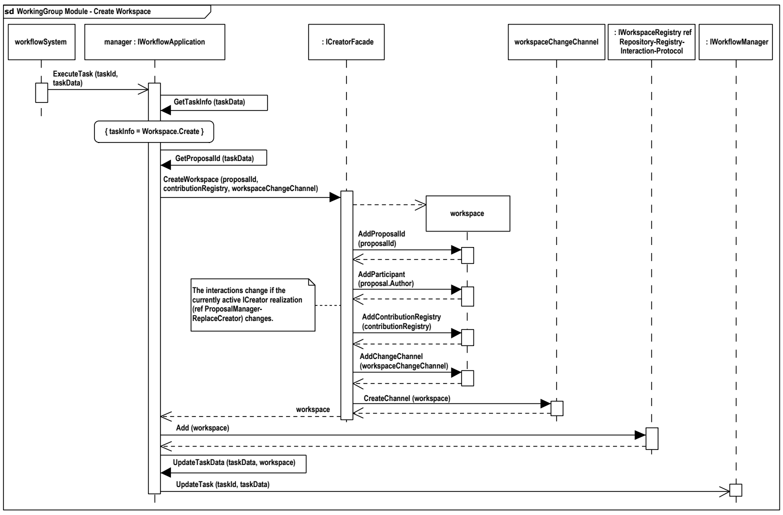

Figure 11.70: WorkingGroupModule-Create Workspace Protocol (SD-WGM-01)

The comprised interaction sequence, at least in regard to the passed data's structure and the initialization procedure, is similar to the previously examined workflow specifications (see, for example, figure 11.50). Furthermore, the details of the general structure of the actual instance building mechanism, that is, the interplay of the `CreatorFacade` submodule and the various concrete `Creator` submodules, has already been discussed above (see also figure 11.48). Therefore, to reduce the protocol's complexity (see figure 11.70), the `CreatorFacade` submodule's lifeline hides the interactions between these entities, i.e., they are mapped onto local operations of the `CreatorFacade` submodule. As indicated in section 11.1, the corresponding creation process, which is also the core of this workflow, is ideally executed directly after the indicator or alternative proposal has taken the initial scrutinizing hurdle. In other words, for each working group proposal that is considered to be safe, the

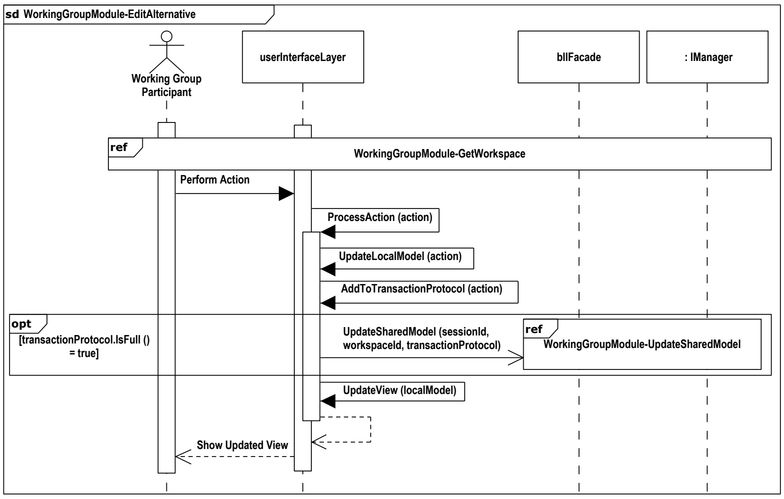

Figure 11.71: WorkingGroupModule-Edit Alternative Protocol (SD-WGM-02)

system should automatically create a group workspace[377]. The sequence diagram shows that the instantiation of such a workspace entails, inter alia, the following activities: the `CreatorFacade` submodule (i) connects the workspace to the underlying proposal and vice versa; (ii) adds the proposal's author to the list of working group participants; (iii) associates the workspace with the `IContributionRegistry` interface instance; and (iv) induces the `WorkspaceChangeChannel` submodule, after adding a reference of the `WorkspaceChangeChannel` submodule to the workspace, to create a workspace-specific change propagation channel. Before the `CreatorFacade` submodule then updates the corresponding workflow, it finally adds the created workspace to the local `IWorkspaceRegistry` interface realization, which, in turn, stores the former, via the module offering an implementation of the `ISharedRepository` interface, in the system's database (see also section 11.5).

After this preparatory step has been completed successfully, the author and/or other working group participants can begin, for instance, to elaborate on the proposal's alternative. The interactions involved in this exemplary process are illustrated in the sequence diagram depicted in figure 11.71. Similar to the 'review contribution' protocol (see figure 11.55), the procedure starts with the presentation of a workspace overview as indicated by the refinement of the first referenced sequence diagram (see figure 11.72) and—after the user has selected an item from the list—the production of a detailed workspace view as captured by the sequence diagram shown in figure 11.73. In this second operation both protocols, due to the requirements unfolding from the need to allow for synchronous scenarios, start to differ slightly: the 'get workspace details' protocol, before retrieving the unformatted logical representation of the workspace, adds the user to the list of active workspace participants. This action, in turn, causes the workspace to propagate a `changeEvent` via the `WorkspaceChangeChannel` submodule. Broadcasting such events to all other active working group participants is not only a vital prerequisite for the `WorkingGroup` module to provide its group-awareness functionalities, but it is also the core mechanism behind the support of collaborative efforts.

More specifically: as already discussed in regard to the `WorkflowSystem` subsystem's `ApplicationBus` submodule, the `WorkspaceChangeChannel` submodule is a variant of the

377. These group workspaces are accessible via a user's private workspace or dashboard, which, by allowing to see and modify submissions, gives the user ownership of her or his data and, following from the former, connects her or him to the initiative (cf. Connors, Lei, and Kelly 2012, p. 1277).

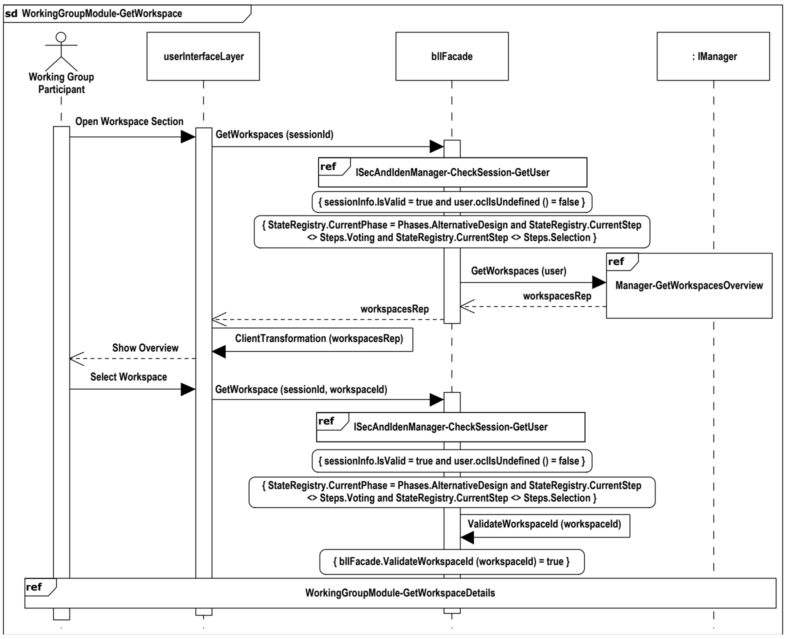

Figure 11.72: WorkingGroupModule-Get Workspace Protocol (SD-WGM-03)

publish-subscribe pattern. However, in contrast to the `ApplicationBus` submodule, the `WorkspaceChangeChannel` submodule cannot work directly with local references, because the interested parties or subjects are located on remote systems. To account for this difference, the local update procedure is substituted with the registration of callback functions as shown in the middle of figure 11.73 and the referenced sequence diagram's refinement depicted in figure 11.74. Depending on the client, this protocol can be concretized and implemented in different ways. For example, a simple web browser application might use client-side scripting technologies (e.g., jQuery as a well-known JavaScript library) to generate a callback function on the website's load event. Nevertheless, leaving such implementation specific details aside, the general procedure prescribes that the client creates a callback function and informs the server that it wants to be notified if changes in the associated workspace occur. The server, after having carried out the obligatory security checks, hands over the callback function to the workspace, which it retrieved from the registry using the identifier passed by the client. The workspace instance, in turn, induces the `WorkspaceChangeChannel` submodule to include the client, or more precisely the callback function to reach it, in the list of observers.

The third and final task necessary in preparation of the collaborative editing of an alternative is to transfer the workspace's model or its shared data (cf. Avgeriou and Tandler 2006, pp. 95–97; Teege 1996, p. 102), that is, the technical representation of the workspace, which includes, for example, the list of uploaded documents and users as well as the history of users' activities, from the server to the client. This process, which is comparable to the retrieval of the other logical representations described before, is captured in the sequence diagram shown in figure 11.75. However, it has to be noted that the second transformation of the two step view pattern changes slightly: instead of transforming the XML-based format into a HyperText Markup Language (HTML) view that is finally transmitted to and interpreted by the client-side of the `userInterfaceLayer`, the server-side for its part, at least if continuing the above example of a JavaScript-based web application, converts the representation into a

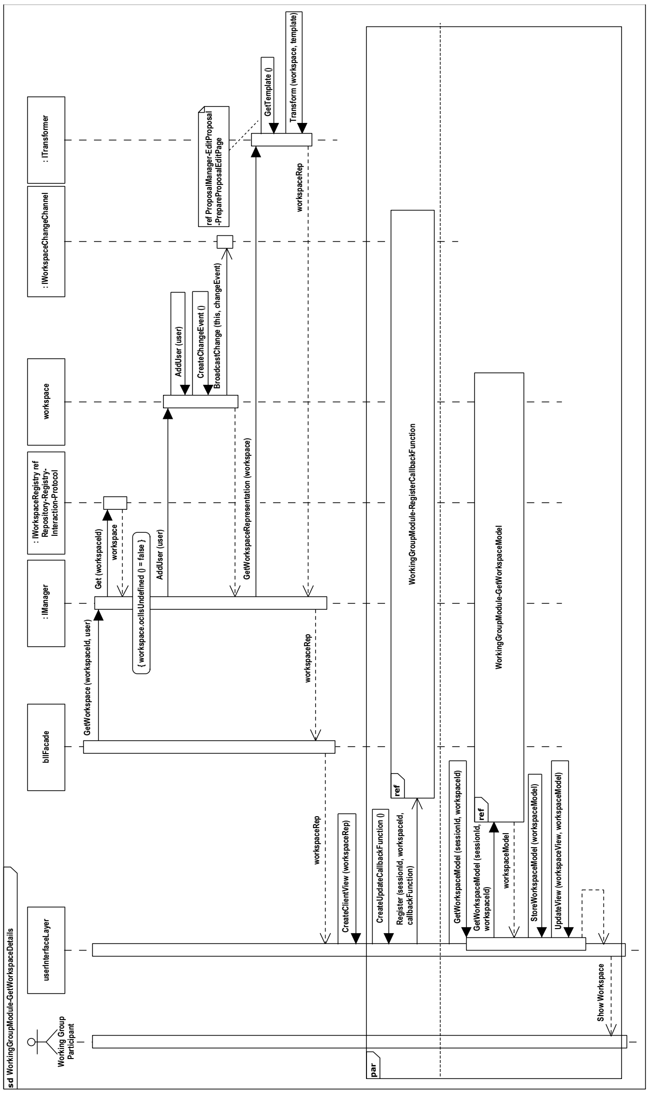

Figure 11.73: WorkingGroupModule-Get Workspace Details Protocol (SD-WGM-05)

JavaScript Object Notation (JSON)-based format (cf. ECMA 2011, pp. 202–208)[378]. The latter is an increasingly popular substitute for the XML facet of the Asynchronous JavaScript and XML (Ajax) approach to the development of web applications (cf. Garret 2005). Although the general procedure prescribed by the protocol is inspired by an Ajax-based solution, the process detailed in the following, thereby doing justice to the technology-agnostic nature of reference architectures, is generic enough to be implemented differently. In fact, the only requirement a concrete realization needs to fulfill is that clients, instead of working with the shared data stored on the server, have a local copy of the workspace's model, because this reduces delays and, following from the former, some of the, further discussed below usability issues caused by the higher latency of networks.

After this tripartite, preparatory phase of the protocol shown in the sequence diagram depicted in figure 11.71, the user can begin to exercise functionalities such as, for example, the editing of the alternative associated with the workspace. The rationale to map such interactions on an abstract 'perform action' operation is that the system's user experience is not only

378. See also: `http://json.org/`, accessed May 25, 2015.

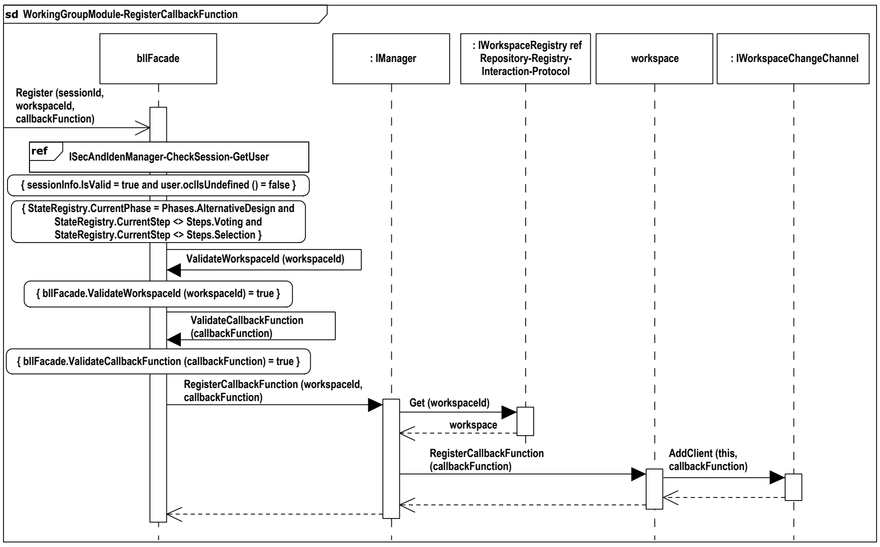

Figure 11.74: WorkingGroupModule-Register Callback Function Protocol (SD-WGM-06)

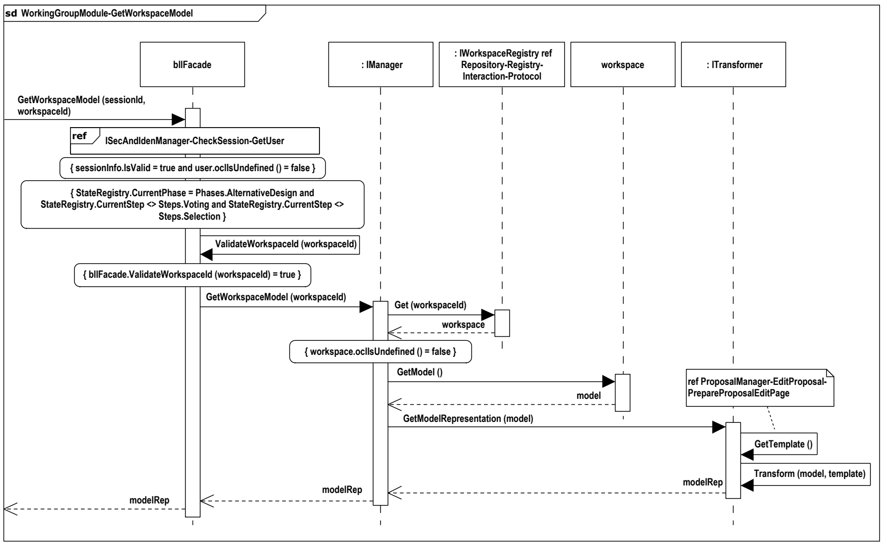

Figure 11.75: WorkingGroupModule-Get Workspace Model Protocol (SD-WGM-07)

influenced by presenting an up-to-date view of the workspace's technical representation, but it also depends, at least if seen from a collaborative angle, on the visualization of other user's activities to enhance or create the feeling of 'colocatedness'. The latter factor requires that even those events that do not directly change the workspace's model such as, for instance, the mouse movements or selections of users have to be transmitted to all currently active working group participants. This, in turn, suggests that clients, besides changing their local copy of the workspace's shared data (see figure 11.75), should keep track of model modifications as well as all other facets of the user's working process in a separate, local transaction protocol. As indicated by the `UpdateSharedModel` call in the sequence diagram shown in figure 11.71, if this temporary storage has reached a specific quota, the set of included actions, together constituting one transaction, is asynchronously sent to the server. The latter then, if the transaction does not contain changes that conflict with updates that other clients have made, adjusts the model and, more importantly, broadcasts a change event to all observers. These subjects,

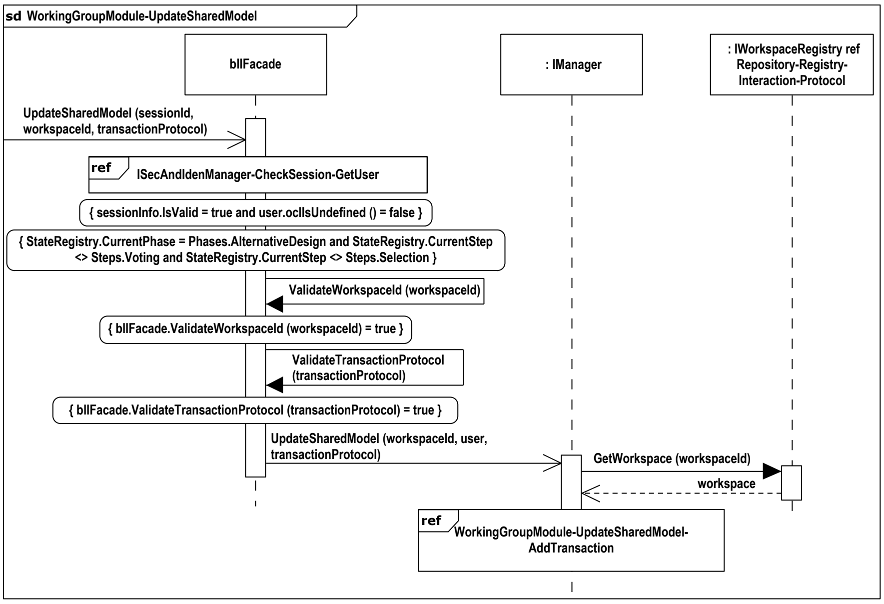

Figure 11.76: WorkingGroupModule-Update Shared Model (SD-WGM-08)

on their part, retrieve a list of changes to harmonize their local model with the one stored on the server. This approach, derived from the optimistic offline lock pattern introduced by Kung and Robinson (1981)[379], has the advantage that the application's responsiveness is enhanced, because clients do not incur delays caused by network latency if working with local data. Nevertheless, this procedure also has two potential shortcomings: on the one side, it cannot ensure that all clients have the same workspace model all the time, and on the other side, it might require that a client has to rollback local changes if they conflict with those that other clients have committed before. However, in the current context these two limitations play a secondary role at best, because (i) the number of actions constituting one transaction is relatively small, which also decreases the rollback penalty, and (ii) the visual representation of other working group participants' activities, besides its effect on the collaborative experience, has the additional practical advantage that it helps to prevent two users from unknowingly changing the same entity simultaneously. Although these techniques lower the chances of conflicts, they cannot avoid them altogether. Therefore, if the server identifies an incompatibility, then the client that has transmitted the irreconcilable transaction has to rollback local modifications as well as to retrieve the list of changes from the server to reestablish the congruency between the local and the server version of the workspace's shared data (cf. Rice 2003a, p. 416).

These client-side operations, besides the acquisition of locks, are similar to the ones that the server carries out if it has to update a workspace's shared model in response to a valid transaction protocol. As shown in the sequence diagrams depicted in figures 11.76, 11.77, and 11.78, in this case the system, after having performed the obligatory security and validation checks, forwards the transaction protocol as well as the client's user representation to the workspace instance with which the client that has committed the changes is associated. This instance, in turn, tries to acquire write locks for all contributions that are affected by the

379. This pattern, similar to the pessimistic offline lock pattern (cf. Meier et al. 2009, p. 105; Rice 2003b) realized by the reference monitor (see section 11.5), is one of the more frequently employed concurrency control mechanisms (see also Meier et al. 2009, p. 105; Rice 2003a).

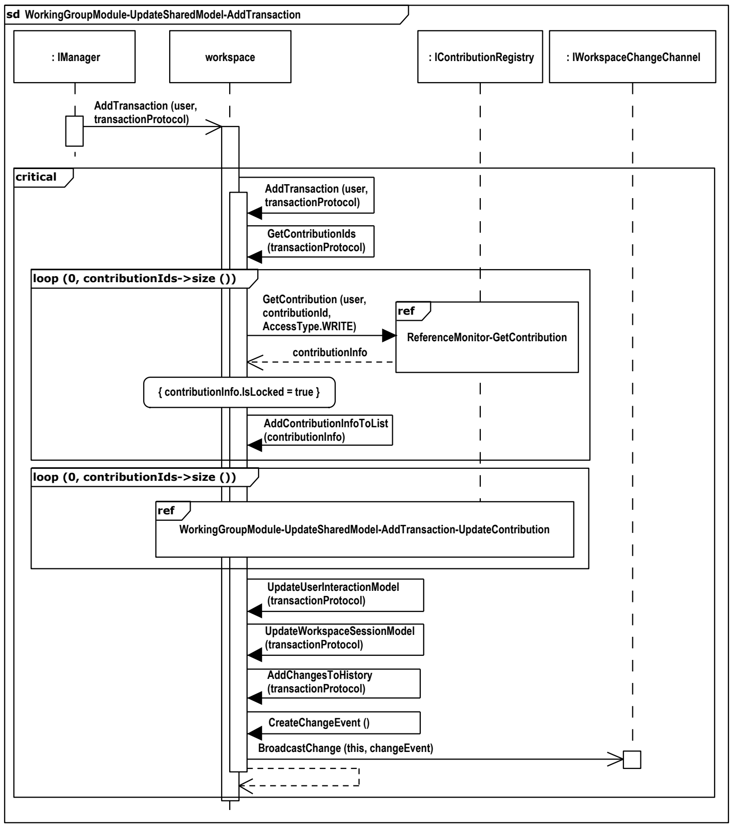

Figure 11.77: WorkingGroupModule-Update Shared Model-Add Transaction Protocol (SD-WGM-09)

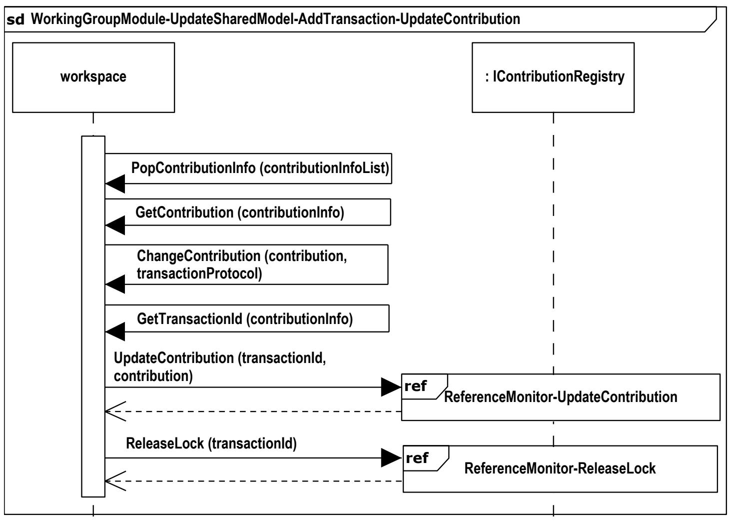

Figure 11.78: WorkingGroupModule-Update Shared Model-Add Transaction- Update Contribution Protocol (SD-WGM-10)

received transaction. Only if this attempt is successful, it proceeds by modifying the reserved elements and releasing all established locks (see figure 11.78). Assuming that this process completes as expected, the workspace instance's next tasks, before propagating the change event to its observers, are to update the remaining parts of the shared data. This includes, inter alia, the user activity list, the session model, and the activity history. As these resources are uncontested, that is, they do not need to be protected by a concurrency control technique, the respective update procedures as final actions in the 'create workspace' protocol are relatively straightforward local operations. Although the previously discussed interaction sequences are primarily concerned with the processes underpinning working groups, the reference architecture's module examined in the following, despite being employed in a completely different, non-group-oriented phase, not only sets up a comparable infrastructure, but it also has a similar core protocol.

The Problem Structuring Module is the key component employed in the decision-making process' problem structuring phase. It is responsible for supporting citizens in their endeavors of carving out the causal structure that underpins the focal problem selected in the problem identification phase. It provides its services through the coordinated interaction of the seven submodules depicted in the component diagram shown in figure 11.79. As mentioned above and suggested by the submodules' names, their responsibilities and offered functionalities are similar to those of their previously explored counterparts.

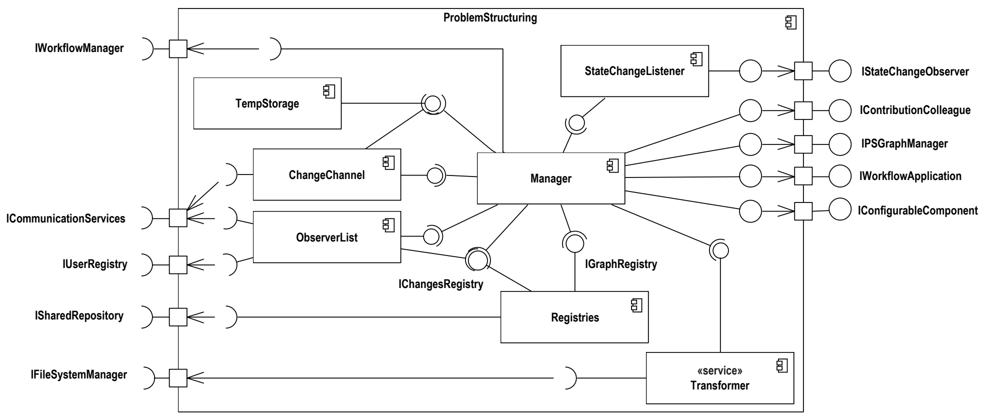

Figure 11.79: Refinement of the ProblemStructuring Module

This applies to the `Manager` submodule, which serves as the module's central interface, the `StateChangeListener` submodule, which listens for state changes propagated by the `EventBus` submodule of the `Core` module, and the `Registries` submodule, which offers an implementation of the `IGraphRegistry` interface as well as the `IChangeRegistry` interface. Whereas the `Registries` submodule in its nature as the realization of the former holds references to those entities that together constitute the problem structuring graph (see the discussions at the end of chapter 10 and in section 11.1), it also maintains, by functioning as instantiation of the latter, a list of changes that have been made to the problem structuring graph. Furthermore, as the problem structuring graph's constituents, by virtue of being publicly available contributions, have to the pass the scrutinizing hurdle, the `ProblemStructuring` module also comprises a `TempStorage` submodule that, similar to the one of the `ProposalManagement` module, stores newly created, not yet scrutinized contributions until they are released by being approved of by safe environment experts.

Moreover, the `ChangeChannel` submodule and the `ObserverList` submodule are two different manifestations of the afore-mentioned publish-subscribe pattern. In fact, the `ChangeChannel` submodule is a simpler and more general version of the `WorkingGroup` module's `WorkspaceChangeChannel` submodule. It informs all citizens, who are viewing the problem structuring graph while the latter is updated, about interim modifications to ensure that, after the client has retrieved the list of changes from the `IChangeRegistry` interface realization, they always view the most recent version of the graph. The corresponding interaction sequence, due to the closeness of both these change propagation channels, can be based on a pared-down variant of the `WorkingGroup` module's two-stage core protocol: firstly, a client that presents the latest version of the problem structuring graph to a user, creates and registers a callback function with the server in, for example, the view's load event, and secondly, the `Manager` submodule, if moving a contribution from the `TempStorage` submodule to the `IGraphRegistry` interface realization and adding the change to the `IChangeRegistry` interface instance, induces the `ChangeChannel` submodule to broadcast a change event to all registered observers. In contrast to this resemblance, the different nature of the problem structuring graph and the constraint that citizens can only add new entities to the graph (see section 11.3) further simplify the `ProblemStructuring` module's central interaction specification, because it does not need, at least in the described form, to incorporate concurrency control mechanisms. On the other side, the `ObserverList` submodule is an asynchronous version of the publish-subscribe pattern: it does not update currently active clients, but it, using the `ICommunicationServices` interface realization, notifies those inactive users who indicated that they want to be informed about changes in, for instance, a daily e-mail. Offering such a service is not only important to keep citizens involved in the problem structuring phase (cf. Kelly et al. 2012, p. 8), but it is important, similar to the idea of sending information messages after each workflow step (see the activity diagrams examined in section 11.3 and those shown in annex C.2), to make citizens feel connected (cf. Hertzberg and Monteiro 2005, p. 382), which, in turn, is a prerequisite for the development of a (g)local identity.

Finally, the `Transformer` submodule, as the `ProblemStructuring` module's remaining constituent, offers two different services: on the one side, it is responsible, like its already discussed counterparts, for transforming the problem structuring graph into an unformatted, logical representation, i.e., for the first stage of the two step view pattern, and on the other side, it also converts the problem structuring graph into a format that can be handled or, more precisely, translated into an initial model by the reference architecture's seventh module, that is, the `ModelAndEvaluation` module discussed in the following.

The Model and Evaluation Module is the connecting link between the decision-making process' problem structuring and alternative design phases. As discussed at the end of chapter 10, the citizen-created causal structure underlying the focal problem not only provides the set of intervention entry points that are used to design alternatives, but it also serves as basis for the development of an evaluation model that allows to estimate the effects and side-effects of designed problem resolutions. Although such models might also be utilized for 'what if' scenarios (cf. Lewis, Casello, and Groulx 2012, p. 87), the present inquiry's 'second research project', due to its exemplary nature, conceives them as static assessment tools and leaves the incorporation of a temporal dimension to the designers of concrete, derived architectures. In other words, currently only the two basic roles that evaluation models or, more precisely, the results of their application play in the decision-making process are of interest: on the one side, their capacity to support the voting endeavors of local citizens by offering a common frame for the comparison of options, and on the other side, their function as informational basis that alternative working group participants can analyze to identify opportunities for the (re-)design of their interventions. As pointed out before, to ensure the comparability of assessments in the former as well as to avoid misusing evaluations to present alternatives in a better light in the latter usage scenario, the model is ideally developed and maintained by an independent third party that has specialized knowledge in the focal problem's domain.

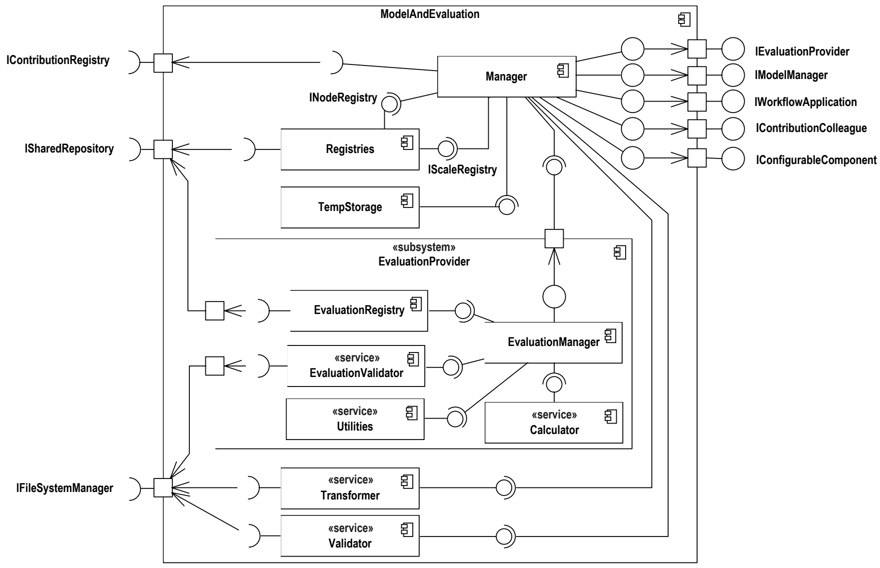

Figure 11.80: Refinement of the ModelAndEvaluation Module

Correspondingly, the core interaction partners of the `ModelAndEvaluation` module are three different entities: firstly, the clients of those users that create the model, that is, of scientists (see section 11.1 and the activity diagrams AD-PS-04 to AD-PS-09 in annex C.2); secondly, the `ScrutinizingAndReview` module as well as the `VotingAndSelection` module, which, via the `ContributionMediator` submodule, retrieve assessment results to include them in the presentation of review tasks and voting options respectively; and finally, the clients of alternative working group participants that use the model to evaluate their designed interventions (see the activity diagram AD-AD-07 in annex C.2). As the protocols of the former two situations are similar to the ones of creating, presenting, and editing contributions as well as review tasks (see the sequence diagrams SD-PMM-03 to SD-PMM-07 as well as SD-SRM-03 to SD-SRM-05 in annex D.2), the respective interaction sequences can be used as blueprints for both these specifications. Therefore, the following discussion focuses on the exploration of the third activity, that is, on the evaluation of alternatives.

As suggested by the naming in the component diagram shown in figure 11.80, the underlying service is offered by the encapsulated `EvaluationProvider` subsystem. However, the `ModelAndEvaluation` module, in addition to this subsystem and its entailed submodules, comprises five further components, which, despite minor variations, are all comparable to their previously examined counterparts. This includes (i) the `Manager` submodule, which aims to decouple the `ModelAndEvaluation` module's constituents from their clients and provides an opportunity for the integration of crosscutting concerns (see section 11.5), (ii) the `TempStorage` submodule, which is concerned with the storing of lists of representations as well as of intermediary results created during an evaluation, (iii) the `Transformer` submodule, which, as indicated before, not only addresses the compatibility quality attribute issue (see section 8.3) and translates the model into an unformatted, logical representation, but also converts the output of the ProblemStructuring module's Transformer submodule into a structure that can be handled by the ModelAndEvaluation module's components, (iv) the Validator submodule, which, in addition to the business rule-related validity checks of user input, is used to assess the model in its total (e.g., the mapping of value functions between parent nodes and their children as described in section 11.3), and (v) the Registries submodule, which offers implementations of the INodeRegistry interface and the IScaleRegistry interface, that is, for those two types of elements that together constitute the evaluation model (see also section 11.3).

Whereas all these submodules provide the infrastructure for the creation of the evaluation model, the latter's application is underpinned by the services realized by the EvaluationProvider subsystem or, more precisely, its five submodules: (i) the EvaluationManager submodule, which, similar to the other Manager submodules, serves as the central interface for and coordinator of the remaining submodules[380], (ii) the EvaluationRegistry submodule, which hides and extends the functionalities of the data access layer in a transparent manner, (iii) the EvaluationValidator submodule, which performs completeness and plausibility checks on evaluations, (iv) the Utilities submodule, which offers several supporting services that are used in the evaluation process, and (v) the Calculator submodule, which, based on a completed evaluation questionnaire, determines the final assessment outcomes. The interactions of these five submodules in regard to the 'evaluation process' protocol as the central interaction sequence of the present discussion is shown in figure 11.81 and in the refinements of the referenced sequence diagrams examined below.

The first of these referenced sequence diagrams, similar to the protocols discussed in the ScrutinizingAndReview module as well as the WorkingGroup module explorations, is concerned with the presentation of an overview of those proposals with which the user is associated and that are evaluable, that is, for which Proposal.Evaluable equals true (see the sequence diagrams SD-MEM-02 and SD-MEM-03 in annex D.2). This condition is ideally fulfilled, although the designers of derived architectures can concretize it differently, in two stages of an alternative proposal's lifecycle (see section 11.1): firstly, it should be possible or it might even be mandatory to evaluate an alternative before it can be committed because this ensures that the alternative working group participants' assessment is double-checked by reviewers, and secondly, it should be possible to create a second evaluation before the alternative proposal is finalized, because aligning the contribution with the reviewer's suggestions can lead to changes, which, in turn, might require an update of the evaluation. However, as an alternative proposal is reviewed only once, the opportunity to make a second evaluation might be exploited or misused for the above-mentioned purpose. To reduce this risk at least partially, the EvaluationProvider subsystem not only finalizes the first evaluation if the proposal is committed, but it also creates a new, second evaluation if alternative working group participants take advantage of the possibility to reassess their intervention after the review process. Furthermore, in the alternative selection phase of the decision-making

380. The rationale to decouple the submodules of the EvaluationProvider subsystem from the remaining submodules of the ModelAndEvaluation module by introducing the EvaluationManager submodule as additional layer is as follows: it faciliates the separate evolution of both sets of submodules. Although it might also be possible to completely separate the EvaluationProvider subsystem, it heavily depends, as illustrated more thoroughly below, on the ModelAndEvaluation module. Therefore, encapsulating the set as separate subsystem and offering a separate Manager submodule, is a compromise between a complete separation and a full integration.

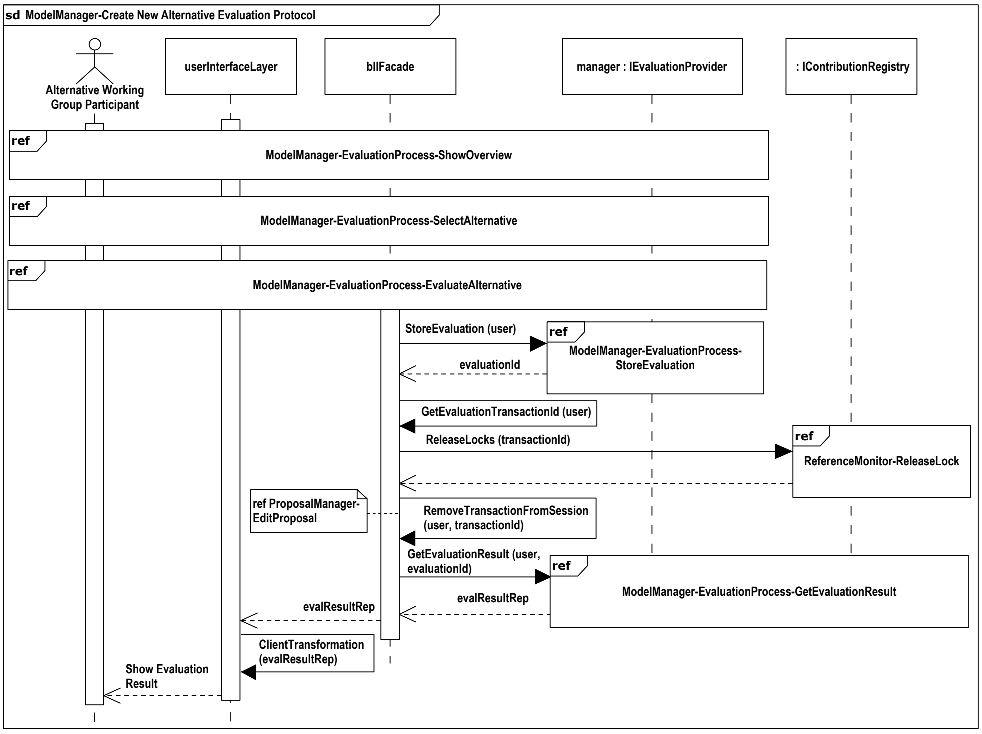

Figure 11.81: ModelManager-Evaluation Process Protocol (SD-MEM-01)

process both evaluations as well as the review are integrated into the presentation of voting options, because this allows local citizens to comprehend how the alternative proposal and its evaluation have changed in response to and after the review. Nevertheless, as the overview presentations in the `ScrutinizingAndReview` module as well as the `WorkingGroup` module already explored the steps involved in this specification (see the sequence diagrams SD-MEM-02 and SD-MEM-03 in annex D.2 for its details), the discussion directly turns to the second referenced sequence diagram of the protocol shown in figure 11.81 (see SD-MEM-04 in annex D.2), which, besides the obligatory security checks and the inclusion of the transaction identifier associated with the selected alternative in the user's session, entails the 'prepare evaluation' protocol depicted in figure 11.82 as its core process.

As the diagram reveals, this part of the preparation of an evaluation is the result of a close cooperation, manifesting itself in three different interactions, between the `EvaluationProvider` subsystem's `Manager` submodule and the `IContributionRegistry` interface realization. In their first interplay, which is preceded by some local operations that aim to separate the transaction identifier associated with the selected option from those that are related to all other evaluable alternative proposals presented in the overview step, they release all but the lock established for the selected item. In the second and third interaction, the `EvaluationManager` submodule fetches the proposal and the corresponding alternative respectively (see also the preliminary object model shown in figure 11.8). Whereas the retrieval in the former situation is simple and straightforward, because the proposal has already been locked in the overview stage, the latter case, as indicated by the state invariant, also needs to establish the lock (see also figure 11.36). Assuming that the flow is a valid trace, the transaction identifier of the third exchange then needs to be added to the `transactionInfo` object that, after the 'get evaluation steps' protocol shown in figure 11.83 has been executed, is returned to the caller, which, in turn, stores the identifier in the user's session.

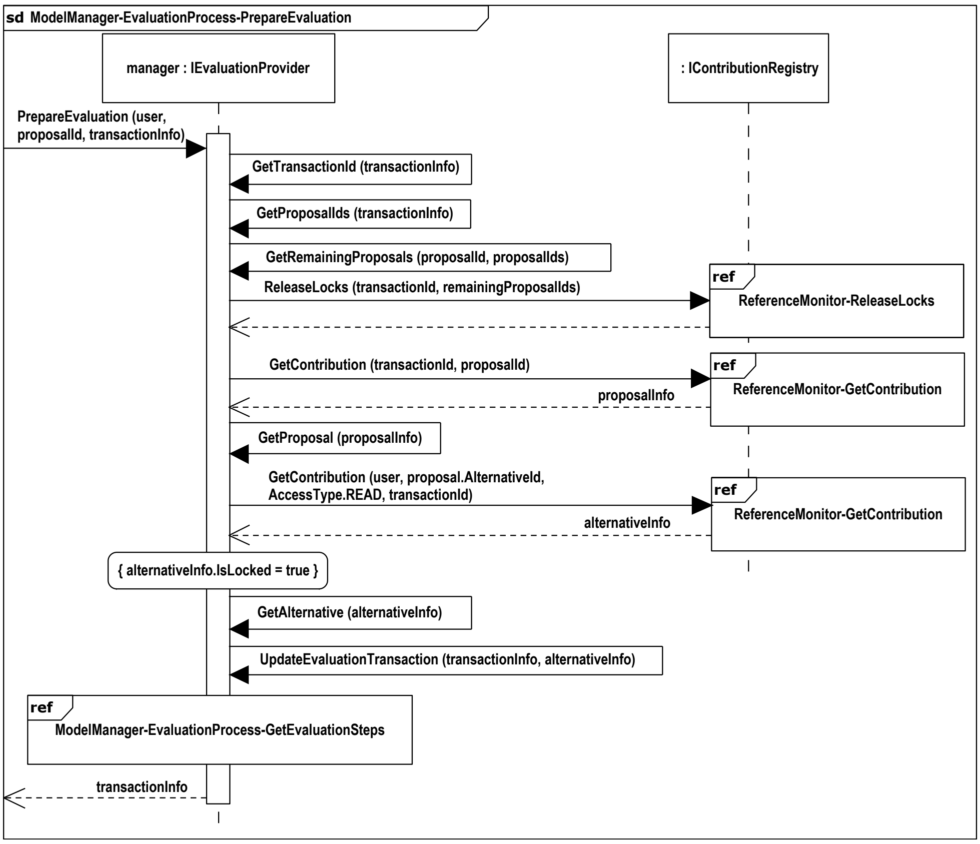

Figure 11.82: ModelManager-Evaluation Process-Prepare Evaluation Protocol (SD-MEM-05)

The core of this interaction sequence, similar to the comparable processes explored in the foregoing discussion, is the creation of unformatted, logical representations by the `Transformer` submodule and the storing of these preliminary views in the `TempStorage` submodule. However, in contrast to the previously examined cases, the construction procedure in this context cannot derive the representations solely from the focal objects and the loaded template; rather, the `Utilities` submodule is employed to devise a sequence of evaluation steps based on the proposal, the corresponding alternative, and the model, which, as indicated before and captured by the first two exchanges in the protocol (see figure 11.83), is a combination of nodes and scales. The lists containing these latter two entities are directly retrieved from the local registries, because it was assumed that the model is finalized when the decision-making process enters the alternative design phase (see section 11.1). If, however, the designers of concrete, derived architectures decide to make the model editable in this phase of the decision-making process, then (a) they need to integrate a mechanism for the handling of outdated evaluations and (b) they should also incorporate the reference monitor in these two interactions to avoid undesirable side-effects (see figure 11.38 and the discussion in section 11.5 respectively). Nevertheless, an evaluation step, as pointed out at the end of the preceding chapter, involves, in addition to the general listing of resources required for the intervention's realization, the more specific selection of scale values for each model dimension, that is, the specification of the estimated or potential impact of each activity entailed in the alternative on each leaf node in the evaluation model (see also section 11.1). A list of such evaluation steps, either in an XML-based format or as set of DTOs, is then passed to the

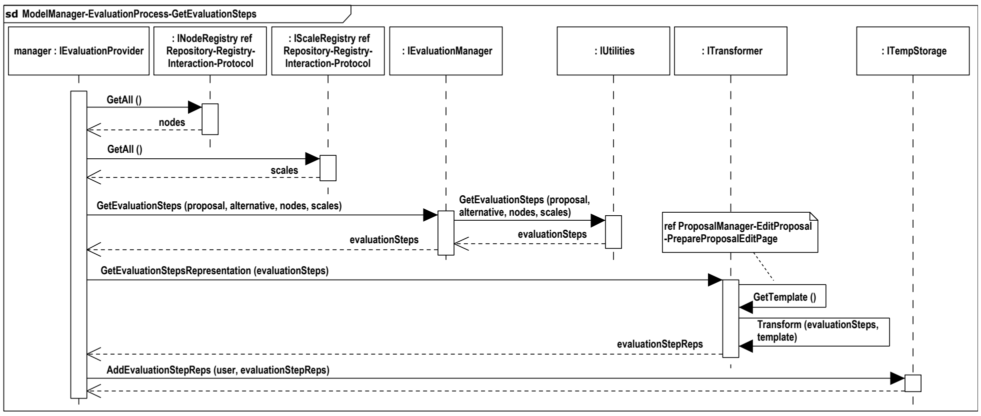

Figure 11.83: ModelManager-Evaluation Process-Get Evaluation Steps Protocol (SD-MEM-06)

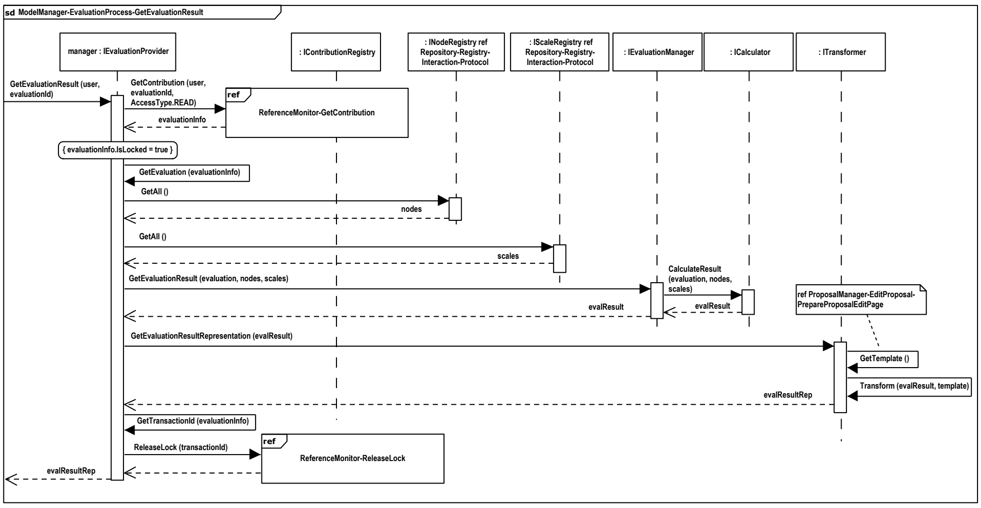

Figure 11.84: ModelManager-Evaluation Process-Get Evaluation Result Protocol (SD-MEM-09)

`Transformer` submodule to get the unformatted, logical representations that are stored in the `TempStorage` submodule until they are used in the actual evaluation process (see SD-MEM-07 in annex D.2). As this interaction sequence and the 'store evaluation' protocol (see figure 11.81) are comparable to the already reviewed steps of the 'voting process' protocol (see figures 11.62 and 11.63), the discussion now turns to the final part of the evaluation process, that is, to the calculation and displaying of the evaluation result as depicted in refinement of the last referenced sequence diagram shown in figure 11.84.

The specification prescribes that the `ModelAndEvaluation` module's `Manager` submodule in its role as `IEvaluationProvider` interface realization first fetches the created evaluation as well as, assuming that the former action is completed successfully, the lists of the model's two constituents and then forwards these three entities to the `EvaluationManager` submodule. The latter, on its part, induces the `Calculator` submodule to determine the final evaluation result. This procedure is carried out by using the model's value functions to map the selected scale values of nodes, starting with the model's leaf nodes, onto the attribute values of their parents until the algorithm has reached the model's root nodes. If it is allowed to leave attribute values of leaf nodes unspecified, this might result in a tree of evaluation outcomes, because the `Calculator` submodule, if not otherwise concretized by the designers of derived architectures, creates multiple different mappings—each based on one of the values that could have been selected for the unspecified dimension. The rationale underpinning this approach is that the emerging tree provides an overview of the possible impact spectrum of the intervention's realization, which, in turn, gives local citizens a better understanding of the potential effect as well as side-effects. Nevertheless, the output of the `Calculator` submodule, leaving the `Transformer` submodule's conversion and the releasing of the corresponding lock aside, is then forwarded to the user interface layer, which translates the unformatted, logical representation of the evaluation outcome into a client-specific format to display it to the user. The latter, as indicated above, then explores the presented assessment or, more precisely, the mapping of values in the model's node hierarchy to identify those aspects of the alternative that might need to be re-designed to improve the intervention.

After this brief exploration of the business logic layer's last module, the inquiry now turns to an even shorter review of the two topmost layers of the reference architecture's overview presented in figure 11.33, that is, to the user interface and the service layer. This, in contrast to the foregoing discussion, considerably less detailed elaboration not only aims to give a rough sketch of the two central clients of the components described before, but it also serves as closing of the description of the reference architecture candidate and thereby of the present inquiry's 'second research project'.

The User Interface Layer and the Service Layer

As indicated in the introduction to this section, an exploration of the user interface and the service layer, despite being too specific—at least from a reference architecture design stance—and therefore actually out of the present inquiry's scope, is inserted to give a brief glimpse of the two layers that make use of the reference architecture's core, that is, of the business logic layer's services, to round out the candidate description by complementing the two discussions of underpinning layers at the beginning of this section by a client perspective.

The service layer, as the first examined entity, is a thin layer that encapsulates the business logic layer's functionalities in an array of services provided to consumers (Stafford 2003, pp. 133–134). Although Stafford (2003, p. 135) suggests that the service layer, an understanding closely resembling that of the business logic layer facade (see section 11.5), is a general layer on top of the business logic layer, which even the user interface layer in an ordinary web application uses to get access to required services, the present inquiry, thereby following Meier et al. (2009, pp. 58–60), uses the term 'service layer' for the component that channels the message-based communication (cf. Buschmann, Henney, and Schmidt 2007a, pp. 420–421) between the DSS and (unknown) remote technical systems. Incorporating such a layer in addition to the user interface layer is not only, as already suggested in section 11.4, a compromise between the web application and the SOA archetype considered as basis for the reference architecture design cycle (see also section 8.3), but it also does justice to the convergence of these application archetypes (see also section 11.4). An example for a usage scenario of the service layer in the extracted use cases is the, briefly touched in section 11.3, gathering of data using mobile applications: in this interplay the service layer provides the service counterparts for these data gathering clients, which without prior notice send collected data to be stored and used by the DSS[381]. Although it is nevertheless possible and in certain circumstances even beneficial that user interface components use the service layer to retrieve data, for example, some client-side parts in Ajax-based web applications, establishing the service layer as general intermediary is a procedure that entails a considerably burden, because services are self-describing entities, which, in contrast to the inter-component communication in ordinary web applications, (i) use platform-independent messages to exchange commands and data, (ii) do not make any assumptions about clients, which, in turn, manifests itself in general interfaces, and (iii), due to the latency of networks, usually have more coarse-grained interfaces to reduce the number of requests (cf. Juric and Pant 2008, p. 38). Therefore, the service-side parts of the user interface layer ideally interact through the more fine-grained interface of the facade without accepting the additional overhead imposed by using the service layer (see figure 11.29).

The second, this time standard, human-oriented component of the selected application archetype (see section 11.4) is the main entry point for users to access the services of the DSS. More specifically, the user interface layer provides modules for the displaying of data, the gathering of user input, and the controlling of user interactions (cf. Meier et al. 2009, p. 68; Newton 2007, pp. 12–13, the latter also on the relationship between presentation and user interface layers, not explored in the present inquiry). As the supported activities depend, at least partially, on the employed technology and might also vary with different, concrete client types, there are usually several pairs of client- and server-side user interface layer components (cf. Hassan and Holt 2000, p. 153). Those protocols examined in the foregoing discussion that involved actors as well as the user interface layer, presented the corresponding interaction sequences mainly in their typical web application form, that is, it was assumed that the user accesses the application via a web browsers and that the communication between clients and server, at least in most cases, follows the traditional post back strategy. However, in a layered architecture the user interface layer can be replaced without or minimal changes to lower levels, for instance, to enhance the application's user experience and responsiveness by integrating more Ajax-enabled views or by designing one of the increasingly popular apps for tablet and pad devices. Nevertheless, as such scenarios are technology-dependent and thereby not part of the design of a technology-agnostic reference architecture, they need to be specified in the endeavor of deriving a concrete architecture for a particular application context. Yet, the previously examined interaction sequences still roughly sketch essential requirements and key parts that such extensions or variations need to consider.

Although this last part of the description of the reference architecture candidate completes the 'second research project', which, by virtue of being a self-contained study, suggests that this exploration should be followed by a closing remark. However, this discussion, due to the exemplary nature of the 'second research project', is incorporated into the one of the final, concluding chapter of the present inquiry.

381. For a comparable example of a web application that provides such services see: `http://www.giscloud.com/apps/mobile-data-collection-portal`, accessed May 25, 2015.

Part V

Conclusions

Chapter 12

Summary of Findings

"Many people now draw the conclusion that the problem with Marxism is its 'utopianism', and that utopias are dangerous. But if Marxism had been more unabashedly utopian, it would not have had the same motive to evade discussion of the mechanics of its proposed future society. The attempt to abstain from utopianism merely leads to unexamined utopias. Critical utopianism could emerge as a legitimate branch of social science [. . .]. This branch of enquiry would not immediately arrive at unanimous agreement on which utopias were out of the question, but there may be rapid convergence on some limited conclusions, along with an identification of those areas still open to investigation and debate. There is no escape from utopianism, other than mute abstentionism. But we can criticize our utopias, discard those convicted of unfeasibility, and replace them with better utopias. Wishful thinking is no vice, but openness to argument is a wonderful virtue."

Steele (1992, p. 375)

After the more specific, illustrative discussion of the exemplary application of the method for the design of 'possible worlds' in part IV, the examination in this final part of the dissertation is primarily—although not solely—concerned with the first or focal layer of the present inquiry's dual exploration (see chapter 2). In this regard, the introduction to this study stated, on the one side, that C&E DSRIS, at least if underpinned by the currently predominating conceptualization, is impossible as well as that DSRIS, given that it is morally responsible for the (side-)effects of its projects (cf. Niiniluoto 1993, p. 15), is unable to assist in the 'completion' of the unfinished project of modernity, because the traditional methodological foundation of DSRIS is internally connected to the concept of instrumental rationality (see part I and section 5.2). On the other side, it was also pointed out that C&E ISR is depriving itself from unfolding its full potential, that is, of its transformative dimension, because it is intimately interwoven with the ontological and epistemological assumptions of (radical) social constructivism (see section 5.3). To contribute to a resolution of both these limitations in the discipline's methodical repertoire, the present inquiry sets out to devise a method that is critically constructive and constructively critical. This endeavor, rooted in a reflection of the philosophical foundations of both streams of ISR (see chapter 7), culminated in the method for the design of 'possible worlds', which, on the one hand, is, by virtue as theoretical approach, freed from factual constraints and systemic imperatives, i.e., the causes of the afore-mentioned limitations in (C&E) DSRIS, and on the other hand, results in constructive suggestions put forward as alternatives to factually existing circumstances that are criticized as undesirable, that is, it overcomes the destructive negativism plaguing C&E ISR (see chapter 8). This central aim of the dissertation, which manifests itself in the first research question (see section 6.1), was achieved by basing the synthesis of the methodical guidelines of both ISR streams on a position in the philosophy of science that can account for the peculiarities of socio-technical systems and by appropriating a suitable research strategy, that is, the realist synthesis, to distinguish 'possible worlds', defined as abstract, future, not yet realized but still at least theoretically possible socio-technical systems, from the unexamined utopias mentioned in the introductory quote (see also part III). Although these three strands integrate seamlessly, a consequence of their interplay is that the justification of the designed artifact is based on fallible evidence. Nevertheless, this is an unavoidable 'flaw' in (applied) sciences dealing with open systems that, even if it is seldom openly acknowledged, is equally present in traditional approaches and their evaluation in practical settings. However, the idea of 'possible worlds' is not to provide ready-made, directly applicable solutions for problems in practice; rather, they serve as inspiring and adaptable input to communicative processes in which those affected by issues devise contextual solutions, that is, they mainly address research's responsibility to enlighten society (cf. Albert 1972, pp. 89–93):

> "Science must be protected from ideologies; and societies, especially democratic societies, must be protected from science. This does not mean that scientists cannot profit from a philosophical education and that humanity has not and never will profit from the sciences. However, the profits should not be imposed; they should be examined and freely accepted by the parties of the exchange. In a democracy scientific institutions, research programmes, and suggestions must therefore be subjected to public control, there must be a separation of state and science just as there is a separation between state and religious institutions [. . .]" (Feyerabend [1975] 1993, pp. viii).

From this discourse-related perspective, the abandonment of the aspiration to achieve absolute validity, if possible at all, is tolerable. An example of such fallible contributions to lifeworld discourses is given through the illustrative application of the design of 'possible worlds' method in part IV. This discussion's primary goal, based on the conceptualization of SHD outlined in section 5.5, was to demonstrate that community-driven SHD initiatives in urban localities of Western, democratic countries—a missing or largely neglected link in the SHD endeavor—are desirable and at least theoretically possible. This program was realized (i) by describing the key factors of factually existing urban localities in Western, democratic countries (see section 10.1), (ii) by explicating the core parts of the envisioned initiatives as well as their underlying normative value position, and (iii) by scrutinizing the former (i) from the perspective of the latter (ii) (see section 10.2). This preparatory step then gave rise to an examination in which some of the insights gained in research on community-driven development, community cohesion, and co-managed natural resources were synthesized to carve out the draft meanings and organizational options that might occur through a transition from the factual world to the 'possible world' (see chapter 10). This more socially oriented analysis, in turn, was complemented by the technical investigation in chapter 11. It used the extracted social structures as a reference model for the elicitation of requirements, which, on their part, provide the basis for the design of a reference architecture that serves as a blueprint for technical systems supporting the decision-making processes within the envisioned initiatives. This aspect of the dissertation was enabled by integrating three existing techniques of the software engineering literature into a preliminary reference architecture design cycle (see section 8.3), which not only structured the actual design process, but also the textual report of the former's results.

Due to the exemplary nature of the 'second research project' carried out in the present inquiry, the descriptions, especially that of the 'possible world', followed a purely narrative format. As will be discussed more thoroughly in chapter 14, the (recently) gained insights in theory development in DSRIS in particular and ISR in general might fruitfully be employed to devise a more sophisticated structure of a ‘possible world’ description and to connect it more clearly to the construction of a reference model. However, before the discussion delves into the details of this potential extension, the elaboration in the next chapter complements the foregoing examination by a review of contributions that the present study makes to the disciplinary body of knowledge.

Chapter 13

Knowledge Contributions

The present inquiry's contributions to the body of knowledge, as already indicated in chapter 3, unfold on different, audience-related dimensions. The most central of these inputs is the extension of the discipline's methodical repertoire. The method for the design of 'possible worlds', on the one side, addresses the lack of dedicated methods in the C&E ISR stream (cf. Cecez-Kecmanovic 2005, pp. 37, 39–40; 2011, p. 440; McGrath 2005, p. 93), and on the other side, offers a potential avenue for projects that aim to mitigate or resolve the issues involved in the 'envisioned world problem' (cf. Woods and Dekker 2000, pp. 276–277).

These two audiences, that is, scholars interested in C&E ISR and (C&E) DSRIS, respectively, not only benefit from the methodical suggestion to the disciplinary body of knowledge, the thorough examination of the implications that unfold if a study is rooted in a certain philosophical position is a particularly relevant insight, because a mismatch of ontological and epistemological assumptions on the one side and methodical derivations on the other side leads to presuppositional inconsistencies that undermine the validity and significance of research results (see sections 5.2, 5.3, 7.1, and 7.2). This, in turn, hampers all efforts to establish ISR as a science that is accepted and valued by relevant reference disciplines.

Another, although not fully explored addition to ISR's knowledge base emerges from the present inquiry's 'second research project'. More specifically: the recently proposed 'framework for the analysis and design of software reference architectures' (cf. Angelov, Grefen, and Greefhorst 2012) has, as Angelov, Grefen, and Greefhorst (2012, p. 430) emphasize, not been employed in development efforts (see also chapter 2). Correspondingly, the exemplary application in the dissertation offers preliminary evidence that such undertakings are feasible (see chapter 11) and, at the same time, points out how the framework can be integrated with existing software engineering techniques to form a comprehensive reference architecture development approach (see section 8.3). This latter aspect, in turn, reveals facets that can be taken up by investigations that aim to extend the framework in the design direction.

However, the focal contributions of the 'second research project' actually unfold on the SHD dimension. From an ISR-related stance, the outlined conceptualization of SHD as well as the process perspective taken in the exemplary application, are particularly relevant to 'Green IT' researchers that usually focus on culmination outcomes (see sections 5.5 and 10.2). Complementing the latter by the former to achieve a comprehensive outcome perspective is, in combination with the method for the design of 'possible worlds' itself, vital to make progress in terms of SHD as pointed out by one of the leading figures of this movement:

> "There is not time to wait for an evolutionary process to produce the

> needed innovations. We need to learn systematically about how to structure analytic deliberation effectively" (Stern 2005, p. 981).

In the same vein but from a different angle, the explication of community-driven SHD initiatives aiming, inter alia, to reconstruct the public sphere within civil society organizations (see chapter 6) is an attempt to draw attention to the neglected link between (inter-)national efforts such as the UN Climate Change Conferences and the individual or household level: on the one side, imposing regulations devised behind closed doors from 'above', even if they are well-intentioned, is a form of paternalism and implementing these restrictions, especially if they are not carried by the willingness of those affected, requires substantial resources; on the other side, those group norms that are responsible for undesirable effects can hardly be changed by isolated individuals (see sections 5.5 and 10.2). Therefore, (re-)establishing an intermediary interaction platform that allows citizens to participate in and to learn about as well as within the process tends to be a necessary complement. In this regard, the synthesis of insights gained in three related research streams, i.e., community-driven development, community cohesion, and co-managed natural resources, revealed that there are striking similarities in the way each domain tries to resolve its focal concerns. To the best of the author's knowledge and beliefs an investigation of how to tackle the various intertwined problems simultaneously by incorporating the insights of these three and other relevant areas has not yet occurred. Hence, the discussion in section 10.3 provides an initial step in the endeavor to create an integrated, interdisciplinary or, which tends to be even more promising, metadisciplinary body of knowledge.

Finally, the second, more technical facet of the 'second research project', despite being specifically concerned with decision-making processes, also contributes to practical discourses, because a reference architecture supports the evaluation as well as the development of corresponding technical systems. Therefore, it is an important instrument that civil society organizations can use to save chronically lacking resources (e.g., money, manpower). These assets, on their part, can then be spent on, from the perspective of the organization's aims, more 'profitable' and target-aiming projects. However, as the designed reference architecture captures only one of a civil society organization's processes, an extension to include further aspects of their operations is necessary. Although this is only of secondary nature to the present inquiry, the next chapter explores this and other avenues for future research.

Chapter 14

Limitations and Future Research

The aim of this final chapter of the present inquiry is to point out the study's inevitable limitations to indicate options for further research. As already indicated in the foregoing discussion, one route that future investigations can take is the combination of the design of 'possible worlds' with those efforts in ISR and DSRIS that are concerned with the development of theories (see also chapter 9). This avenue, however, is not a one-way street; rather, the recently made advances, for instance, manifesting themselves in the studies of W. L. Kuechler and Vaishnavi (2012b, 2012a), Goldkuhl (2004), or Gregor (2009), can fruitfully be informed by the design of 'possible worlds'. More specifically: whereas theory development in both ISR streams can re-discover the intimately related, path-dependent, social facets of information systems (IS), which, although present to some extent in early theory-related contributions (e.g., Walls, Widmeyer, and El Sawy 1992), are excluded through the narrowing conceptualization of IS (see also section 5.1), the suggested method or, more precisely, its outputs can be substantially enhanced by translating them into a form that is connected to and integrated with the (technological design) propositions constituting ISR (design) theories. This applies to the horizontal and to the vertical dimension of the possibility hierarchy (see section 8.1) as well as to 'transient' structures. Furthermore, both, theory development and the design of 'possible worlds', can benefit from the wealth of knowledge accumulated in the design of socio-technical systems and, as already indicated in section 8.1, the analysis of institutions (cf. Cox, Arnold, and Tomás 2010; Geels 2005; Geels and Schot 2007; Keidel 1995; Lucena, Schneider, and Leydens 2011; Murtinho et al. 2013; Ostrom 1990, p. 90; 2002, pp. 1330–1333; 2012, p. 141; Ostrom and Basurto 2011; Ostrom and Cox 2010, pp. 458–459) as well as the insights revealed through the review of research failures or mistakes (cf. T. Binns 2009b, p. 36). The latter facet, in turn, presupposes a rethinking in science and academic publishing as pointed out by Couzin-Frankel (2013) in her *Science* article, because failed research projects are seldom published (see also section 8.2).

Another point of extension of the dissertation's primary purpose or focal layer concerns the evaluation of artifacts, that is, of designed 'possible worlds' and corresponding reference architectures. Within the present inquiry this aspect, which might be desirable to round out future studies guided by the developed method, was omitted, because the exemplary application mainly served to demonstrate the method's feasibility. On the one side, instruments for the evaluation of 'possible worlds' might be derived from the appraisal functions suggested by O. P. J. Hall (1975) or the applicability checks proposed by Rosemann and Vessey (2008), because these tools allow to account for the discourse-related purpose of 'possible worlds'.

Although both might also be employed in the evaluation of reference architectures, the latter endeavor, on the other side, might draw more fruitfully on already existing techniques used to scrutinize software architectures (see Bass, Clements, and Kazman 2013, chap. 21; Clements, Kazman, and Klein 2002, for overviews). Nevertheless, the abstract nature and the different scope of reference architectures require a range of modifications to make these devices applicable; unfortunately, efforts in this direction are still in an early stage of development (Angelov, Grefen, and Greefhorst 2012, p. 429). Closely related to this latter, more technical facet but originating from the 'second research project', the designed, initial reference architecture itself, in addition to its extension to cover further process of the operation of civil society organizations, should, based on suitable collaborative undertakings, be refined from a preliminary, facilitating reference architecture to a classical one (see section 5.4), because only then does the resource-saving advantage of references architectures mentioned in the preceding chapter fully unfold. In anticipation of such an extension, the specification of the architectural objectives in section 11.2 selected that reference architecture type that, in comparison to other types, rules out as few evolution paths as possible (see figure 14.1).

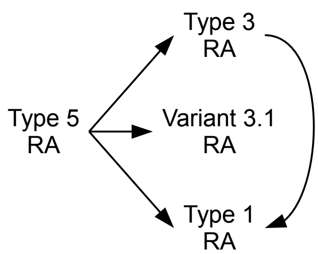

Figure 14.1: Example Evolution Path of a Type 5 Reference Architecture, source: Angelov, Grefen, and Greefhorst (2012, p. 427)

Besides this technical aspect of the exemplary application, the envisioned initiative's scope can also be extended by incorporating the relationship between urban localities and their rural surroundings as well as the global community, because this provides a more comprehensive picture of how it is connected to SHD endeavors on other social units. For example, several studies and reports indicate that urban localities depend on ecosystem services produced in peri-urban and rural areas (see McGranahan et al. 2005, p. 806, and the referenced literature). Not only a normative stance suggests that this justifies some form of exchange to reimburse those who bear most of the costs (cf. Andersson and Ostrom 2008, p. 81), but also a purely instrumental perspective, on the one side, points out that activities in peri-urban areas (e.g., waste disposal, emissions) affect, for instance, the agricultural products urban citizens rely on (McGranahan et al. 2005, p. 809), and on the other side, estimates that payment systems for the maintenance of natural ecosystems (cf. Kosoy and Corbera 2010; Vatn 2010) provide considerable cost reductions in comparison to the artificial manufacturing of such services (e.g., water treatment) (McGranahan et al. 2005, p. 811). Correspondingly, research on how to motivate such exchanges, to determine fair agreements, and to organize this horizontal interaction between localities or initiatives are options for SHD-oriented research projects that aim to extend the set of extracted draft meanings.

A final avenue for further research that concerns both the primary and the 'second research project' of the present inquiry, is the relationship between desirable or ideal worlds on the one side and an active citizenry and societal development on the other side. For instance, it has been pointed out that (too much) civic engagement might be negatively correlated with political activism (cf. Clarke 2008, p. 25; Conover, Searing, and Crewe 2004, pp. 1059–1061), which, in turn, suggests that there is an inherent tension between the involvement of local citizens in the envisioned initiative and SHD as a political process. However, the initiative is more than a service provisioning device, it is itself an embedded political endeavor. Nevertheless, the potential emergence of adverse effects justifies further investigations. Yet, this question can potentially be solved in the near future, whereas the related but more general doubt about the desirability of envisioned, ideal societies might never be answered, although the issue has been raised nearly 300 years ago by Mandeville in his fable of the bees:

> "The Moral
>
> Then leave Complaints: Fools only strive
> (X.) To make a Great an Honest Hive
> (Y.) T' enjoy the World's Convieniences,
> Be fam'd in War, yet live in Ease,
> without great Vices, is a vain
> Eutopia seated in the Brain.
> Fraud, Luxury and Pride must live,
> While we the Benefits receive:
> Hunger's a dreaful Plague, no doubt,
> Yet who digests or thrives without?
> Do we not owe the Growth of Wine
> To the dry shabby crooked Vine?
> Which, while its Shoots neglected stood,
> Chok'd other Plants, and ran to Wood;
> But blest us with its noble Fruit,
> As soon as it was ty'd and cut:
> So Vice is benificial found,
> When it's by Justice lopt and bound;
> Nay, where the People would be great,
> As necessary to the State,
> As Hunger is to make'em eat.
> Bare Virtue can't make Nations live
> In Splendor; they, that would receive
> A Golden Age, must be as free,
> For Acorns, as for Honesty.
> " (Mandeville [1724] 1998, p. 79).

Appendicies

Appendix A

Realist Synthesis

A.1 Community-Driven Development

The results of the screening process can be found on the CD attached to this dissertation. The file is located in the directory `realistSynthesis` and named `Community-driven Devel-opment.xlsx`. It contains, in addition to literature meta-data and its assessment, an overview of query terms as well as a list of considered countries.

A.2 Community Cohesion

The results of the screening process can be found on the CD attached to this dissertation. The file is located in the directory `realistSynthesis` and named `Community Cohesion.xlsx`. It contains, in addition to literature meta-data and its assessment, an overview of query terms as well as a list of considered countries.

A.3 Co-Managed Natural Resources

The results of the screening process can be found on the CD attached to this dissertation. The file is located in the directory `realistSynthesis` and named `Co-managed natural resources.xlsx`. It contains, in addition to literature meta-data and its assessment, an overview of query terms as well as a list of considered countries.

Appendix B

User Stories

Within the following some of the user stories that can be extracted from the discussions in chapter 10, that is, from the designed ‘possible world’, are presented. This enumeration, which is organized around the five phases of the outlined decision-making process, is by no means a comprehensive and final overview; rather, it is an initial, extensible set of user stories that was created within the first step of the reference architecture design carried out in the exemplary application. To avoid unnecessary duplicates of user stories, those that are involved in different phases are mentioned only in that phase in which they occur first.

Indicator Selection

- As a user I want to create an account to get access to the systems functionalities.
- As a user I want to delete my account so that all personal information is removed from the system’s data storage(s).
- As a user I want to edit my profile so that other users can learn more about me and that the system can make personalized suggestions.
- As a user I want to view an overview of interesting events that have taken place since my last login.
- As a user I want to login with the credentials of existing single sign-on providers so that I do not need to create a new account.
- As a board member I want to assign specific roles to users so that they can exercise specific functionalities.
- As a local citizen I want to explore the existing knowledge base so that I get an overview of the locality’s current situation and development.
- As a local citizen I want to view a tutorial on how to create indicator proposals so that the proposal fulfills all (quality) criteria (cf. Greene et al. 2010, p. 2105; Hirschheim and Klein 1989, p. 1209; 1994, pp. 90–91).
- As a local citizen I want to learn about how to write appropriate comments so that the discussion is in the common good.

- As local citizen I want to create a new indicator proposal (see, for example, the list of HD indicators briefly touched in sections 5.5 and 10.2) so that this facet of valuable living conditions is included in the knowledge base (cf. Raymond and Cleary 2013, pp. 4–9, for a case study of an ICT-supported process).
- As a local citizen I want to vote on indicator proposals to indicate my preferences in regard to their importance.
- As a local citizen I want to be informed about each step in the handling of a newly created indicator proposal to keep track of the processing and feel more connected or involved (cf. Hertzberg and Monteiro 2005, p. 382).
- As a local citizen I want to flag proposals and/or comments as inappropriate so that a safe environment is maintained.
- As a citizen I want to comment on indicators proposals so that they are appropriately framed, ideas are incorporated, and local citizens know all types of arguments when they make their votes.
- As a citizen I want to collaborate with other citizens on indicator proposals so that the knowledge base about living conditions in the locality is enhanced.
- As a citizen I want to get access to the system from different devices so that I can use my time more effectively.
- As a citizen I want to know how my comments or arguments have been taken into account in the selection process so that I know they have been taken seriously.
- As a citizen I want to be informed about replies to my comments so that the discussion is kept up.
- As a safe environment expert I want to scrutinize indicator proposals and comments so that they do not endanger the safe environment (cf. Hirschheim and Klein 1989, p. 1209; 1994, pp. 90–91).
- As a safe environment expert I want the system to identify proposals and comments that might endanger the safe environment.
- As a safe environment expert I want to give local citizens feedback on their proposals and comments so that they can improve their current and/or next contribution.
- As a reviewer I want to review indicator proposals of working groups to given them feedback about the proposal's quality as well as its feasibility.
- As a reviewer I want the system to pre-check the completeness of committed proposals so that that the review process is more effective and I save time.
- As a board member I want to initiate a new, time-bound indicator selection phase so that local citizens can form working groups in which they collaborate.
- As a board member I want to use the comparatively inexpensive internet to engage local citizens so that resources are saved for the realization of productive activities (cf. A. R. Edwards 2005, p. 4).

- As a board member I want to select a number of indicators proposals that are maintained by the initiative to provide a better overview of the living conditions in the locality.
- As a board member I want to explain to indicator working group participants why their proposal has not been selected to be included in the initiative's program.
- As an indicator working group participant I want to rework the description of the indicator proposal to incorporate new ideas.
- As an indicator working group participant I want to process the participation requests of citizens to include them in or exclude them from the working group.
- As an indicator working group participant I want to leave the indicator working group so that I am no longer involved in its processes.
- As an indicator working group participant I want to change the database schema of the database in which the data of the indicator should be stored to align it with the latest version of the indicator proposal.
- As an indicator working group participant I want to upload a new mobile data gathering application to make it available to other working group participants.
- As an indicator working group participant I want to create a new and modify/delete already existing questionnaires to prepare the collection of data underpinning the indicator proposal.
- As an indicator working group participant I want to upload a new data collection service to make it available to other working group participants.
- As an indicator working group participant I want to close the indicator proposal so that the working group can focus on the elaboration of the proposal.
- As an indicator working group participant I want to commit the indicator proposal so that it can be reviewed by a reviewer.
- As an indicator working group participant I want to finalize a proposal so that it will be included in the list of proposal available in the voting and selection steps of the decision-making phase.
- As an indicator working group participant I want to manage the organization of the working group so that the project is more target-aiming.
- As an indicator working group participant I want to share documents with other working group participants so that all relevant information is available in an accessible place.
- As an indicator working group participant I want to (video) chat with other working group participants so that we can work more efficiently.
- As an indicator working group participant I want to know why my indicator proposal has not been selected to be included in the initiative's program so that I know it has been taken seriously.

Problem Identification

- As a local citizen I want to share an important personal problem so that the situation leading to the issue can be changed to prevent the issue from emerging.
- As a local citizen I want to explore the existing knowledge base so that I can support my problem proposal with data.
- As a board member I want to initiate a new, time-bounded problem identification phase so that (local) citizens discuss the locality's most pressuring problem.

Problem Structuring

- As a citizen I want to add a cause to the selected focal problem so that all its facets are known.
- As a citizen I want to connect causes so that their relationship is known.
- As a citizen I want to upload material that contains information related to a cause and/or connection so that relevant material is available to all interested parties.
- As a board member I want to initiate a new problem structuring phase so that (local) citizens collaboratively analyze the selected focal problem.
- As a scientist I want the system to transform the problem structuring graph into an initial model to save time.
- As a scientist I want to add scales so that I can use them in the model creation process.
- As a scientist I want to add new, edit existing, and delete unnecessary nodes so that the model reflects the locality and the initiative's aims more appropriately.
- As a scientist I want to add and modify value functions of nodes so that the scales of their children can be mapped accordingly.
- As a scientist I want the system to point out inconsistencies in the model so that I can remove them.
- As a scientist I want to add meta data and descriptions to nodes so that the model is more comprehensible.

Alternative Design

- As a local citizen I want to get informed about proposals that are interesting to me so that I can contribute or comment on them.
- As a local citizen I want to search for potential partners so that I can form a working group that comprises all necessary competencies.
- As an alternative working group participant I want to add new activities to the alternative so that the project is described more completely.
- As an alternative working group participant I want to search for comparable options so that I can include ideas into the alternative proposal.

- As an alternative working group participant I want to review past alternative design approaches so that I can improve the design process of my working group (cf. Stenseke 2009, p. 222).
- As an alternative working group participant I want to get informed about where and how to apply for funding so that I can identify options to gather required resources for the intervention.
- As an alternative working group participant I want to publish resource requests so that potential supporters can see them.
- As an alternative working group participant I want to reply to citizens' comments so that I can explain how these arguments are taken into account (cf. Stern 2005, p. 981).
- As an alternative working group participant I want to create an evaluation of the designed intervention so that the alternative's weaknesses can be analyzed.
- As a resource committer I want to get informed about resource requests that search for resources I offer so that I can support interesting and promising projects.
- As a board member I want to initiate a new, time-bound alternative design phase so that (local) citizens devise solutions for the selected focal problem.
- As a board member I want to analyze the access statistics of alternative proposals so that I can give authors of less frequently accessed proposals feedback so that they can make their proposals more interesting (cf. A. R. Edwards 2005, p. 4).
- As a board member I want to get informed about resource requests so that I can encourage inter-group collective action.
- As a safe environment expert I want to review resource requests and resource offerings so that they do not endanger the safe environment.

Alternative Selection

- As a citizen I want to explore all finalized alternative proposals so that I am informed about potential changes in the locality.
- As a citizen I want to comment on the alternative proposal so that extra-local effects or general concerns of their realization are considered in the voting and selection steps.
- As a local citizen I want to indicate in which way the arguments put forward in favor of an against an alternative proposal have influenced by voting decision.
- As a board member I want to initiate a new, time-bound alternative selection phase so that the initiative's program for the next period can be planed.

Appendix C

Requirements Model Diagrams

C.1 Preliminary Object Models

Within table C.1 the file paths of the preliminary object models on the CD attached to this inquiry are shown (see Esposito and Saltarello 2009, pp. 130–131, for a distinction of domain models from object models). All these files are located in the directory `/UML-Models/ObjectModels`.

Table C.1: Preliminary Object Models

Name	File Path
Indicator Selection	00bObject-Model-Indicator-Selection.pdf
Problem Identification	00bObject-Model-Problem-Identification.pdf
Problem Structuring	00bObject-Model-Problem-Structuring.pdf
Alternative Design	00bObject-Model-Alternative-Design.pdf
Alternative Selection	00bObject-Model-Alternative-Selection.pdf

C.2 Activity Diagrams

The UML activity diagrams of the requirements model can be found on the CD attached to this dissertation. The files are located in the directory `/UML-Models/ActivityDiagrams`. This directory contains five further subdirectories that comprise the activity diagrams listed in the table C.2.

Table C.2: Activity Diagrams

Subdirectory	Id	Name of Activity Diagram and File Path
00Common		
	AD-C-01	Access Dashbaord 01AccessDashboard.pdf
	AD-C-02	Show Login Page 02ShowLoginPage.pdf
	AD-C-03	Show Create Proposal Page 03ShowCreateProposalPage.pdf
	AD-C-04	Show Vote for Proposal Page 04ShowVoteForProposalPage.pdf
	AD-C-05	Show Select Proposal Page 05ShowSelectProposalPage.pdf

Continued on Next Page

	AD-C-06	Show Board Selection Process Page 06ShowBoardSelectionProcessPage.pdf
	AD-C-07	Show Message Box Page 07ShowMessageBoxPage.pdf
	AD-C-08	Show Message Overview Page 08ShowMessageOverViewPage.pdf
	AD-C-09	Show Rejected Contributions Page 09ShowRejectedContributionsPage.pdf
	AD-C-10	Match Arbiter 10MatchArbiter.pdf
	AD-C-11	Match Safe Environment Expert 11MatchSafeEnvironmentExpert.pdf
	AD-C-12	Match Reviewer 12MatchReviewer.pdf
	AD-C-14	Scrutinize Contributions 14ScrutinizeContributions-System.pdf
	AD-C-15	Show Explore Scrutinizing Tasks Page 15ShowExploreScrutinizingTasksPage.pdf
	AD-C-16	Select Objected Assessments Option 16SelectObjectedAssessmentsOption.pdf
	AD-C-17	Show Explore Arbiter Tasks Page 17ShowExploreArbiterTasksPage.pdf
	AD-C-18	Show Explore Review Tasks Page 18ShowExploreReviewTasksPage.pdf
	AD-C-19	Show Edit Proposal Page 19ShowEditProposalPage.pdf
	AD-C-20	Show Process Volunteer Offerings Page 20ShowProcessVolunteerOfferingsPage.pdf
	AD-C-21	Show Close Proposal Page 21ShowCloseProposalPage.pdf
	AD-C-22	Show Commit Proposal Page 22ShowCommitProposalPage.pdf
	AD-C-23	Show Finalize Proposal Page 23ShowFinalizeProposalPage.pdf
	AD-C-24	Show Manage Working Group Page 24ShowManageWorkingGroupPage.pdf
	AD-C-25	Show Evince Interest in Working Group Page 25ShowEvinceInterestInWorkingGroupPage.pdf
	AD-C-26	Show Comment on Proposal Page 26ShowCommentOnProposalPage.pdf
01IndicatorSelection		
	AD-IS-01	Show Indicator Selection Phase Section 01ShowIndicatorVotingPhaseSection.pdf
	AD-IS-02	Show Initiate Indicator Proposal Selection Phase 02ShowInitiateIndicatorProposalVotingPhase.pdf
	AD-IS-03	Show Work on Indicator Page 03ShowWorkOnIndicatorPage.pdf
02ProblemIdentification		
	AD-PI-01	Show Problem Identification Phase Section 01ShowProblemIdentificationPhaseSection.pdf
	AD-PI-02	Show Initiate Problem Identification Phase Page 02ShowInitiateProblemIdentificationPhasePage.pdf
	AD-PI-03	Show Release Problem Proposal Page 03ShowReleaseProblemProposalPage.pdf
	AD-PI-04	Show Board Problem Proposal Selection Process Page 04ShowBoardProblemProposalSelectionProcessPage.pdf
03ProblemStructuring		

Continued on Next Page

Table C.2 – Continued from Previous Page

	AD-PS-01	Show Problem Structuring Phase Section 01ShowProblemStructuringPhaseSection.pdf
	AD-PS-02	Show Initiate Problem Structuring Phase Page 02ShowInitiateProblemStructuringPhasePage.pdf
	AD-PS-03	Show Structure Focal Problem Page 03ShowStructuralFocalProblemPage.pdf
	AD-PS-04	Show Modify Model Page 04ShowModifyModelPage.pdf
	AD-PS-05	Show Modify Scales Page 05ShowModifyScalesPage.pdf
	AD-PS-06	Select Modify Nodes Option 06SelectModifyNodesOption.pdf
	AD-PS-07	Select Remove Node Option 07SelectRemoveNodeOption.pdf
	AD-PS-08	Select Add Child Node Option 08SelectAddChildNodeOption.pdf
	AD-PS-09	Select Modify Value Function Option 09SelectModifyValueFunctionOption.pdf
04AlternativeDesign		
	AD-AD-01	Show Alternative Design Phase Section 01ShowAlternativeDesignPhaseSection.pdf
	AD-AD-02	Show Initiate Alternative Design Phase Page 02ShowInitiateAlternativeDesignPhasePage.pdf
	AD-AD-03	Show Provide Resource Page 03ShowProvideResourcePage.pdf
	AD-AD-04	Show Design Alternative Page 04ShowDesignAlternativePage.pdf
	AD-AD-05	Show Add Resource Request Page 05ShowAddResourceRequestPage.pdf
	AD-AD-06	Select View Resource Requests Option 06SelectViewResourceRequestsOption.pdf
	AD-AD-07	Show Evaluate Alternative Proposal Page 07ShowEvaluateAlternativeProposalPage.pdf
05AlternativeSelection		
	AD-AS-01	Show Alternative Selection Phase Section 01Show-Alternative-Selection-Phase-Section.pdf
	AD-AS-02	Show Initiate Alternative Selection Phase Page 02Show-Initiate-Alternative-Selection-Phase-Page.pdf

Appendix D

Architectural Diagrams

D.1 Component Diagrams

The created UML component diagrams of the reference architecture descriptions can be found on the CD attached to this dissertation. All specifications are located in the directory `/UML-Models/ComponentDiagrams`, whereby the mapping of the module's names onto file names is shown in table D.1.

Table D.1: Component Diagrams

Name	**File Path**
CoreModule	01CoreModule.pdf
ProposalManagementModule	02ProposalManagementModule.pdf
ScrutinizingAndReviewModule	03ScrutinizingAndReviewModule.pdf
VotingAndSelectionModule	04VotingAndSelectionModule.pdf
WorkingGroupModule	05WorkingGroupModule.pdf
ProblemStructuringModule	06ProblemStructuringModule.pdf
ModelAndEvaluationModule	07ModelAndEvaluationModule.pdf

D.2 Sequence Diagrams

The UML sequence diagrams of the reference architecture description can be found on the CD attached to this dissertation. All corresponding files are located in the directory `/UML-Models/SequenceDiagrams`, whereby this directory has seven further sub-directories, one for each reference architecture's modules. The respective paths are listed in the following tables.

Table D.2: Sequence Diagrams 00CoreModule

Id	**Name of Sequence Diagram and File Path**
SD-CM-00	ComponentConfigurator-Load and Unload Components Protocol 00ComponentConfigurator-LoadAndUnloadComponents.pdf
SD-CM-00b	Repository-Registry Interaction Protocol 00bRepository-Registry-Interaction-Protocol.pdf
SD-CM-01	ContributionMediator-Get Contribution Protocol 01ContributionMediator-GetContribution.pdf
SD-CM-02	ContributionMediator-Release Lock Protocol

Continued on Next Page

Table D.2 – Continued from Previous Page

	02ContributionMediator-ReleaseLock.pdf
SD-CM-04	ReferenceMonitor-Get Contribution Protocol 04ReferenceMonitor-GetContribution.pdf
SD-CM-05	Reference Monitor-Release Lock Protocol 05ReferenceMonitor-ReleaseLock.pdf
SD-CM-06	SingleSignOnModule-Protocol of Interactions 06SingleSignOnModule-ProtocolOfInteractions.pdf
SD-CM-06b	ISecAndIdenManager-Check Session and Get User Protocol 06bISecAndIdenManager-CheckSession-GetUser.pdf
SD-CM-07	SSOManager-Load Plugins Protocol 07SSOManager-LoadPlugins.pdf
SD-CM-08	SSOManager-Show Login Page Protocol 08SSOManager-ShowLoginPage.pdf
SD-CM-09	SSOManager-Process Selected Login Option Protocol 09SSOManager-ProcessSelectedLoginOption.pdf
SD-CM-10	SSOManager-Get User Details Protocol 10SSOManager-GetUserDetails.pdf
SD-CM-11	EventBusModule-Protocol of Interactions 11EventBusModule-ProtocolOfInteractions.pdf
SD-CM-12	WorkflowSystem-Initiate Workflow Protocol 12WorkflowSystem-InitiateWorkflow.pdf
SD-CM-13	WorkflowSystem-Perceive Event Protocol 13WorkflowSystem-PerceiveEvent.pdf

Table D.3: Sequence Diagrams 01ProposalManagementModule

Id	Name of Sequence Diagram and File Path
SD-PMM-00	ProposalManager-Receive Task Protocol 00ProposalManager-ReceiveTask.pdf
SD-PMM-01	ProposalManager-Create Proposal Protocol 01ProposalManager-CreateProposalProtocol.pdf
SD-PMM-02	ProposalManager-Publish Proposal Protocol 02ProposalManager-PublishProposal.pdf
SD-PMM-03	ProposalManager-Edit Proposal Protocol 03ProposalManager-EditProposal.pdf
SD-PMM-04	ProposalManager-Edit Proposal-Prepare Proposal Edit Page Protocol 04ProposalManager-EditProposal-PrepareProposalEditPage.pdf
SD-PMM-05	ProposalManager-Edit Proposal-Store Changes Protocol 05ProposalManager-EditProposal-StoreChanges.pdf
SD-PMM-06	ProposalManager-Edit Proposal-Store Changes-Update Proposal Protocol 06ProposalManager-EditProposal-StoreChanges-UpdateProposal.pdf
SD-PMM-07	ProposalManager-Add Comment Protocol 07ProposalManager-AddComment.pdf
SD-PMM-08	ProposalManager-Replace Creator Protocol 08ProposalManager-ReplaceCreator.pdf

Table D.4: Sequence Diagrams 02ScrutinizingAndReviewModule

Id	Name of Sequence Diagram and File Path
SD-SRM-01	MatchReviewer Protocol 01MatchReviewer.pdf
SD-SRM-02	Review Contribution Protocol 02ReviewContribution.pdf
SD-SRM-03	Manager-Get Review Tasks Overview Protocol

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	03Manager-GetReviewTasksOverview.pdf
SD-SRM-04	Manager-Get Review Task Protocol 04Manager-GetReviewTask.pdf
SD-SRM-05	Manager-Add Review Protocol 05Manager-AddReview.pdf

Table D.5: Sequence Diagrams 03VotingAndSelectionModule

Id	Name of Sequence Diagram and File Path
SD-VSM-01	VotingManager-Voting Process Protocol 01VotingManager-VotingProcess.pdf
SD-VSM-02	VotingManager-Voting Process-Prepare Voting Protocol 02VotingManager-VotingProcess-PrepareVoting.pdf
SD-VSM-03	VotingManager-Voting Process-User Voting Protocol 03VotingManager-VotingProcess-UserVoting.pdf
SD-VSM-04	VotingManager-Voting Process-Vote Analysis Protocol 04VotingManager-VotingProcess-VoteAnalysis.pdf
SD-VSM-05	VotingManager-Voting Process-Store Vote Protocol 05VotingManager-VotingProcess-StoreVote.pdf
SD-VSM-06	VotingManager-Selection Process Protocol 06VotingManager-SelectionProcess.pdf
SD-VSM-07	VotingManager-Selection Process-Prepare Selection Protocol 07VotingManager-SelectionProcess-PrepareSelection.pdf
SD-VSM-08	VotingManager-Selection Process-Make Selection Protocol 08VotingManager-SelectionProcess-MakeSelection.pdf
SD-VSM-09	VotingManager-Selection Process-Store Selection Protocol 09VotingManager-SelectionProcess-StoreSelection.pdf
SD-VSM-10	VotingManager-Board Selection Protocol 10VotingManager-BoardSelection.pdf
SD-VSM-11	VotingManager-Board Selection-Prepare Board Selection Protocol 11VotingManager-BoardSelection-PrepareBoardSelection.pdf
SD-VSM-12	VotingManager-Board Selection-Process Disagreement List Protocol 12VotingManager-BoardSelection-ProcessDisagreementList.pdf
SD-VSM-13	VotingManager-Board Selection-Process Disagreement List-Get Details Protocol 13VotingManager-BoardSelection-ProcessDisagreementList-GetDetails.pdf
SD-VSM-14	VotingManager-Board Selection-Process Inclusion List Protocol 14VotingManager-BoardSelection-ProcessInclusionList.pdf
SD-VSM-15	VotingManager-Board Selection-Process Exclusion List Protocol 15VotingManager-BoardSelection-ProcessExclusionList.pdf
SD-VSM-16	VotingManager-Board Selection-Process Decision Protocol 16VotingManager-BoardSelection-ProcessDecision.pdf

Table D.6: Sequence Diagrams 04WorkingGroupModule

Id	Name of Sequence Diagram and File Path
SD-WGM-01	WorkingGroupModule-Create Workspace Protocol 01WorkingGroupModule-CreateWorkspace.pdf
SD-WGM-02	WorkingGroupModule-Edit Alternative Protoco 02WorkingGroupModule-EditAlternative.pdf
SD-WGM-03	WorkingGroupModule-Get Workspace Protocol 03WorkingGroupModule-GetWorkspace.pdf
SD-WGM-04	WorkingGroupModule-Get Workspaces Overview Protocol 04WorkingGroupModule-GetWorkspacesOverview.pdf

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SD-WGM-05	WorkingGroupModule-Get Workspace Details Protocol 05WorkingGroupModule-GetWorkspaceDetails.pdf
SD-WGM-06	WorkingGroupModule-Register Callback Function Protocol 06WorkingGroupModule-RegisterCallbackFunction.pdf
SD-WGM-07	WorkingGroupModule-Get Workspace Model Protocol 07WorkingGroupModule-GetWorkspaceModel.pdf
SD-WGM-08	WorkingGroupModule-Update Shared Model Protocol 08WorkingGroupModule-UpdateSharedModel.pdf
SD-WGM-09	WorkingGroupModule-Update Shared Model-Add Transaction Protocol 09WorkingGroupModule-UpdateSharedModel-AddTransaction.pdf
SD-WGM-10	WorkingGroupModule-Update Shared Model-Add Transaction-Update Contribution Protocol 10WorkingGroupModule-UpdateSharedModel-AddTransaction-UpdateContribution.pdf

Table D.7: Sequence Diagrams 06ModelModule

Id	**Name of Sequence Diagram and File Path**
SD-MEM-01	ModelManager-Evaluation Process Protocol 01ModelManager-EvaluationProcess.pdf
SD-MEM-02	ModelManager-Evaluation Process-Show Overview Protocol 02ModelManager-EvaluationProcess-ShowOverview.pdf
SD-MEM-03	ModelManager-Evaluation Process-Show Overview-Prepare Overview Protocol 03ModelManager-EvaluationProcess-ShowOverview-PrepareOverview.pdf
SD-MEM-04	ModelManager-Evaluation Process-Select Alternative Protocol 04ModelManager-EvaluationProcess-SelectAlternative.pdf
SD-MEM-05	ModelManager-Evaluation Process-Prepare Evaluation Protocol 05ModelManager-EvaluationProcess-PrepareEvaluation.pdf
SD-MEM-06	ModelManager-Evaluation Process-Get Evaluation Steps Protocol 06ModelManager-EvaluationProcess-GetEvaluationSteps.pdf
SD-MEM-07	ModelManager-Evaluation Process-Evaluate Alternative Protocol 07ModelManager-EvaluationProcess-EvaluateAlternative.pdf
SD-MEM-08	ModelManager-Evaluation Process-Store Evaluation Protocol 08ModelManager-EvaluationProcess-StoreEvaluation.pdf
SD-MEM-09	ModelManager-Evaluation Process-Get Evaluation Result Protocol 09ModelManager-EvaluationProcess-GetEvaluationResult.pdf

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