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Creating Economic Space for Social Innovation

CRESSI Working papers

The CRESSI project explores the economic underpinnings of social innovation with a particular focus on how policy and practice can enhance the lives of the most marginalized and disempowered citizens in society.

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Learning from Recent Work on Innovation Processes and the Co-evolution of Technology, Economy and Society

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Content

1 Introduction

This part comprises the work of AIT regarding task 4.1 and 4.2 of CRESSI workpackage 4. It is based on a broad range of expertise in the interdisciplinary field of innovation studies.

This Working Paper "On the Co-evolution of Technology, Economy and Society" is a CRESSI deliverable (D4.1 "Social Versus Technological Innovation & their Co-evolution"). It comprises two topic areas (Tasks 4.1 and 4.2) of CRESSI WP 4:

Task 4.1 aims at learning from recent work in business/technology innovation, by taking stock of the existing bodies of literature on technological/business innovation and generate suggestions as to how to extend these to social innovation?

Task 4.2 aims at embedding social innovation for marginalised in an account of the co-evolution of technology, economy and society.

The description of work (DoW) underlying the CRESSI project, implicitly takes an approach which seems to assume a dichotomy between technological innovations and social innovations. Not reflecting on this assumption might hinder the learning process within our project and with respect to outcomes. Hence, in order to learn for social (socially-oriented or societal) innovations, it is important to clarify at the outset of this reports that actually we should consider knowledge about all sorts of successful innovations independently of its dependence on or involvement of new technology.

CRESSI WP 4 is looking at literature which is commonly understood as related to "technological innovation"[1]. This however does not mean that this literature is restricted to innovations in the sense of technological changes but includes any new products and

[1] OECD Definitions: Technological innovations comprise new products and processes and significant technological changes of products and processes. An innovation has been implemented if it has been introduced on the market (product innovation). (Source: http://stats.oecd.org/glossary/detail.asp?ID=2688)
Disembodied technical change is the shift in the production function (production frontier) over time. Disembodied technical change is not incorporated in a specific factor of production. Source: http://stats.oecd.org/glossary/detail.asp?ID=2684
Embodied technical change refers to improvements in the design or quality of new capital goods or intermediate inputs. Source: http://stats.oecd.org/glossary/detail.asp?ID=2685
OECD Definition of Technology: Technology refers to the state of knowledge concerning ways of converting resources into outputs. Source: http://stats.oecd.org/glossary/detail.asp?ID=2692
OECD Definition of Innovation: An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. Source: http://stats.oecd.org/glossary/detail.asp?ID=6865

processes (see also the OECD definition in the footnote). The broader definition of "innovation" used by the OECD also includes novelties in marketing, organisation, and other practices at the business level, hence implicitly excluding novelties in the non-commercial realm. The term technological innovation is mainly used in the context of industrial policy and what is today summarised under STI policy-making.

This literature assumes that innovation is (a) based on some investment (money, time, knowledge…), (b) has to be successfully introduced on a market and, (c) in order to be profitable, it has to earn the costs of developing the innovation.

The underlying basic assumption is that the intention of the innovating firm is to make profit from its investments into developing such innovation. This can be achieved by reaping off a "monopoly rent" before others copy the new product/service/process. The monopoly rent should on the one side cover the investment costs and to create a net profit after deduction of the investment costs. Inventive components of an innovation can be protected by intellectual property rights (IPR) such as patents or trademarks, thus securing the possibility of temporary monopoly.

When referring to recent literature on innovation in this report, we understand this as being innovations based on the above mentioned basic assumptions. Thus we use the terms **business innovation and technological innovation as synonyms** in order to avoid a-priori-dichotomy between social and technological aspects when learning from existing innovation literature. When using the term technological innovation we are addressing those innovation that are in most cases profit oriented with a strong focus on technological artefacts.

CRESSI defines social innovation as follows: "The development and delivery of new ideas (products, services, models, markets, processes) at different socio-structural levels that intentionally seek to improve human capabilities, social relations, and the processes in which these solutions are carried out." The main differences between this definition and the classical definitions of innovation (see contribution in Part 2) in the profit-oriented innovation literature are:

- the focus on solutions as defining the success of an innovation other than successful introduction at a market in the social realm.
- intentionality seeking social outcome beyond the economic goals of the innovator
- the distinction of different socio-structural levels, meaning that innovation beyond markets is also considered, including innovations at the level of institutions, cognitive frames and social networks

As we will see in this Working Paper, several of the innovation approaches (e.g. open innovation) tend to overcome the mere focus on markets defining the success of an innovation.

Structure of the Working Paper

In the first paper the authors look into the recent literature related to innovation processes and life cycles of innovation with a view on what can be learned for dealing with social innovation for the marginalised groups in European societies.

However, it becomes clear that, in order to develop a theoretical understanding of the economic underpinnings of social innovation – their co-evolution with technology based growth and their contribution towards systemic change – the Schumpeterian understanding of techno-economic trajectories has to be extended. The paper will therefore aim at embedding the notion of social innovation into broader theoretical approaches towards the co-evolution of science, technology, economy and society, such as the ones developed within the interdisciplinary field of science and technology studies (STS).

Chapter 1 is mainly concerned with the recent literature and concepts regarding innovation process. It analyses the literature on open innovation dealing with new concepts and trends like user innovation, innovation communities, open source, networks of innovation and crowdsourcing, as well as the literature on design thinking and value sensitive design (VSD). The learnings for social innovation for marginalised are then discussed.

Chapter 2 analyses the embedding of social innovation (for marginalised groups) in the co-evolution of technology economy and society which is mainly dealt with in the field of Science and Technology Studies (STS). It analyses the literature on social construction of technology (SCOT) including actor network theory and the multi-level perspective (MLP) commonly applied in transition studies. Furthermore it briefly touches the innovation diffusion literature. This section will then analyse how far these concepts are able to explain the contribution of social innovation to socio-technological trajectories, including the ones that go along with economic growth and others that affect systemic change. Conclusions are drawn with the aim to support the empirical work in other workpackages.

Chapter 1 on "Learning from Recent Work on Innovation Processes" aims at taking stock of existing body of literature on "technological innovation" respectively business oriented innovation in social sciences (mainly social studies of technology in sociology and neo-Schumpeterian approaches in evolutionary economics). It mainly focusses and the innovation process and different analytical and practical approaches stemming from a long tradition of innovation studies in a broad range of (often interdisciplinary) academic fields ranging from sociology, architecture, business administration and management etc.
It gives an overview and analysis of open innovation literature (user innovation, innovation communities, open source, networks of innovation and crowdsourcing) approaches and lessons learned for understanding social innovation Furthermore it gives an overview of

literature on design approaches (design thinking and value sensitive design) and the co-development of social innovation and technological development. Based on that, it draws learning lessons and tries to generate suggestions as to how to apply these approaches to social innovation.

Chapter 2 on "Innovation System Approaches and Embedding Social Innovation in an Account of the Co-evolution of Technology, Economy and Society" assumes that the Schumpeterian understanding of techno-economic trajectories has to be extended in order to learn from business innovation for social innovation. It mainly focusses and the complexity and systemic aspects of innovation stemming from a long tradition of critical innovation studies in a broad range of an interdisciplinary academic fields ranging from evolutionary economics, institutional economics, complexity theory, sociology etc. It aims at analysing, concepts in science and technology studies (STS) such as the actor network theory (ANT) and social construction of technology (SCOT). Furthermore, the multi-level-perspective (MLP) in transition studies will be analysed, focusing on the following guiding question: Are these concepts useful in explaining the contribution of social innovation to socio-technical trajectories?

The last chapter draws some more general conclusions from processes-oriented innovation literature in order to conceptualise life cycles of social innovations. Furthermore it discusses the role of system innovation literature in conceptualising innovation eco-systems for social innovation.

2 Learning from Recent Work on Innovation Processes

2.1 Analysis of "Open Innovation" and lessons learned for understanding social innovation *(Karl-Heinz-Leitner)*

In the following chapter we will deal with new open forms and models of innovation as described in the recent literature and analyse its implications for the dynamics of social innovation. In the business oriented innovation literature a number of new innovation models have been debated which all assume that the innovation process becomes more open and participatory and can be based summarized under the umbrella of open innovation. While open innovation has been mainly discussed originally in the business literature it also expands our understanding of various forms of innovation which goes beyond technological and commercial oriented forms of innovation. In Recent years many various forms of open innovation have been investigated and debated from very different theoretical perspectives and in different disciplines, too.

2.1.1 Open Innovation

The term **open innovation** was originally coined by the Harvard Business School Professor Henry Chesbrough with his book "Open Innovation: The New Imperative for Creating and Profiting from Technology" published in 2003. Chesbrough (2003) defines open innovation as "a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough, 2003, xxiv). Chesbrough argues that in order to exploit all technological possibilities, companies must combine the knowledge generated inside their company with compatible outside knowledge from institutions and other companies.

However, the idea of an open, highly interactive, innovation process is not completely new. A scan of just a few scholars results in Rosenberg (1999), Hippel (1986) and Lundvall (1988), who have already drawn attention to the importance of integration and co-operation with customers, suppliers, universities and competitors for successful innovation activities in the 1980s. However, Chesbrough's (2003) concept attracted a lot of attention probably because it points out in a unique way the necessity to combine both external and internal knowledge resources, and to realise innovations adopting various external commercialisation pathways.

2.1.2 User Innovation

With the term **user innovation**, Hippel (1986) already argued in the 1980ies that the involvement of users goes beyond the traditional customer orientation as propagated by marketing and market research, e.g. by optimizing already developed products and validating product concepts. In this sense, product development is "outsourced" to the customer, who

creates his own products, while the manufacturer provides the tools necessary for the customer to develop and adapt products. The existence of user innovation is also a key argument against the linear innovation model. Particularly, new ICTs and more generally online sharing through the Internet has allowed the integration of users and other partners within the innovation process. For example, with the help of new information and communication technologies, virtual customer methods represent a novel way of recording the "voice of the customer" (Dahan and Hauser, 2001).

A number of studies have been conducted ranging from extreme sports industries, such as mountain biking (Lüthje *et al.*, 2002) or kite surfing (Hippel, 2006), to software development (Franke and Hippel, 2003), and high-tech industries like the semiconductor and electronic subassembly manufacturing equipment producers (Urban and Hippel, 1988). Herstatt and von Hippel (1992)reported the application of the lead user method at Hilti AG, the 3M case study conducted by Lilien et al. (2002).

2.1.3 Innovation Communities

The concept of **innovation communities** is closely related to this development trend. Innovation developed by communities, such as the **open source community** at MIT, started in the 1980s, when users were willing to freely share their developments in order to utilise a larger number of researchers and developers and therefore improve their products. Innovation communities consist of individuals or firms interconnected by information transfer links, which may involve face-to-face, electronic or other means of communication. Innovation communities may consist of users and producers. If they involve users, they are often referred to as **user communities**. Hippel (2006) defines an innovation community as a subset of an information community. Innovation communities consist of individuals or firms interconnected by information transfer links which may involve face-to-face, electronic or other means of communication. Innovation communities can consist of users and producers; if they involve users, they are often referred to as user communities, too. In this case, they are closely related to the concept of user innovations; indeed, many studies have shown that in industries where user innovations are a major source of innovation, e.g. in some sport industries, users frequently form a physical or virtual community to share their ideas.

2.1.4 Open Source

Open Source Software (OSS) development is one form of a **community-based innovation**. Linux, the Apache web server and computer games are the most well-known examples of this type of innovation. In 1984, Richard Stallman set up the "Free Software Foundation" and the GNU "General Public License" initiative, which defines the rules for co-operation within the community. However, it has to be mentioned that, in many cases, individual software developers (e.g. Linus Tovalds) initiated the projects which then quickly became accepted by a community. Research has also stressed that self-organisational processes are an important

feature of such communities, i.e. innovations are not the output of managerial or organisational strategies or management decision.

A few studies have investigated the motivation of open source software developers (e.g. Lakhani *et al.*, 2002; Ghosh *et al.*, 2002) which are significant for all type of collaborative innovation activities by a group of different actors and individuals. These studies found that most developers worked on the development in their leisure time, although some of them worked on it during their job in the community. As most software developers have some freedom and leeway in their working day, it is possible to exploit this time for open software development. Interestingly, the formal rules within the community are less strict; for instance, developers do not do have to plan a project, apply for funds, report about the progress, or set incentives to carry out riskier, softer projects(Ghosh *et al.*, 2002). By sharing the work in open source communities, for instance, users are further motivated, albeit extrinsically, as they share results and receive help from or provide help to other users within the community. Gratification comes mainly through the recognition from other developers.

2.1.5 Networks of Innovation

Tuomi's (2006)work on "**Networks of Innovation**" is another interesting contribution in this field. Innovations are adopted when users integrate them in meaningful ways into existing social practices. Histories of major technological innovations show that the creative initiative of users and user communities often became the determining factor in the evolution of particular innovations. Tuomi argues that innovation is about creating meaning; that it is inherently social; and is grounded in existing social practices.

Traditional physical networks are another form of innovation community. The already mentioned case of extreme sports can be referred to again. However, there are other examples of interest. In Austria, for instance, in the 1980s, farmers and private individuals who build their own homes formed a network to develop solar collectors for their own use (Ornetzeder and Rohracher, 2005). This small group has since grown and became the driving force for a movement which enabled the diffusion of this technology. Within this community, individuals improved the existing technologies and some companies adopted developments and launched commercial products. The community also founded the Society for Renewable Energy, organised workshops and co-ordinated research projects. Ornetzeder and Rohracher (2005) have labelled the development of the various members as "**peripherally, decentralised development departments**."

2.1.6 Crowdsourcing

A further form of open innovation is **crowdsourcing**. Jeff Howe (2006)first coined the term crowdsourcing, which is the idea that problems are broadcasted to an unknown group of solvers in the form of an open call for solutions. Crowdsourcing can be interpreted as a way of applying the open source concept to physical products that do not lend themselves well to

the open source type of peer production in current economic framework conditions. Crowdsourcing has been applied to research and design tasks, but also operational activities, such as advertising, product configuration or the analysis of large amounts of data. It has been suggested that there may be a potential for applying crowdsourcing in the public domain, e.g. in urban planning. Crowdsourcing has been criticised as a new form of labour exploitation as the monetary prizes paid are usually well below the wages for similar tasks performed by regular employees. At the same time, the benefits of reconnecting workers to the productive process and providing an outlet for creative potential have been stressed (Braham 2009). Empirical studies about the motivations of individuals to participate in crowdsourcing competitions confirm earlier studies of OSS development showing that individuals are having both, extrinsic (monetary) and intrinsic motivation (e.g. fun) for the involvement (e.g. Sundic and Leitner (2013)).

The development in relation to opening up the innovation process is hence not just driven by companies which, for instance, organise innovation contests or crowdsourcing projects. Flexible working patterns, outsourcing and the increasing number of professional freelancers, foster and enable the emergence of new organisational innovation strategies (Leitner, 2013). The further individualisation of society is a driver for this development, which, as one effect amongst others, increases people´s ambitions to express themselves. By influencing the design of products, individuals may change the functionality of solutions and services according to their individual needs. Due to the growing awareness of customers and citizens to shape the direction of innovation and enhance the quality of the innovation output, the innovation process is becoming more and more deliberative and consultative.

The Innovation Futures (INFU) Project funded within FP 7 dealt with various open patterns of innovation encompassing commercial and non-commercial forms of innovation (Leitner *et al.*, 2011). Based on a collection of international practice examples from industry and society, the project involved a diverse range of international experts in developing and assessing future pathways of doing and organising innovation. The project which also organized a number of workshops to analyse the experiences of many diverse cases across Europe clearly reveals that open forms of innovation are frequently associated with changing patterns of motivation. Intrinsically motivated users, communities, citizens, and social entrepreneurs contribute to companies' innovation activities without expecting an economic return, thus complementing the typical driver of profit motive.

2.1.7 Innovation for tackling societal challenges

Solving societal problems is becoming an important driving force for research and innovation, for companies and research-performing organisations, as well as for individuals. A number of examples identified within the INFU project, an EU project which was looking into the future of innovation (Leitner *et al.*, 2011)reveals that individual actors are motivated to contribute to research and innovation activities, e.g. by launching crowdsourcing initiatives

or idea competitions for their pleasure and outside of the boundaries of established organisations.

The INFU project stresses also that the role of market mechanisms as the main mediators between innovation demand and supply is challenged by several new innovation patterns. Coordination mechanisms such as self-organised user communities, web-based co-design platforms or innovation initiatives on the city level involving public and private actors are on the rise and are complementary to market mechanisms or even substituting them. Citizens and customers will play a more relevant role in innovation in the future, both in deciding on innovation priorities and in contributing to the innovation process. The latter argument holds also for research activities. Patients, for instance, increasingly serve as partners in medical research, and volunteers get actively involved in research on the conservation of nature.

The **opening of the innovation process is the key trend in economy and society** and recently also heavily supported by the policy (Jong *et al.*, 2008). It expected to continue and become even stronger in the years to come. Innovation models and examples such as the organisation of innovation contests, crowdsourcing projects, innovation camps, open source software development, online voting for the approval of new products and other forms of user involvement all provide evidence for this development. Open innovation, user innovation and community innovation is probably not a new or emerging phenomenon but already a significant trend. This phenomenon will further diffuse not only across industries but also to the public sector and the non-commercial sphere.

2.1.8 Lessons from Open Innovation literature for the study of social innovation

With the notion of open innovation, the focus on the firm as the key innovation actor has substantially **broadened towards social entrepreneurs, users, customers, the public sector and citizens**. Following this broader view on open innovation encompassing the economic, social and public domains, innovation is understood as the creation of new products, processes, technologies and services that are accepted by markets, governments and society. This is particularly relevant in the context of innovation for tackling societal challenges. Both, commercial but also social motivations are a strong driver for open innovation resulting in a development where private, individual and public actors collaborate simultaneously.

Implications for understanding the dynamics of social innovation:

Empirical findings studying various open forms of innovation reveal some interesting findings in relation to understanding the dynamics of social innovation (e.g. Leitner, 2013):

- Involving a large number of participants and interests including a wide range of social requirements may not always lead to novel solutions but sometimes may also generate **lukewarm solutions**. In addition, highly participatory processes might hinder a long-term transition towards more sustainable ecosystems because the majority of society

may not accept negative short-term effects at an individual level. Slogans such as NIMBY ("Not in my backyard") and BANANA ("build absolutely nothing anywhere near anybody" indicate this development. Society may thus become locked into its current status, where taking collectively binding decisions become increasingly difficult to take, and where conflicts of interest easily lead to stalemate situations.

- An extensive externalisation of the innovation process and its inherent risks by companies without adequate compensation of the innovators may lead to emergence of the "**creative poor**" class in the long run. The question for companies, public organisations, and policy is thus: what is the adequate level of participation that (a) assures realization of real creative solutions, (b) long-term competiveness of the solution, and (c) adequately addresses societal problems?

- Finding the right level, scale and instruments to **enable participatory co-creation of solution** is crucial future challenge for actors involved in developing social innovation. Adequate consultation processes where people are motivated to contribute must be developed.

- This implies a change in the **role of policy makers towards mediators** within a wide range of coordination activities (Leitner, 2013). Such a role is also in line with arguments based on the systems theory which argues that policy should govern the system by assuring the adaptation capabilities of innovation systems and by establishing rules which **foster the self-organisation** capabilities of different actors (e.g. Haan and Rotmans, 2011).

- Supporting small and specific groups individually for long periods as required by social change is an economically unsustainable process (Warnke *et al.*, 2011). Forms of up-scaling should be found either by sedimenting part of the **experts' knowledge into toolkits** to be reused in similar situations or by teaching people part of the experts' professional competences. In both cases the challenge for experts is to transfer their skills in order to **enable the population to autonomously improve** and disseminate their own initiatives.

- Open and participatory forms of innovation often require the adoption of new business models. Such (**hybrid) business models** have to consider not only profit making motives but also the interest of citizens and the intrinsic motivations of users. Here, for instance, the 3P Models (profit, people, planet) can be mentioned (Fisk, 2010).

2.2 Design Approaches: Bridging Social Innovation and Technological Innovation *(Petra Schaper-Rinkel)*

2.2.1 Introduction: Co-evolution of Technological and Social Innovation[2]

Much is known about technological innovation on the one hand and social innovation on the other hand. Technological innovation and its management in organizational settings have been studied extensively. Recently, social innovation has become a fast growing field of research[3]. Less studied, but particularly interesting is the interaction between social innovation and technological innovation. Both dimensions have never been separated as important new technologies always intervene into social setting and social settings determine the innovation pathways of technologies. Different concepts in science technology studies (STS) highlight the close interaction: At the level of society we can analyse the co-production of science and social order (Jasanoff, 2004) as a pre-condition of today's science-based innovation. Technology and society are co-evolving (Geels, 2005) and science technology and innovation policies (STI) try actively to foster this co-evolution (Roco and Montemagno, 2004). At the micro-level of specific innovation cases, **approaches in the area of design try to conceptualize the interaction of technology and social settings to steer innovation**. This paper analyses concepts in the area of design with regard to the co-creation and co-evolution of social innovation and technological innovation.

One is **Design Thinking** as a **concept as for practical, creative creation** of solutions that starts with a goal and uses de facto today technologies for improved future results. Design thinking implies the use and the improvement of technology without being oriented on analysing the co-evolution of social and technological innovation. However, the approach is implicitly an attempt to bring both dimensions together. The social dimension of technology, especially the values emerging from the technologies that we build and how we choose to use them is addressed with the concept of **value-sensitive design** (VSD) (Friedman, 1996, Dym et al., 2005), but also in approaches such as **participatory Design** and **Responsible Research and Innovation** (Schomberg, 2013, Owen et al., 2012). Design approaches can be used to analyse how designer, engineers and other actors deal with the co-evolution of technological innovation and social innovation.

[2] This chapter is based on: Schaper-Rinkel, Petra and Wagner, Petra (2014)

[3] Frameworks to analyze to investigate social innovation in relation to technological innovation as a driver of social change are contested (Cajaiba-Santana, 2014). Social innovation research focus often on social entrepreneurship (Shaw and Bruin, 2013; Maclean *et al.*, 2013) and addresses mainly the governance level (Grimm *et al.*, 2013; d'Ovidio and Pradel, 2013; Jing 敬乂嘉 and Gong 公婷, 2012; Edwards-Schachter *et al.*, 2012; Moulaert *et al.*, 2007). The relation of Social Innovation and technological innovation is often underexposed, however the discussion on the topic get growing attention (Bulut *et al.*, 2013; Lundström and Zhou, 2011).

2.2.2 Design Thinking as practical approach to combine technological and social aspects in innovation

Concepts of Design Thinking and related approaches have gained attention over the past years in a wide range of contexts beyond the communities of designers and design researchers. The core idea is that the ways professional designers solve problems is useful in different contexts where individuals and groups in economy and society try to innovate and make change happen. Design Thinking addresses the interaction of technological development and social aspects mainly implicitly, as its focus is on creating new solutions. In this chapter we will review the design thinking approach and related approaches with regard to the interaction of technologies and social change.

Peter G. Rowe (1987) used the term "Design thinking" as the title of his 1987 book on solving problems in the making of buildings and public spaces (Rowe, 1987; Bell, 2009). For him, design thinking is the central means of inquiry by which architects and planners conceptualize and shape buildings and public spaces. Despite of different theoretical positions from simply providing procedures for solving problems in complex planning to normative stands to create desirable architecture and urban spaces, design thinking is in this view an underlying structure of inquiry common to all design practices. Therefore, it combines technologies – process innovations as well as product innovations – with social change and social innovations in a broad sense.

Multiple models and approaches of design thinking have emerged since then, based on different ways of viewing design practices and using theories and approaches from design methodology, engineering, psychology, education, creativity research etc. Nowadays, 'Design Thinking' is often identified as a new paradigm for dealing with problems in different professions, such as engineering architecture, business economics, art, education and educational research and computer science. In engineering, design thinking is practically used to raise the awareness of students, that they intervene, transform and therefore 'innovate' social settings and relations by developing and introducing technologies (e.g. Dym *et al.*, 2005).

Design thinking has become a dominant issue in contemporary design discourse and rhetoric, especially with the design thinking practice of the design and innovation firm IDEO, and with the application of its concept to design education at prestigious d.school, the Institute of Design at Stanford University (Bjogvinsson *et al.*, 2012) The main characteristic of design thinking is its approach to think beyond the omnipotent designer and to overcome the obsession with artefacts, products, and things (Bjogvinsson *et al.*, 2012). 'Design things' are technologies and in all the cases when the technologies at stake can be characterized as potentially "controversial design Things", designers are involved in engineering technological and social innovation *together*. This is especially obvious in infrastructure technologies such as railroad tracks, cables, or the Internet.

Bjögvinsson, Ehn and Hillgren summarise the suggestions of design thinking in the following way (Bjogvinsson *et al.*, 2012) :

1. "that designers should be more involved in the big picture of socially innovative design, beyond the economic bottom line;
2. that design is a collaborative effort where the design process is spread among diverse participating stakeholders and competences; and
3. that ideas have to be envisioned, "prototyped," and explored in a hands-on way, tried out early in the design process in ways characterized by human-centeredness, empathy, and optimism."

From this perspective, design thinking is closely connected with traditions such as 'participatory design', 'design for change' (Bjogvinsson *et al.*, 2012) and Socially responsible design (Melles *et al.*, 2011).

These design approaches aim at designing for, by, and with stakeholders. This demand becomes especially challenging for designers regarding new innovation areas where no social community exists. Design discourse could provide platforms or infrastructures to constructively deal with disagreements related to future innovation. "Design thinking that wants to make a difference cannot ignore the challenge of passionate engagement in controversial design Things" (Bjogvinsson *et al.*, 2012). These "things" are results as well as starting points of the co-evolution of social and technological innovation.

2.2.3 Innovating as practice in Design Approaches

Design-thinking and related concepts focus on how innovation happens and how to design innovation. As design thinking refers to the generation and implementation of new ideas about solving problems at the micro level and meeting one or more common goals by mainly focusing the process of design itself, technologies and social settings are both inherently present. In business processes, Design Thinking in the business community combines an individualistic concept of innovation with needs on the level of the individual (Brown and Wyatt, 2010):

- Design thinking is "a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos. By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported."
- Brown uses the example of Thomas Edison to historicize design thinking by stating that Edison was already "creating a team-based approach to innovation"
- Design thinking is seen as basis for innovation and the "human-centered, creative, iterative and practical approach to finding the best ideas and ultimate solutions."

In their article "Design Thinking for Social Innovation" Tom Brown and Jocelyn Wyatt (2010) describe explicitly examples where design thinking is used to create social innovation.

One example is from 1990, describing an approach to decrease malnutrition among children in Vietnam. At that time, most solutions relied on government donations of nutritional supplements, but these measures were found to be insufficient. The initiators of an alternative approach, Jerry and Monique Sternin, used an approach called positive deviance, which looks for solutions among individuals and families in the community who are already doing well. They were searching for poor families whose children were healthy, analysed their uncommon but successful strategies to enable other families to find better solutions. This example of combining the "positive deviance" approach with design thinking relies on "local expertise to uncover local solutions". "Design thinkers look for work-arounds and improvise solutions […] and they find ways to incorporate those into the offerings they create" (Brown and Wyatt, 2010). The co-evolution of social and technological aspects, however, remains a blind spot in this approach as technology is only taken into account as "available technology" for creating social innovation (Brown and Wyatt, 2010). Therefore, the mutual development potentialities of social and technological innovation remain largely neglected.

2.2.4 Objectives of Innovation & Models of innovation dynamics

Mainstream Design Thinking is about developing artefacts, processes, services and systems by bringing together the desirability of products and services with technological feasibility and economic viability. From a critical perspective this approach is questionable, because "for what is technologically feasible cannot be predicted in advance of a project, and, even within one, partly depends on the scale of economic investment. And that, like economic viability, is partly a political question. Many things can turn out to be viable and sustainable if people decide that they are" (Woudhuysen, 2011). Design Thinking's **orientation towards users and their needs** supports a 'demand-pull' innovation model. Design Thinking proponents such as Brown and Wyatt (2010) depict innovation dynamic as a cycle. Beside the cycle, the design thinking process is described as "a system of overlapping spaces rather than a sequence of orderly steps" (Brown and Wyatt, 2010). These so-called three spaces are **inspiration**, **ideation**, and **implementation**. In this approach,

- inspiration is seen as the driver that motivates the search for solutions;
- ideation is seen as the process of generating, developing, and testing ideas;
- and implementation is characterized "as the path that leads from the project stage into people's lives.

The three spaces are connected with aspects and specific practices of the Design Thinking process.

- Inspiration is linked to the practice of discovering by observing and researching. The core is to identify the problem or opportunity that motivates people to search for solutions.

- Ideation is linked to distilling observations into potential solutions/opportunities for change by encouraging divergent thinking
- Implementation focuses on selected ideas that are turned into an action plan and where prototyping begins. These practices focus on testing, iterating and refining products and services.

It is stated that "the whole design process as a matter of meaning creation provides new perspectives on both design and innovation"(Johansson-Sköldberg *et al.*, 2013). But crucial questions remain open: generalised design thinking might not only provide resources for organisation but might also ignore the diversity of designers' practices and institutions which are historically situated. Another problem of the model of design thinking is that the model privileges the designer as the main agent in designing (Kimbell, 2011).

Design Thinking concepts claim to be centred on people, arguing for an ideal of human-centred design rather than technology-centred design. This shift implies a change in where power is located (Blythu. a. 2011) even if this is not made explicit. **Moving beyond individualistic models towards social or systemic models is seen as challenging contemporary design thinking** (Manzini, 2007). Designers have been "active promoters of the ideas of wellbeing and ways of living that we have recently and dramatically discovered to be unsustainable" (Manzini, 2007). To become "part of the solution, to become active agents in the transition towards sustainable ways of living, designers must make a profound change in their culture and praxis" (ibid). Therefore, designers need to develop new conceptual and methodological tools and an "effort must be made to play a positive role in the social discourse on how to imagine and build a sustainable future" (Manzini, 2007).

A "lack of shared visions", in the sense of a "lack of common ideas on what possible, sustainable ways of living could be like" is seen as a crucial barrier for change(Manzini, 2007). To overcome this situation the approach is: "Fostering the vision of a multi-local society is a question of establishing a 'virtuous circle' encompassing social innovation … and technological and institutional innovation (Manzini, 2007).

Designers and design researchers could contribute by organizing their capabilities in four steps (ibid p. 239f.):

- Focusing and giving visibility to promising cases (highlighting their most interesting aspects)
- Building scenarios of potential futures (showing what could happen if these cases were to spread and consolidate, becoming mainstream ways of doing)
- Developing enabling systems (conceiving specific solutions to increase the promising cases efficiency and accessibility)
- Promoting creative contexts (collaborating in the development of new governance tools).

Also in this approach to social innovation, technology remains a blind spot and a black box: It is only stated, that in practical terms, "it has been observed that the contexts that facilitate creative attitudes present certain common characteristics: they have to give access to appropriate technologies, to promote the diffusion of knowledge, skills and abilities, and to enhance social and political tolerance" (Manzini, 2007). The term and concept of "appropriate technologies" indicates given technologies that are used for social innovation instead of seeing the co-evolution of social and technological innovation.

One design approach to conceptualize how technologies are co-evolving by values incorporated is the idea of "Value sensitive design". Value sensitive design was first introduced to incorporate moral values into the design of computer technology and into human computer interactions, and later the methodology was further developed to address the inclusion of values in other domains of design and engineering (Friedman, 1996; e.g. Cummings, 2006; e.g. Walton and DeRenzi, 2009; e.g. van Wynsberghe, 2013). Value sensitive design aims to combine technological innovation and social innovation by incorporating values of stakeholders into innovation processes. The incorporation can have different forms as described in methodological reflections: In general, Value sensitive design uses conceptual investigation that focuses on the discovery of values to analyse them and identify potential value tensions. Stakeholder analysis is used to identify direct and indirect stakeholders – as well people who interact directly with a technology and the ones who are impacted by the technology without interacting with it. Harms and benefits can be identified and mapped and key values can be identified. However, it remains unclear, how active stakeholders are involved in the process of (co-)creating innovation.

Critical views on VSD: Often stakeholders are seen as 'suppliers' of data on values but not actively involved in the development of technologies and the creation of related innovation (e.g. Pommeranz *et al.*, 2012). The participatory elements are limited, the designer is still in the centre of the design process and value centred design is mainly seen as a tool that "can help designers substantiate the choices in their design" (van Andel *et al.*, 2015).

2.2.5 Lessons from Design Approaches for the study of social innovation

Approaches that highlight the process of innovation at the **micro level of specific projects in the design** area address the implementation of social aspects as part of new solutions. **VSD focuses on how to implement values**, such as sustainability and wellbeing, in the design phase of technological innovation. In that concept, the future demand of different users and stakeholders should be anticipated by elicit the values of the ones affected by the solution being aimed at. Concepts focusing explicitly at the innovation process are inescapably confronted with the co-evolution of technological and social development. However, this dimension is often mainly implicitly addressed. Design Thinking, as an approach to come to innovation, addresses the **small-scale social dimensions** of innovations and proposes an **interactive iterative process of finding** solutions. Design Thinking approaches

conceptualise objectives as context specific objectives articulated by the group or organisation that applies design thinking in their innovation processes. Demand is addressed as demand of **specific user groups** (micro-level), thus **societal demand (macro-level) is beyond the scope of design thinking**. There are attempts to extend the scope to larger social entities such as communities or networks in the future. Technology remains often a black box in design thinking as technology is mainly seen as a resource to be used for design. Recent approaches of Design thinking however address the issue of participatory technology and infrastructure design as contemporary design challenge. Design thinking is **mainly a programmatic** approach and **not an analytical** approach, focussing on practices of groups and by focusing on interaction. Despite Design Thinking's attested strengths in the inspiration and ideation space (see above), contributions are contested in the implementation space. Due to a lack of evidence, the question of impact (how to create social impact) remains largely unanswered. The elaborated models in Design Thinking of how to design solutions with different stakeholders can serve as **inspiration and as experimentation tools for a kind of co-creation of social innovation and technological developments**. In comparison with the practice-oriented Design thinking, Value sensitive design has complementary strength and weaknesses: Value sensitive design **(VSD) is mainly an analytical approach** and not a practical approach focussing on the co-development of innovation.

3 Innovation System Approaches and Embedding Social Innovation in an Account of the Co-evolution of Technology, Economy and Society *(Björn Budde and Klaus Kubeczko)*

3.1 Analysing the co-evolution of technological and social change

This section provides a short overview about the literature on several approaches related to Science and Technology Studies (STS). In doing so it will illustrate how STS could inform the debate on social innovation and to re-think the dichotomy of social vs. technological/business innovation.

Approaches related to STS share the understanding that technologies do not evolve along a 'natural scientifically logical' path, but understand them as the result of complex social processes. Thus technologies and technological change is and can be influenced by the social context. Even though scientists and engineers often understand and perceive the technological development as following a technologically determined path, STS has shown that **technologies are shaped by social processes** (Pinch and Bijker, 1987b; Pavitt, 1984b; Latour and Woolgar, 2013a; Rip, 1992b).

In the following this section focusses on constructivist approaches to study technological innovation, in particular on the "Social Construction of Technology" (SCOT) approach (Bijker *et al.*, 1987; Bijker, 1997). There are three different literature streams which are often referred to as SCOT, sharing a common understanding and interpretation. On the one hand, the SCOT approach in a narrow sense as initially outlined by Pinch and Bijker (Pinch and Bijker, 1987b) and on the other hand approaches such as actor network theory (ANT) (Callon, 1987) and large technological systems (LTS) (Hughes, 1987), which are often referred to as approaches on their own. Some of the confusion of the relationship between these three approaches originates probably from the fact, that influential articles for the further development of ANT and LTS were published in a book titled "The Social Construction of Technological Systems" (Bijker *et al.*, 1987).

SCOT, ANT and LTS have in common that they were developed as an answer to technological determinism, which neglects the role of the social for technological change. Thus, all three approaches share the ambition to move away from previous conceptualizations emphasizing the role of the individual inventor (or genius) and from making distinctions between technical, social, economic and political aspects of technology development, conceptualizing society and technology as a "**seamless web**" in which different actors, social groups or technological artefacts constantly interact (Bijker *et al.*, 1987, p. 3). Bijker and colleagues argue that **frequently used distinctions, such as society/technology,**

technical/social or 'pure'/applied science are socially constructed and can, consequently, be misleading the researcher of technological change. This holds in particular true with regard to the dichotomy of science/technology which was prevailing at the time of publication. They argue that the concepts of "science" and "technology" "[…] are socially constructed cultures and that the boundary between them is a matter for social negotiation and represent no underlying distinction" (Bijker *et al.*, 1987, p. 11). The most extreme position is proposed by ANT, which suggests that there is no need for categorizing different elements in a system related to a technology, since all elements and their relationships are shifting continuously [source], whereas SCOT as developed by Pinch and Bijker does not follow the idea of a seamless web completely. Their aim is rather to gain a better understanding of the question how the social environment shapes the technical characteristics of an artefact, taking into account the seamless web character of technology and society (Bijker *et al.*, 1987, p. 10).

3.1.1 The Social Construction of Technology – SCOT

This section discusses the SCOT approach in a narrow sense, as outlined by Pinch and Bijker (e.g. Pinch and Bijker, 1987b, Bijker, 1997). SCOT builds in principal upon the sociology of science, a constructivist approach which follows the notion that the analysis of what is "true" or "false" should be searched in the social domain, rather than in the "natural world", since it argued that true and false are the results of social processes.

A first assumption is that until the 1970s and 80s often used distinction of science and technology is socially constructed and thus the literature looking at the impact of science on technology would ask the wrong question. The same holds true with regard to much of the literature related to technology and innovation studies in the 1970s, which treated technology as a black box and externalized the technological development, being more interested in the effects of technological change. This, however changed already in the 1980s, for instance by the work on evolutionary economics (e.g. Dosi, 1982).

The SCOT approach follows in principle an evolutionary understanding of innovation and technological change, describing the developmental process of an technological artefact as "an alternation of variation and selection." (Pinch and Bijker, 1987b, p. 28). .

Consequently SCOT follows a multidirectional model of technological change, taking into account multiple streams of development. It opposes the linear model of innovation and argues that only retrospectively a quasi linear development can be (re)constructed. Instead SCOT puts emphasis on the research and innovation processes as such.

To study the processes leading to technological change, SCOT proposes to look at relevant social groups and their relation to (technological) artefacts. To qualify as a social group "[…]

all members of a certain social group share the same set of meanings, attached to a specific artefact." (Pinch and Bijker, 1987b, p. 30). Applying this definition several dimension and aspects such as **power and economic strength are taken into account**, and Pinch and Bijker urge to draw a detailed description of the relevant social groups going beyond the dichotomy of consumers and producers, to analyse the function of an artefact for the respective group. They propose to look at the problems each group articulated with regard to an artefact and potential solutions proposed. Such an analysis of technological artefacts and the perspectives and arguments of different social groups is expected to reveal all kinds of conflicts involved in the overall development of a technology. These can be conflicts regarding different technical requirements or potential solutions put forward by specific social groups.

Key concepts and terms for such an analysis are *interpretative flexibility*, *closure and stabilization*, *wider context* and the later introduced term *technological frame*.

Interpretative flexibility is a common concept of SCOT and the sociology of science and knowledge, putting emphasis on and enabling to take into account the existence of different interpretations of the same technological artefact, with regard to its performance, functional requirement and its design as such.

Closure and stabilization: When the problems related to a technological artefact are solved from the perspectives of relevant social groups, a situation of closure and stabilization emerges. This has been reached when no other technological options are considered as viable alternatives anymore. Mechanisms leading to closure and stabilization can be a *rhetorical closure* when previous problems are solved from the perspective of relevant social groups. Another mechanism can be *closure by redefinition of the problems*, when former problems are re-interpreted as being not problematic or features of the technological artefact (it is not a bug, but a feature). An example provided by Pinch and Bijker are air tires for bike, which were first perceived as bulky and an anti-vibration measure for bad bicycle designs, thus a disadvantage of certain technological designs. This however changed, when air tires were re-interpreted as a technological artefact enabling high-speed cycling. Thus, the characteristics of air tires were re-interpreted as the solution to the problem to go as fast as possible with bicycles (Pinch and Bijker, 1987b, p. 46).

The *wider context* in the sense of the socio-cultural and political milieu plays only a minor role for the SCOT approach. Even though Pinch and Bijker refer to the importance of the wider context, SCOT does not offer a systematic conceptualization of the environment or context even though some of the analysis refer to group interactions and dimension such as power.

Later on Bijker (1997) introduced the term *technological frame*, following critique regarding the missing conceptualization of the background conditions of group interactions, the relationship between groups or different power relations between relevant social groups or

more generally taking into account social structures (Bijker, 1997; Klein and Kleinman, 2002). A technological frame structures the interaction between the actors, and takes into account the social structure (e.g. gender roles influencing how social groups interact). "[A] **technological frame structures the interaction among the actors of a relevant social group**[4]. Thus it is not an individual's characteristic, nor a characteristic of systems or institutions; technological frames are located between actors, not in actors or above actors. Existing practice does guide future practice, though without logical determination. If existing interactions move members of an emerging relevant social group in the same direction, a technological frame will build up; if not, there will be no frame, no relevant social group, no future interaction." (Bijker, 1997, p. 123)

3.1.2 Critique

There have been several streams of critique regarding the SCOT approach (e.g. Clayton, 2002; Klein and Kleinman, 2002). First, there seems to be some confusion about the relation of SCOT, actor-network theory (ANT) and the large technical systems (LTS) and their relation (see above). Although these approaches share a common understanding, SCOT usually refers to the approach outlined by Pinch and Bijker (Bijker and Pinch, 2002; Pinch and Bijker, 1987b; Bijker, 1997).

A more fundamental critique is that SCOT neglects social structure and power. Partly as a reaction to this critique Bijker introduced the concept of technological frame, but still the background conditions of group interaction and the (power) relations between relevant social groups "remain largely invisible" and it becomes not clear why some social groups are more influential than others (Klein and Kleinman, 2002). Klein and Kleinman conclude in their review that "power is either ignored or deployed in an ad hoc fashion" (Klein and Kleinman, 2002, p. 34) and that it is not clear why some groups have more influence than others.

Another critique focuses on the concept of a "seamless web", which SCOT shares with other stream of the literature such as ANT) which makes it conceptually impossible to distinguish the cause and effect of technological development. Following the argument that we cannot even make an analytical distinction between society and technology, some authors have claimed that this consequently leads to where the content (technology) cannot be differentiated from the (social) context, meaning that it becomes impossible to understand how the social world shapes technological development (Klein and Kleinman, 2002).

In addition, other authors have claimed that SCOT lacks explanatory power with regard to the question, why in some cases success occurs and in other failure. Even though SCOT explains the mechanisms (closure and stabilization, see above) leading to the successful establishment of a technological artefact, respectively a technology as such, it remains unclear with regard

[4] Emphasis added

to the factors facilitating or constraining closure and stabilization mechanisms (Klein and Kleinman, 2002; Clayton, 2002).

Another stream of critique focusses on the delineation of relevant social groups. Clayton (2002) argues that SCOT provides little guidance with regard to the question which social groups should be taken into account in the analysis. This comes with two challenges: First, there is an **inherent risk of missing groups,** which is a general challenge but even more relevant when studying issues as marginalization as Cressi does. **Second, missing criteria** which groups may be relevant can lead to the opposite direction, so that the analyst cannot differentiate with regard to the importance of an actor group. Clayton (2002) argued that these missing criteria induced Bijker to recruit "[…] half of the population of England into a relevant social group." (Clayton, 2002). Going beyond this criticism, some authors expressed dissatisfaction with the conceptual terms. A lack of clear definition would make the analyses of socio-technical change using SCOT, entirely dependent on the perspective and interpretation of the analyst (Clayton, 2002). With regard to the latest criticism Bijker and Pinch replied that these perceived lack of clarity in the definition of key terms and the resulting flexibility in interpreting their concepts could have a productive role. They value this characteristics and argue "[…] that exactly because of this characteristics they [remark: SCOT concepts] provide the much needed antidote against naïve empiricist ideas […]" (Bijker and Pinch, 2002, p. 367).

Other criticism is directed at the case studies Bijker used to develop and illustrate his conceptual approaches, as bicycle historians question a number of empirical details and interpretations presented in the initial case studies (Clayton, 2002, p. 370)

3.1.3 Lessons from Science Technology Studies for the study of social innovation

There are several key lessons from the STS based approaches, in particular SCOT for the analysis and conceptualization of social innovation. First, following the argumentation provided by SCOT and related approaches such as ANT and LTS a distinction into social vs. technological innovation does not seem adequate, since technology is by definition social. Second, success or failure of social innovations[5] in solving problems always depends on the perspective and interpretation of social groups. Thus a social innovation may be a social innovation with regard to one social group, whereas it is neither an innovation nor social to others. This dimension becomes of particular relevance, when studying social innovations addressing the issue of marginalization. Third, Pinch, Bijker and Hughes formulate a thought provoking hypothesis regarding the originality of inventors and innovations: inclusion in a

[5] It should be noted that the term ‚innovation' as such implies a kind of success, since most theoretical approaches refer to an innovation only, if it reaches some degree of diffusion (which is a common measure for success), more or less explicitly following the basic definition of innovation provided by Schumpeter.

group, organization and/or bureaucracy decreases the originality of innovators, since high inclusion brings mission orientation or commitment to incremental improvements. Outsiders on the other hand create the radical inventions, which initially phase a high level of resistance, due to the lack of initial support (Bijker *et al.*, 1987, p. 7). In that sense, the focus could shift from solely overcoming marginalization in a narrow sense towards untapping the potential of 'outsiders' or marginalized groups to come up with highly innovative and radical solutions. Thus, their relative outside position could be an asset for developing radically new solutions, which can easily be neglected by 'insiders' inclined to overcome marginalization using more incremental approaches. Fourth, the SCOT approach could benefit from a fruitful discussion, with other approaches discussed within the Cressi project, which have a more elaborated conceptualization of the role of power. Even though power has a certain role and explanatory power within SCOT, other may offer a more useful conceptualization of power and its role for innovation.

To conclude, SCOT and related approaches frame the co-evolution of technology, economy and society as highly related processes and argue to overcome these distinctions, conceptualizing technology, economy and society as a 'seamless web'. In particular the related approach of ANT is the most radical one dissolving the boundaries between society, economy and technology.

3.2 Multi-Level Perspectives and Life-Cycle Approaches in Innovation Theory *(Susanne Giesecke and Klaus Kubeczko)*

The debate on transition towards holistic sustainability at the turn of the millennium gave rise to an understanding of innovation as a live cycle, developed by Geels and Schot. It is connected to the terminology of 'multi-level perspective', meaning that transition is seen as an 'outcome of alignments between developments at multiple levels' (Geels and Schot, 2007). The MLP (multi-level perspective) approach is meant as a heuristic concept distinguishing the three levels *niche*, *regime* and *landscape*. Here, multi-level does not stand for the policy levels region, nation, supra-nation. Rather, the heuristic approach describes the scope of an innovation: operating restricted to a niche market; is the scope of the innovation at the level of a socio-technical regime; and how do innovation activities react to the transformative pressure from the socio-technical landscape.

Origins of this approach are rooted in the classic innovation system work of Nelson and Winter (1982)who coined the term technological *regime*. This refers to shared cognitive routines among a wide community of technicians, e.g. engineers. While Nelson/Winter stuck to the technological paradigm, sociologist of technology have broadened the scope towards society, because technology is not and end in itself but a product of social production, thus social actors should be acknowledged for their impact as well (see Bijker, 1997). This

broadening of the MLP approach also opens it for Beckert's social grid approach (Beckert, 2010) as applied in the CRESSI project. For example the understanding of socio-technical regimes manifested by cognitive routines that lead to lock-ins is very similar to that of cognitive frames in Beckert's approach as one of the three social powers responsible for reconfiguration and reproduction of an existing social grid.

3.2.1 Differentiation of three levels

The differentiation of three levels puts the regime in the sandwich position between the niche or niches and the landscape. Geels and others (Geels and Kemp, 2007) also use the terms micro (niche), meso (regime) and macro (landscape) level but this terminology is often used in (innovation-) economics with a slightly different meaning which might lead to confusion. The technological niche thus signifies the micro level where new developments occur. The niche is a room of experimentation; some experiments are more successful than others; some disappear, some are able to prevail on the market and can be classified as innovations. Interestingly, as Geels and Scot point out, niches are "carried and developed by small networks of dedicated actors" (Geels and Schot, 2007, p. 400), thus here already we encounter the network as a social power in Beckert's understanding. Similarities occur with the development of social innovations. In general, they start as a niche just as business innovations do and are at the beginning minor alternatives to a dominant social practice.

The term *landscape* describes a contextual system in which regime and landscape are embedded and experience influence of such landscape. Changes at the landscape level take place slower than at niche or regime level. Geels and Schot do not explicitly say how change occurs and why. If or how changes at regime level also affect the socio-technical landscape has not been discussed so far (e.g. how 20th century consumption patterns accelerated climate change). This interpretation is supported by Geels' and Schot's explanation for transition, which happens through interaction at all three levels. Both niche innovations and changes at landscape level (e.g. demographic change) create pressure at regime level and might lead to a transformation of that regime and give a niche the chance to change a regime. This transformation could even be radical. Landscape pressure is also crucial for the development of a social innovation. If and how a social innovation can become stable, grow in scope and scale and succeed at regime level depends to a large degree on the opportunities induced by changes at or pressure from the landscape level. Pressure on the incumbent regime might open up opportunities for niche solutions and expand to become regimes themselves.

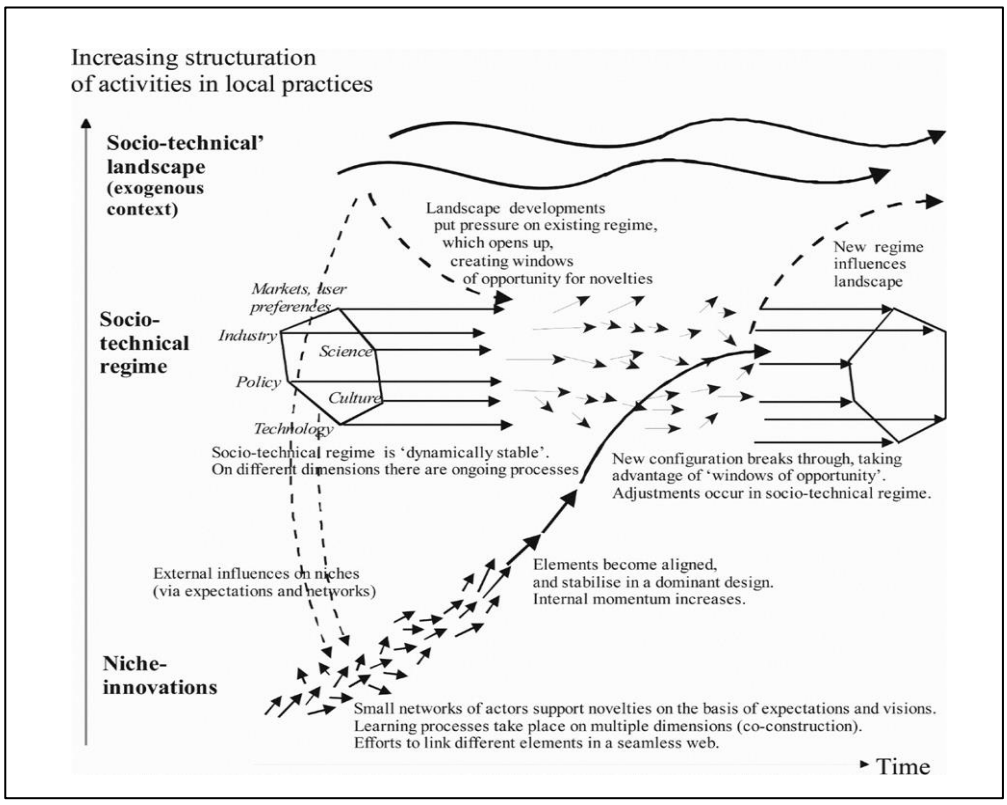

Figure 1: Multi-level perspectives on transitions according to Geels (2002), p. 1263; see also (Geels and Kemp, 2007)

Additional theoretic threads to explain change were introduced by Smith et al. (2005) who also regard change as the outcome of a selection process on the regime by – what Geels and Schot (2007) call – landscape and niche forces. Pressure from niches can be of economic origin (e.g. competition) or from landscape level of political, social and economic developments (globalization, neoliberalism). Pressure can be internal and/or external, whereas the landscape level usually exerts external pressure.

For the link to Beckert's (2010) social grid model it is also interesting to consider the differentiation of types of change processes.

3.2.2 Different mechanism in change processes

The typology most commonly used to describe different mechanisms in change processes was introduced by Geels and Kemp (2007). As in Beckert's social grid approach the question of how change occurs and is ignited remains not totally answered, the distinction of those mechanisms might be fruitful in the CRESSI context.

The first mechanism is "reproduction". It relates to dynamics within an existing regime. As no pressure occurs from landscape and niche levels, incremental innovation by incumbent

actors (e.g. to increase efficiency) are the intrinsic change mechanism to keep the system in a stable status.

"Transformation" is the mechanism by which incumbent regime actors reacts to pressure from the landscape. The role of the incumbent actors is to play an active role in adapting and reorienting the regime in order to stabilize the system with respect to changes in its macro-level environment. This type of change process does not depend on radical innovations stemming from the niche level. However cumulative adjustments of the social grid leads to a new direction in the development of the socio-technical system.

"Transition" is the type of change process that reacts to changes in the landscape which create increasing tension in the regime. Innovations, which can develop in niches eventually, break through. When incumbent actors fail to solve regime problems themselves, outsiders with radical innovation lead to a shift in the regime and those innovations in co-evolution with the changes in the institutions, social groups and cognitive rules might lead to a new phase of stability.

Table 1: Different Mechanism in Change Processes (Geels and Kemp, 2007)

	Reproduction	**Transformation**	**Transition**
Levels involved	Regime dynamics	Pressure from landscape Adaptation and reorientation in regime	Pressure from landscape Increasing problems in regime, and attempts at re-orientation New innovation in niches that eventually break through
Role of actors	Incumbent regime actors	Pressure from outsiders Incumbent regime actors respond through re-orienting innovation trajectories	Pressure from outsiders Incumbent actors fail to solve regime problems Outsiders develop new innovations

Another similar typology which attempt to explain change from internal vs. external resources was introduced by Berkhout et al. (2005). There are some unsolved issues with this typology which are not of interest in the context of CRESSI. One option to frame how change occurs given by Berkhout's et al. (2005) terminology is endogenous renewal, resulting from within the regime, from its actors who make conscious and planned efforts in response to pressures. Another type is the reorientation of trajectories, resulting from internal or external shock, followed by a response from regime actors. Thirdly, emergent transformation is the result of uncoordinated pressure, outside the regime. And finally, purposive transformations typify intended and coordinated change process from outside the incumbent regime. The latter resembles what Geels and others ((Geels and Kemp, 2007) call "transition".

Freeman and Perez (1988) introduced a differentiation of innovation according to its impact. Scholars of MLP and life cycle analysis make use of this typology to define change through innovation in a more refined way. The typology distinguishes incremental, radical, and system innovation and techno-economic paradigm shift. Incremental innovations are minor alterations of an existing product or process but do not alter the power constellation within a regime and are usually independent of landscape changes. Radical innovations affect firms and industries. System changes go beyond that level and affect user practices, policies, and cultural meanings (e.g. introduction of book printing, introduction of PC).

A more recent understanding of technological/business innovation and its causes and effects in the context of MLP puts emphasis of studying the change not only triggered at niche level but as a result of ongoing processes at regime and landscape level and mutual interaction as well. Thus niche developments cannot by analysed isolated or out of context.

Scholars of MLP assign niches and regimes the same or similar kinds of structures; differences exist, though in size and stability. Both have communities of interactive groups, also called 'organisational fields'. For niches they are smaller than regimes and less stable. Their communities share certain rules that coordinate action. This is another theoretic similarity with the Beckert social grid. According to their different character, niches have less articulated and less stable rules than regimes. Just as in Beckert's understanding, in MLP (and based on Giddens 1984), "actors are embedded in rules and structures, but at the same time reproduce them through their action". (Geels and Schot, 2007, p. 403) Rules are much harder to change for actors of an established regime than for actors in a feeble or ephemeral niche. "Niche-innovations can become regimes, when social networks grow larger and rules become more stable and constraining, leading to a reversal in their relation to agency." (Geels and Schot, 2007, p. 403)

Landscape changes can also influence the developments of niches and regimes. But since landscapes are structured differently they do not determine directly the developments of the other configurations but make some actions easier than others. Generally, socio-technical landscapes are relatively static and solid and change only over much longer periods of time and more at a macro scale (e.g. global). One exception is an external shock such as war. Actors of regimes and niches can usually not influence developments at landscape level.

To categorize differences of transitions Geels and Schot (2007) introduce a typology of four pathways, differing from each other in terms of timing of interaction and in terms of nature of interaction. Timing is important with regard as to when landscape pressure hits regimes and in which state the niche developments are at that point: "If landscape pressure occurs at a time when niche-innovations are not yet fully developed, the transition path will be different than when they are fully developed." (Geels and Schot, 2007, p. 405)Landscape pressure on the regime can at times open up a window of opportunity for niche developments to stabilize and substitute - or at least alter - the old regime – if the niche developments are ready for this.

Different natures of interaction can be distinguished by the school of MLP:

- *Reproduction process:* This is business as usual. The absence of landscape pressure reproduces the incumbent regime. The regime is dynamically stable, thus incremental change is possible. It has sufficient problem solving capacity to react to pressure from niches or minor pressure from the landscape level.

- *Transformation path*: In case of moderate landscape pressure at a time when niche innovations have not yet been sufficiently developed, the regime actors might reorient their strategies and alter parts of their actions but the niche innovations are not ripe enough to take advantage of the landscape pressure and cause a substantial turnaround. Some will be absorbed, other will disappear, some will co-exist. In the Geels/Schot terminology, the transformation path is the only one which acknowledges the impact of outsiders such as societal pressure groups and social movements who target specific issues and demand solutions, e.g. with regard to tougher regulations. This gives also opportunities to niche innovations that respond to the demand of such pressure groups more appropriately than the incumbent who serve a mass demand, e.g. organic food as opposed to conventionally produced food. Food scandals, coverage of the press and tougher regulations imposed by the government (landscape) create a supportive structure for a broader adoption of the niche innovation. This development might take some time as outsider protests and landscape pressure to not automatically lead to a regime change. There is usually some resistance in the old regime. However, we do not talk about a total turnover of the old regime here. Rather, the traditional regime actors will "use their adaptive capacity to reorient development trajectories" (Geels and Schot, 2007, p. 407), thus they will survive the turbulence but in an altered way. Most regime actors are still part of this altered regime, although some changes may occur in social networks, external knowledge might be integrated and absorbed. The basic architecture of the incumbent regime remains intact. (Example: organic food production picked up by incumbent regime actors in the 1990s, e.g. supermarkets.)

- *De-alignment and re-alignment:* Accompanied or even triggered by a massive and sudden landscape change, regime problems occur and cannot respond to the disruption. Traditional regime actors lose faith and turn to new options or resign. "This leads to de-alignment and erosion of the regime. If niche-innovations are not sufficiently developed, then there is no clear substitute. This creates space for the emergence of multiple niche-innovations that co-exist and compete for attention and resources. Eventually, one niches-innovation becomes dominant, forming the core for re-alignment of a new regime" (Geels and Schot, 2007, p. 408). This pathway is often accompanied by a vacuum of some sort, a power vacuum, a regulatory vacuum, a market failure, etc. (Example: transition from horse-drawn carriages to automobile in

the US in the late 19th century, enhanced by the hygiene movement, the urban expansion and the augmenting cost of large stable operations in cities.)

- *Technological substitution:* Here we are also speaking of a massive landscape pressure of the same quality as in the de- and re-alignment case, but at a time when niche innovations have sufficiently developed and can make a breakthrough on the market. A new regime is substituting the incumbent regime. Such innovations have been developed over time under the old regime but could not yet break through because the old regime (and the landscape) was still stable. (Example: British transition from sailing ships to steam ships mid-19th century, enhanced by government subsidies for steam ships to make communication within the Empire faster.)

- *Reconfiguration pathway*: A new regime grows out of the old one through radical innovations that have initially been developed in niches. They have symbiotic relations with the incumbent regime without endangering the traditional actors, can easily be adopted and improve existing technologies, processes or systems. Originally started to solve a local problem, this reconfiguration alters the basic structure of the regime substantially. Reconfiguration pathway are especially typical in distributed systems or sectors with multiple technologies involved (agriculture, retail, hospitals). Change in one sub-system might trigger another change and so on, leading to new overall organisations of production and redistributions but not necessarily the actors. Parts of the system might be exchanged while the majority adapts the new innovations and complies with its new system logic. (Example: Transition from traditional factories to mass production which developed over a span of more than 50 years in the US, starting in the mid-19th century. This change was accompanied by several parallel and subsequent technological process innovations, managerial and system innovations.)

- *Sequence of transition pathways*: A combination or sequence of transition pathways occurs if slow but continuous pressure is exerted from the landscape to the regime level. The initially moderate reaction of regime actors to cope with the changes imposed by the landscape level eventually becomes more disruptive as more and more problems occur at regime level. If adjustments from within the regime are sufficient, the change can be characterized as "transition path", see above. But if such adjustments are sufficient, niche innovations are adopted and find their way into the incumbent regime. This change will bring about even more adjustment measures. If the regime architecture is changed during the course of this transition, it can be characterized as a reconfiguration path. If landscape pressure and regime problems continue, radical niche innovations, new firms, entrepreneurs etc. enter the scene and can set foot on the market. If the incumbent regime is able to make sufficient adjustments before such new actors and developments become prominent on the

market, the traditional actors will survive, if not, a lot of the traditional regime actors, products, processes and systems will be substituted by new ones. Depending on further pressure from landscape level and readiness of niche development, technological substitution and/or de-alignment and re-alignment mechanisms change the configuration. (Example: Climate change is likely to become a major pressure factor in a disrupted landscape triggering changes in a sequence of transition paths in transport and energy.)

3.2.3 Rule-based model of action'

MLP theorists stress that their approach is a 'rule-based model of action', thus incorporating different types of rule-based agency. Examples of rule-based action are rule-following, using, creation and alteration. They use several authors to differentiate four foundational paradigms:

1. *Rational choice*: based on Hodgson (1997) and Callon (1998), rational choice based on rules and cost-benefit calculations assume formal, normative and cognitive rules providing a stable frame for action.

2. *Interpretation and sense-making* are actions within predefined cognitive frames based on rules, their creation and alteration and on interpretation of such rules in form of negotiation and shared meaning.

3. *Power* is used for formal rule alteration, e.g. from collective actors such as industry association, unions, social movements

4. *Deep structures* are shared by actors with the same cultural believe systems and have grown over time. The more they are shared in a growing community, the deeper they become. This way, new structures can become deep structures when introduced by new or changed cultural practices, finding increasingly more acceptance (Swidler, 1986).

For the analysis of social innovations and the CRESSI case studies, some of the pathways and categories described here might be applicable. Further research has to investigate if empirical evidence supports the basic assumptions or if they need some refinement. The differentiation will also help to assign the different cases to certain categories. Deficits in the theoretical assumption will require not only adjustments in the framework but also recombination of pathways and bring about the differences and similarities of technological and social innovations.

3.2.4 Lessons from the Multi-Level Perspective for the study of social innovation

The question we wanted to address in this section was: how far these concepts are able to explain the contribution of social innovation to socio-technological trajectories, including the ones that go along with economic growth and others that affect systemic change.

For the historical analysis of social innovations in the CRESSI case studies, some of the pathways and categories described by the MLP approach might be applicable to some degree.

1. The socio-technical perspective of the MLP approach is open enough to take into account the co-evolution of social innovations as part of broader change process (as part of reproductive , transformative or transitional processes) encompassing technological changes and changes in the organization of production and consumption.

2. The understanding of the regime level in MLP is closely related to Beckert's social grid (Beckert 2010) approach in that both draw particular emphasis on institutions and rules, social networks as well as cognitive frames (social-grid-terminology) and cognitive routines (MLP-terminology) (Geels and Kemp, 2007).

3. The consideration of socio-technical systems as the "tangible elements needed to fulfil societal functions" (Geels and Kemp, 2007) as part of the analytical dimension in the MLP approach adds another dimension for describing systemic change, in the sense of transition and transformations .

4. Particularly those who lead to changes in the social grid. It particularly highlight, as do the SCOT approaches, that technological change and social innovation cannot be seen as distinct but that any innovation has technological/artefactual as well as social components.

5. Drawing an analogy between the regime level of the MLP-approach and the Beckert's social grid should become productive when accepting that Social Innovations are co-evolving from both non-technological and technological novelties.

6. As the notion of regime in MLP and the social grid approach are closely related and analogies and differences should be explored in further research.

For the above mentioned mechanisms in change processes (Table 1), we can also draw conclusion regarding the potential role and forms of social innovation in different form of change processes (replication, transformation or transition). Table 2 provides some examples of different kinds of social innovations.

Table 2: Potential role of social innovation in different change processes

	Reproduction	Transformation	Transition
Role for social Innovation	Incremental changes in the context of a stable social grid by incumbent actors (e.g. adaptations of the institutional setting, new constellations in relation between actors at the supply and demand side, refinement of models of coordination in the system)	Social innovation through incumbent actors in the social grid in order to adapt and reorient the regime (e.g. foundation of new coordination mechanisms based on self-organisation between actors in order to avoid state intervention in the regulatory system)	Social innovation developing in niches (e.g. protected and/or financed by the state or by other outsiders) Social innovations (in institutions, cognitive frames and social networks) to set up a new social grid in reaction to the pressure from the landscape and the new innovations (technological and/or social)

However, especially the pathways described in 3.2.2 need to be critically assessed with respect to their relevance for analysing change processes dominated to a lesser extent by technological niche developments and probably redesigned according to the empirical evidence from our long-term cases. Further differentiation will also help to assign the different cases to certain categories. Deficits in the theoretical assumption will require not only adjustments in the framework but also recombination of pathways and bring about the differences and similarities of technological/business and social innovations.

4 Conceptual Notes *(Klaus Kubeczko)*

4.1 Notes on processes oriented innovation literature conceptualising life cycles of solutions for the marginalised:

Open innovation

Open innovation emphasises the role of the user in the innovation process, which might be particularly relevant for an early phase of the social innovation life cycle.

Design thinking and value sensitive design (VSD)

Design thinking and VSD are more related to the micro-level analysis of the cognitive frames of individual actors involved in the design phase of concrete social innovation process. They are rather useful as mental maps of individual actors in the phase of invention and development of an artefact not intended to provide an analytical framework for a case study analysis.

Constructivist approaches to study technological innovation (SCOT, ANT, LTS)

Approaches related to STS share the understanding that technologies do not evolve along a 'natural scientifically logical' path, but understand them as the result of complex social processes. Thus technologies and technological change is and can be influenced by the social context. Even though scientists and engineers often understand and perceive the technological development as following a technologically determined path, STS has shown that technologies are shaped by social processes (Latour and Woolgar, 2013b; Pavitt, 1984a; Pinch and Bijker, 1987a; Rip, 1992a). In the report we focus on constructivist approaches to study technological innovation, in particular on the "Social Construction of Technology" (SCOT) approach and on the other hand approaches such as actor network theory (ANT) (Callon, 1987) and large technological systems (LTS) (Hughes, 1987).

SCOT, ANT and LTS have in common that they were developed as an answer to technological determinism, which neglects the role of the social for technological change. Thus, all three approaches share the ambition to move away from previous conceptualizations emphasizing the role of the individual inventor (or genius) and from making distinctions between technical, social, economic and political aspects of technology development, conceptualizing society and technology as a "**seamless web**" in which different actors, social groups or technological artefacts constantly interact (Bijker *et al.*, 1987, p. 3). Bijker and colleagues argue that frequently used distinctions, such as society/technology, technical/social or 'pure'/applied science are socially constructed and can, consequently, be misleading the researcher of technological change. The above mentioned MLP approach is already taking this into account by considering socio-technical systems and their "landscape" as their object of analysis.

Thus, we suggest that in analysing Social Innovation cases in WP5 technological aspects and artefacts of Social Innovation shall have equal importance as social grid dynamics.

Diffusion of innovation (DoI)

As the seminal work by (Rogers, 2003) on DoI covers a wide range of innovations – including social innovations, e.g. the case of worldwide diffusion of Kindergarten – shows, the role of networks is an important aspect in the adoption of all kinds of innovations independently of being profit-oriented or intending social change. Therefore the literature on diffusion research can provide valuable input for the analysis of this particular phase in the social innovation life cycle.
Rogers also treated with criticism the diffusion research and has shown different biases that should also be taken care of in CRESSI (pro-innovation bias, individual-blame bias, recall problem). He also addresses the issue of (in-)equality in the diffusion of innovations through the different type of adopters (early adopters, change agents, late adopters, etc.).

Innovation Journey

The Innovation Journey approach (van de Ven, Andrew H. *et al.*, 1999) distinguishes three phases as common elements of the innovation process (initiation period, development period, implementation/ termination period). It focuses on innovation process of companies, taking into account also their external connections and institutional rules as "boundaries of the journey". It also analyses the process using a concept of power of internal and external groups. This might help link to the concept of power used in CRESSI.
From a methodological point of view, the innovation journey approach is using quantitative event analysis, which might be interesting to look at from the point of view of WP5.

Multi-Level-Perspective (MLP)

One of the most influential streams of literature in transition studies is based on MLP. Geels understands it as middle-range framework for analysing socio-technical transitions to sustainability and is intended to describe long term change (Geels, 2011).
Transition pathways follow different patterns (transformation, technological substitution, reconfiguration, de-alignment and re-alignment) (Schot and Geels, 2008; Geels and Schot, 2007). For the analysis in WP5 it could be interesting to take this as a hypothesis for looking into the dynamics of change through the lifecycle of a social innovation.
The notion of socio-technical systems emphasizes that transitions requires not only changes with regard to technologies, but more fundamental transformation processes which include user practices, regulations, the governance and the cultural meaning of certain products and services (Markard *et al.*, 2012; Geels *et al.*, 2008). As in Beckert's social grid approach, the MLP approach focusses on markets. However we think that it can also be used in analogy for non-market niche actors reacting to societal needs.

The MLP literature distinguishes three levels: landscape, regime and niches:

- socio-technical landscape factors are technical and material backdrops, demographical trends, political ideologies, societal values, and macro-economic patterns. (Geels, 2011)
- socio-technical regime change as "semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems" (Geels, 2011) (similar to institutions as understood by Beckert).
- Emergence of new niches which "are 'protected spaces' …. where users have special demands and are willing to support emerging innovations" and "[n]iche actors … work on radical innovations that deviate from existing regimes."(Geels, 2011).

This framework might provide a valuable starting point for developing an analytical framework in WP5, as(a) it distinguishes between a "landscape" which on the one hand provides and does not forget to look at path dependent factor which cannot be influenced by the dynamics of the regime/social grid level and on the other hand can help to capture external shock which can influence and triggers change, and (b) it shows that it is possible to link up the meso-level approach (regime-level / with an analogy in the social grid) with the micro-level of concrete innovative activity over time as a kind of life-cycle approach.

4.2 Notes on conceptualising Innovation (Eco)systems for Social Innovation:

Innovation (Eco)systems

Innovation ecosystem is a term rarely used in the European academic discourse on innovation but it can be seen as an innovation system approach emphasising the evolutionary or co-evolutionary characteristics of interaction of actors and networks within the realm of innovation. In the US discourse it is commonly understood as encompassing a broader range of actors and networks than in the European discourse. D.J. Jackson (Deborah J. Jackson, undated) emphasises the distinction between, and consideration of, actors in a "knowledge economy" and in the "commercial economy". Others use it in the sense of National Innovation Systems (Frenkel and Maital, 2014) also addressing issues of financing innovation more prominently than the European NIS literature. While the European discourses emphasise the role of policies and the public sector in innovation, the US discourses (Adner, 2006; Schrage, 2014; Markmann, 2012) emphasise the role of enterprises and their surrounding acting in a co-evolutionary way.

This implies that from the point of view of specifying the concept of ecosystems for social innovation for marginalised it is of less importance to focus on the distinction between "innovation systems" and "innovation ecosystems" as the main lessons can come from the

fact that there is rich and long-standing empirical evidence that systems matter and that the success or failure of innovation rarely depends (solely) on individual actors (e.g. a genius with a brilliant idea or a patentable blueprint of a new artefact or model) but on a wide range of actors (including those on the demand side), possessing different types of knowledge, providing different kinds of services and (knowledge, material , monetary) resources, their interaction and the institutional settings framing the environment in which innovation processes take place. In sum, successful innovations require different types of knowledge and skills, and those are rarely – if ever – available inside a single organisation (possessed by a single actor).

The innovation system literature on National Innovation Systems (NIS), Sectoral Innovation Systems (SIS), Regional Innovation systems (RIS), and Technological Innovation Systems (TIS) stresses the importance (the role) of…

- various types of actors
- various types, sources, and forms of knowledge
- networks, clusters, interactions, various types of co-operations
- distributed knowledge bases
- institutions

…in conducting innovation activities.

Important notions include:

- risk vs. uncertainty
- optimisation vs. routines
- information vs. knowledge (learning and learning capabilities)
- individual vs. organisational learning (processes, capabilities)
- explicit vs. tacit knowledge
- linear vs. networked (interactive) models of innovation
- market failure vs. systemic failure as a justification for policy intervention
- co-evolution of technologies and institutions (respectively social-grid in the terminology of Beckert)
- policy learning, adaptive policy-making vs. optimal policies
- best practice vs. good practices
- benchmarking vs. intelligent benchmarking

All innovation system approaches (NIS, RIS, SIS, innovation ecosystems) are very much in line with at least two dimensions of the social grid approach, namely institutions, networks and how they interact. More recent streams of the literature related to technological innovation systems (TIS) also emphasise the functions of innovation systems, which can be understood as cognitive frames (and dynamics between cognitive frames, institutions and

networks) in the social grid context (e.g. the TIS function of "influencing on the direction of search" and "legitimation" (Bergek *et al.*, 2008))

Therefore it can be clearly stated that Beckert's social grid approach (Beckert, 2010) can be used as a framework compatible with some of the fundamental notions of the innovation system literature. As the innovation system literature has been developed over several decades now, it can also be expected that it provides more guidance for some aspects of the dynamics than Beckert's paper. As the dynamics between the components of the social grid has not been so much in the forefront of the analysis of innovation systems so far, the social grid approach might provide a new framework not only in the context of social innovation, but also for more conventional innovation system studies.

It should also be noted that the social grid analysis must be widened from the dynamics of markets (i.e. the economic sphere; as in the work of Beckert) to the dynamics of the social (non-market) sphere as well (and also the dynamics between markets (economy) and non-markets (in the sense of non-commercial interactions, policy and science)

Another important question, which has been an issue in the innovation systems literature, which has to be tackled, when developing a Social Innovation approach, is how to draw systems boundaries. The notion of the "social" certainly influences the definition of adequate systems boundaries differently than in the realm of commercial innovations and the market field. It will be of relevance in all the three dimensions of the social grid approach.

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Creating Economic Space for Social Innovation

The CRESSI project explores the economic underpinnings of social innovation with a particular focus on how policy and practice can enhance the lives of the most marginalized and disempowered citizens in society.

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