COLLABORATIVE CAPABILITY DESIGN: REDUNDANCY OF POTENTIALITIES[1]

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Abstract

In this paper we extend the core socio-ecological concept of two contrasting design principles applicable to all work systems. Reframing those design principles as strategic as well as operational choices leads us to propose a third design principle, Design Principle 3 (DP3), which has remained undeveloped in social ecology. We call this design principle *Redundancy of Potentialities* and demonstrate its application in transorganizational work systems. We argue that DP3 is at the core of socio-ecological practice and is therefore appropriate for coping with the highly turbulent environments now experienced in many industries and fields. We offer several illustrations of DP3 in practice and draw implications for enhancing capabilities for creative collaboration in inter-organizational fields through deliberate attention to design.

Key words: design principle; social ecology; trans-organization; inter-organizational field; capabilities

1. INTRODUCTION

Interlinked global crises exist today, including climate change, the viability of the Euro, stalled growth in the OECD, growing inequality and peak oil. These crises are multi-faceted, manifesting in economic, political, institutional, ecological and cultural spheres. The crises have long been experienced in 'peripheral' countries of the developing world, but since the advent of the global financial crisis (GFC) in 2008 the 'core' countries of the first world have experienced them too, often in unexpected ways. The GFC was *produced* by core 'developed world' institutions, as is evident in the way those institutions have been working since the eruption of the GFC. Because the multifaceted crises have infected the core institutions of even the largest developed nations, they now threaten the entire world.

No central institution (e.g., the UN, US Federal Reserve, IMF, European Central Bank, NATO) or combination of them has found the capacity to deal with these crises in a holistic way. As of this writing (October 2012), in the EU the central bank is prevented from acting as the lender of last resort to ameliorate the eurozone debt crisis, but even if it were able to act in that capacity, it is not certain that the ECB would be effective given the cumbersome nature of the EU governance system. The US political system is gridlocked, and its lender of last resort, the Federal Reserve Bank, has bumped up against the limits of its traditional monetarist tools.

Why has the GFC hit with such intensity and breadth? Some commentators have asserted that the global economic/political meta-system is very crisis-prone (Beck and Holzer, 2007; Homer-Dixon, 2006). Individual sub-systems within the global meta-system appear to be subject to more frequent and more intense disruptions. These impinge from various sources in the environment, such as attempts by players in an industry to gain competititve advantage by destroying the conventional bases of competition, which spin out

of control; intentional attempts to 'jolt' a field or industry; and natural or man-made disasters (Selsky and McCann, 2010: 172-173).

This predicament of sudden macro-level, or contextual, change with insufficient coping capacity in organizations and institutions creates the fertile ground for this paper. We argue that the global crises sketched above may usefully be understood and analyzed as a *design crisis* brought about by the persistence of environmental turbulence. This design crisis evokes new arenas of risk and opportunity.

Ever since Herbert Simon (1969) identified the 'sciences of the artificial' as a design challenge, systems and organizational scholars have attended to this approach. Building on Churchman's (1971) work on 'designing inquiring systems,' Ackoff adopted a design approach in his work on redesigning the future (1975) and the corporation (1999). Recent organizational research on design finds salient connections among design, capabilities and strategy (Normann and Ramirez, 1993, 1994; Dunbar and Starbuck, 2006; Greenwood and Miller, 2010; Pascal, Thomas and Romme, 2012). At the inter-organizational level a design approach has been evident for some time (see Ackoff, 1975; Cummings, 1984). Van de Ven and Hargrave (2004: 264) trace the notion of institutional design – that is, "view[ing] institutions [as] a reflection of conscious, intentional decisions and actions" – to the work of J.R. Commons in the 1920-1930s. However, design at the inter-organizational level requires further development. In this paper we seek to contribute to this effort within the conceptual context of social ecology. We do so by reframing the original Emery design principles (1967) so that they are as responsive as possible to today's turbulent environment.

Social ecology, or the socio-ecological perspective, is a school in organization studies whose origins lie in the work of Fred Emery, Eric Trist and others on the relations between systems and environments (see Emery, 1999, 2000; Selsky, Goes and Baburoglu, 2007; Ramirez, Selsky, van der Heijden, 2010). In this paper we focus on an important

class of systems, namely, inter-organizational fields, and their constituent parts, namely, complex organizations and their transactions with their environments. According to social ecology, a set of systems (for our purposes, organizations), the transactions among them, and their relevant environments constitute a social field; examples of such fields are the higher education sector in Florida, the Mexican cement industry, and the multi-sectoral set of organizations devoted to dealing with AIDS in Africa or with global climate change. Social ecology holds that field-level (rather than organization-level) interventions are required to address the contextual disturbances which erupt in social fields, such as those manifested in the crises described above. But the structuring of such fields tends to be weak and ad hoc (Trist 1977; McCann, 1983), so an important question is, what is the principle, or basis, for the design of large-scale fields? Echoing Emery (1969) and Barton and Selsky (2000), we inquire as to how social ecology might inform the design thinking needed for the regulation of inter-organizational fields.

Given recent calls for organizational research to be re-thought *as* design science (e.g., Greenwood and Miller, 2010), social ecology has the potential for increased salience and impact. The starting point is the legacy of Fred Emery (1967) and Merrelyn Emery (1999, 2000), who identified and elaborated the two organization design principles: *Redundancy of Parts* and *Redundancy of Functions*. Although Merrelyn Emery (1999) considers them to be "complete and exhaustive," we argue that a third design principle, made visible by the reframing we undertake in this paper, may help to advance understanding of how work systems spanning across organizations, or "trans-organizations" (Cummings, 1984; Motamedi, 2012), either currently are or potentially could be designed.

In this paper we attempt to introduce the Emery legacy of design principles into current debates about the design of inter-organizational fields to foster creative collaboration. In the next section we outline the broad context for this issue in terms of

turbulence and collaborative responses to it. We argue that a third design principle is at the core of socio-ecological practice and is particularly appropriate for the turbulent (Emery and Trist, 1965; McCann and Selsky, 1984), vortical (Baburoglu, 1988) and 'hyper' (Selsky et al., 2007) environments now experienced in many industries and public policy sectors. We then offer contrasting perspectives on how value is created in inter-organizational fields, which provides a platform for discussing knowledge-based collective capabilities. We then explore the meaning and function of the Emery design principles, and identify an area of practice where those design principles may be extended, namely, into trans-organizational work systems and into the future potential of such systems. This leads us to identify system requirements for a third design principle, then to outline its contours. We call this new design principle *Redundancy of Potentialities*. We offer two illustrations of it in practice, then draw implications for enhancing capabilities for creative collaboration in inter-organizational fields through attention to the design of trans-organizational work systems.

2. TURBULENCE AND CREATIVE COLLABORATION

We believe a third design principle needs to be articulated because turbulence, the need for collaborative endeavors to cope with it, the burgeoning array of collaborative arrangements and the increasing number of social system failures call for a reframing of the original two design principles. Apple's controversy regarding outsourcing to Chinese subcontractor Foxconn illustrates the importance of these phenomena (*New York Times*, 22 and 26 January 2012). Apple became embroiled in public controversy involving global supply chains, intensive industry competition at a global level, greater scrutiny made possible by social media, shifting expectations regarding MNCs' social responsibilities, and other high-level drivers.

In social ecology "[e]nvironments are conceptualized as 'extended social field[s]… with a causal texture' (Emery, 2000: 625). The *causal texture* is an emergent property of the whole field and affects the behaviour of all systems within it. It is produced by the interactions of the social actors inhabiting the same field plus the effects of external forces acting on those actors" (Selsky et al., 2007: 74). Most contemporary studies using a socio-ecological perspective, including this one, use the texture called the *turbulent field* as a touchstone. The high relevant uncertainty produced by a turbulent field for those in it penetrates organizations, seriously affecting their ability to strategize effectively and achieve their goals. Emery and Trist (1965) suggested that the volatility of the turbulent field would or should lead organizations to engage in collaborative endeavors to address it.

Indeed, collaborative inter-organizational arrangements have exhibited significant growth during the past thirty years. Arguably as a response to growing turbulence in contextual environments, many industries and sectors are now well populated with a panoply of NGOs, QUANGOs, task-forces, working groups, think-tanks, coalitions, industry associations, federations, consortia, alliances, partnerships, joint ventures, platforms, commissions of inquiry, and other collaborative structures. The recent explosion of virtual and on-line collaborative arrangements – peer-to-peer, open source, copy-left, etc. – have added to this list. It would appear that Trist's (1977) lament of weak structuring between the agencies of the state and the single organization is being redressed.

In the wake of the burgeoning of these 'in-between' structures and studies of them, some researchers have examined collective capabilities and the designs and governance structures associated with them (see Normann and Ramirez, 1993; Clegg et al., 2002; and the papers in Beyerlein et al., 2004, 2005). Davis and Marquis (2005) reviewed studies that explicitly or implicitly consider field-level capabilities; and Meyer, Gaba and Colwell (2005) reviewed a set of Meyer's studies of nonlinear change in various fields. In the innovation

literature, Sawhney and Prandelli (2000) propose a clan-based governance form for innovation, which they call a “community of creation”, that acknowledges that “[t]he locus of innovation is no longer within the firm; it is within a community of members in an opportunity arena” (Selsky et al., 2005: 26), such as a regional biotechnology field or an open-source software network. Powell et al.’s (1996) landmark study of the biotechnology industry found the locus of innovation to be the network of learning, not the individual firm. The open-source software community, which we refer to in Section 6 below, has been used to understand how innovation emerges and develops in a field (von Hippel and von Krogh, 2003; Weber, 2004). In addition, Dougherty and Dunne (2011) have proposed that “ecologies” of private and public organizations be brought together to catalyze field-level emergence for “complex innovation” to address major societal problems.

Thus, a number of studies in several literature areas have examined collaborative capabilities and the structures associated with them. However, no one so far as we know has delved into the design principle(s) that underlie them. Our intent is to inquire whether these inter-organizational, field-level developments warrant the identification of a third design principle that we argue is already in widespread practice. As such, it is not a new principle, but a principle-in-use that we bring to attention and connect to the existing body of knowledge.

3. PERSPECTIVES ON VALUE CREATION

Normann and Ramirez (1989, 1994) view *offerings* as the links co-produced between economic players that enable the ‘supplier’ (a player defined as such by the role it plays within a specific offering linking it to another player or players) to help the ‘client’ (*idem*.) to be a more effective or efficient value creator. In the Normann-Ramirez framework the value of a given offering for a given ‘client’ is only apparent to that client in the context of

other ‘offering’ relationships s/he engages in. The same applies to any given ‘supplier’. Value and values are thus considered to be co-produced (Ramirez, 1999) not only among players but among interactions (or ‘offerings’), and they are contingent on the network of offering relations any one player enters into. This ‘co-producer perspective’ differs from a more conventional value production perspective captured in the sequential value chain concept popularized by Michael Porter (1985). Recently, Vargo and Lusch (2004, 2006, 2008), in highly cited articles on “service dominant logic” (SDL), go beyond Normann and Ramirez in stating that all transactions are, or should be, dominated by a services perspective, displacing what they see as a “goods dominant logic” which has captured the mindset of strategists for decades. A related development is Jim Spohrer’s IBM-driven initiative of “service science” (SS), which attempts to carve out a distinctive inter-disciplinary field to study and promote services research. Both SDL and SS acknowledge the important role of Normann and Ramirez’s notion of interactive strategy when studying how service logic has extended to non-service fields. In this alternative view, the service-inspired co-production logic of interactive strategy is a more useful and more widely applicable heuristic than the value chain for furthering understanding of how value is created in complex and fast-changing settings.

The potential for any player to have the role of, and in that sense become, a ‘supplier’ or ‘client’ lies in the potential offering links the player wants to enact and wants to invite his/her counterparts to enact. Such links are win-win based on a ‘dialogue’ (Bohm, 1996: 6). Dialogue never has been a zero sum game; in dialogue everybody wins if anyone wins. In other words*, the more connections the player engages in, and the larger the number of connections s/he promises to bring in, the more value s/he will co-generate***.** This is presumably why people join various social media and other on-line networking platforms like Facebook or LinkedIn; those services promise to enhance the social capital of an

individual member, building on the wealth potentially created by the 'strength of weak ties' (Granovetter, 1985) in interpersonal networks. In the same way, ex-prime ministers and other senior public figures get hired at high prices by investment banks, hedge funds and private equity firms not so much for their financial acumen, but for the potential that their rolodex, relations, and connections (and perhaps Facebook friends) bring to these firms. In short, potential connections are widely valued, but to become actually valuable this potential for connection value needs to be activated and used. We are not proposing that the practice of building social capital via rolodexes or Facebook contacts is new, but that it is important to recognize that a design principle is embedded in such an established practice and that attending to the embedded design principle can make a difference in performance and in effectiveness. One way in which this principle is articulated is to design the potential into the value creation formula of a network of actual and potential co-producers.

Actor-Network Theory (ANT) helps in understanding this. In ANT an 'actant' has a specific definition as a potential actor, which over the trajectory of becoming, usually becomes an 'actor' (Latour, 2005). Actors work hard with those in the network that they sustain and which sustains them to develop, transform, and keep their role, identity and position. For example, in its trajectory of development from the Model T to its present form, a car is now an actor that constrains and directs the activities of a huge network of actors that also define it: drivers, mechanics, insurers, pedestrians, traffic wardens, city planners, etc. Many of these actors started out as relationships, as offerings linking two pre-existing actors (like the client and the manufacturer). Over time the offering itself (the car in this example) becomes an actor that acts upon the actors it links. Inter-organizational activities that have retained 'actant', or potential, characteristics while at the same time exhibiting 'actor', or actualized, ones have been remarkably successful. The VISA payment club

(Ramirez and Wallin, 2000) and Airbus (remarkably, until each was constituted as a single company) are examples.

In the industrial 'actor only' perspective, value creation is conceived in terms of commercial transactions where one can only win or lose, that is, in terms of competitive relations at each stage in a value *chain*. Its focus is on the supplier, who maximizes the rent it can appropriate by being the sole value producer. Clients are considered to destroy rather than produce value when they consume it. In contrast, the co-producer perspective outlined above focuses on the network and on enhancing value production jointly for as many of the players involved as possible in a value *constellation*. For the purposes of this paper, a value constellation is a useful way of conceptualizing co-produced trans-organizational work systems, as discussed below. While inequality in economic transactions clearly exists, the win/win logic in this perspective profits everyone. The differences between these perspectives were summarized by Ramirez (1999) as in Table 1.

- insert Table 1 about here -

This distinction opens the way to a third design principle. One may envision the design of a value constellation from the point of view of any one player in three ways: (a) the design of the player within; (b) the design of the relations of the player with other players now; and (c) the design of the potential relations the player can have with players which it is not currently related to, as well as new relations it develops with players it is already related to. Let us examine them in turn, first using a simple mechanical example, then introducing some social messiness.

a) Consider the player as a single, independent, non-divisible entity or "part" that has only one function in the system of which it is a part. The design principle here suggests that if the function the player/part performs were to be removed from the system, the player/part would itself be removed from the system. In the case of a wheel and axle this is what happens if one of eight bolts holding the wheel to the axle is removed; seven such bolts still hold the wheel securely. System effectiveness remains acceptable for most purposes (perhaps not for the Paris-Dakar rallye). In Emery's (1967) design terms the functional redundancy that the system has assigned to the part is built into the part entirely, and when the function is made redundant, the player/part is removed. In the same way, if the part is removed (e.g., the bolt falls off) the functionality it brought to the system is no longer available to the system. This is what Emery (1967) called Design Principle 1 (DP1) – the redundancy is built into the part. Its key property is "subjective seriality, in which 'the governing relation is asymmetrical dependence. The sharing of parts is necessary to one of the parts but not to both' (Feibleman and Friend, 1969: 36)" (Emery, 1976/1993: 214).

b) Consider the player as a single, non-divisible entity or "part" still having only one function in that system, but now inter-dependent with other parts. Its leaving the system would affect other players, for it co-produces value with them. In the example, if the bolt in question leaves the system (is made redundant), and if the design principle in (a) above were operating, then the seven remaining bolts would have to take up 1/8th more of the load; but the wheel would become less balanced, reducing the overall system effectiveness. To prevent this, one could 'over-design' the carry load of each of the eight bolts, such that if any one of them were to fall off, the other seven would use their full potential, taking up the load of the missing one so that wheel balance is maintained and system effectiveness remains acceptable.

This extra strength built into each of the eight bolts, which they do not use if all bolts remain attached, is built into the *collection* of bolts. This is what Emery called Design Principle 2 (DP2) – the redundancy is built into the function, not into a single part, and is shared among the parts.

Emery extended this situation from a single function to multiple functions, making each part capable of performing more than one function. The collection of parts/players grouped around a set of functions they could share was thus semi-autonomous; it could internalize the regulation of those functions and link them with those of other such semi-autonomous groups. Its key property is "complementary seriality, in which 'the governing relation is symmetrical dependence. The sharing of parts is necessary to both of the parts. Neither part can survive separation…' (Feibleman and Friend, 1969: 36)" (Emery, 1976/1993: 214).

Merrelyn Emery (personal communication) considers that this second design principle includes the possibility to accept both new functions and new parts/players. Thus, if a bolt maker were to introduce an innovative "intelligent" bolt with a built-in sensor that indicates when one might break down, that failed condition would be signaled to a computer aboard the vehicle (cf. an existing tire of Michelin). A wheel-axle propulsion system designed according to DP2 could easily accept the new type of bolt and could link to the on-board computer in ways it had not done before.

It is possible to take a step beyond situation (b). In both situations above, redundancy is located either within an existing part of a system (a), or within the system and distributed among the parts of the system (b). We indicated the design principle associated with each situation. Now we want to envision a third situation, where redundancy is located *outside* the system as it is currently constituted, both materially and temporally. The

redundancy includes the ability to take on functions which do not exist within the system at the present time. What is the design principle associated with such a situation?

c) Consider the player in situation (b) – a single, non-divisible, interdependent entity – but in the future and a "part" of two systems, not just one. In the co-producer perspective of value creation, it is the actant (potential player), not the already constituted actor, that matters. Design here focuses not on the part itself (DP1) nor on the system of which the part is currently a member (DP2), but on the relations that the system of which the part is a member might have in the future with existing other parts/players or potential new parts/players. In the example, the relevant design principle might attend to regulatory frameworks that the bolt and its wheel-axle propulsion system might be subject to in the future, or to the pollution produced in the environment in which the vehicle operates.

An example of this situation occurred recently in the white-goods sector in Denmark. A new demand external to that sector is the effect of the nation's energy conservation priorities. Instead of retrofitting more energy efficient parts into old white goods, a Danish utility ordered the wholesale disposal of them, and offered its customers brand new models whose energy efficiency helped the utility to avoid building two new power plants. The design principle applicable to such situations introduces a temporal dimension into system design by projecting parts, functions and whole systems into potential and broader future contexts. We call this third design principle *Redundancy of Potentialities* and introduce it in the next two sections.

One may question the mechanical example above because it neglects the social messiness that inevitably occurs in the "real world" for which the design principles were

conceived[2]. An educational example may mollify this critique. Consider a classroom of students as the analogue of the wheel-axle system, with each student equivalent to a bolt. The DP1 situation outlined in (a) is a traditional classroom in a school governed by command-and-control principles. The behaviours of the students and teacher in the classroom are prescribed by rules and policies over which they have little control. The DP2 situation outlined in (b) is a collaborative classroom characterized by project work, shifting roles and bringing the real world into the classroom through various kinds of projects and demonstrations. The teacher and perhaps the students have considerable discretion in designing pedagogical approaches and subject content. The DP3 situation outlined in (c) is an open-ended, seamless learning arena in which the students' and teacher's lives are framed as a joint learning project. There is no boundary between learning settings and the rest of life. Physical gatherings of the students and teacher are intended and designed to facilitate reflection on life's lessons in partnership with relevant stakeholders.

4. THE EMERY DESIGN PRINCIPLES: WHAT THEY MEAN, WHAT THEY CAN DO

The Emery design principles function as follows:

"*Each design principle produces a different set of outcomes in terms of productivity, learning and innovation, organizational effectiveness, power relations and other organizational factors. The logic is that (1) one of these principles underlies the explicit design of every workplace; (2) recognition of alternative design principles can lead to the explicit re-design of workplaces; and (3) such re-redesigns would have potentially profound consequences on the capabilities and competencies that derive from many organizational processes*" (Selsky et al., 2005: 18).

[2] We thank one of the anonymous reviewers for suggesting this addition.

The two original design principles sprang from the socio-technical "level" of social ecology (see Baburoglu, 1992) and were developed in the context of routine factory and office work. They were seen as the complete set of ways by which people in organizations did and could relate to each other in terms of the organization, coordination and control of their work behavior. Writ large, the application of a given design principle in an organization produces a certain design configuration, consisting of its structure, tasks, reward systems, information flows, decision making processes and other arrangements. It also has implications for the distribution of authority and power that derive from such arrangements (Hirschhorn et al., 2001; Barton et al., 2004). That is,

> *"In DP1 responsibility for coordination and control is located at least one level above where the work, learning, or planning is being done. DP1 yields a supervisory or dominant hierarchy… In DP2 responsibility for coordination and control is located with the people performing the task… A change of design principle is systemic and will ultimately require the redesign of all subsystems. For formal, employing organizations, the design principles are embedded in industrial relations legalities…"* (M. Emery, 2000: 627-628).

Some researchers have considered and adapted the original design principles for new contexts. For instance, Pava (1983) adapted and applied DP2 to non-routine office work and Hirschhorn (1984, 2001) took up this effort. Trist (1983b/1993: 664) called for a "new conceptual language" in new socio-technical system applications, and pointed to Pava's work. He identified new analytical categories to use in a socio-technical system analysis when work is non-routine and interdependency among potential work groups is "saturated." He considered these categories to be *deliberations* and *discretionary coalitions* (ibid.: 665-666). Hirschhorn et al. (2001) amplified this line of thought in "mass customization" settings, that is, settings where experimentation and learning rather than

controlled production are the primary task. In a rethinking of the usual socio-technical system analysis, Hirschhorn et al. articulated new “design principles” for the role system, the skill base and functional redundancy in such settings.

When the analysis is raised to the field level, the function of a design principle (to deliver effective work behavior and governance) remains the same; but it makes more visible the existence of work units spanning across organizational boundaries (see Sinha and Van de Ven, 2005; Cummings, 1984). Examples of such work units include global supply chains, value constellations and strategic partnerships to jointly produce a new consumer offering. Hence, whereas DP1 corresponds with hierarchical and bureaucratic design and DP2 corresponds with participative design, we argue that DP3 is at the core of designing trans-organizational work systems that are future responsive.

This moves the design of work systems beyond what DP2 affords. DP2 is meant to deliver creative work behavior by embedding control and coordination within the work unit itself. The search conference, a participatory planning methodology geared explicitly to DP2, illustrates that DP2 can be and has been extended to extra-organizational situations (M. Emery, 2000: 628). Search conferences are intended to be “learning environment[s, in which] members work and learn together around system futures” (M. Emery, 1999: 112). More generally, Merrelyn Emery (1999: 111) claims that

> “*Redundancy of functions [DP2] refers not only to technical skills but to all of the peculiarly human characteristics of conscious planning and goal setting, measuring and analyzing within cycles of decision making… People within DP2 structures are free and motivated to merge their experiential knowledge from all sources, the external social field, their various task environments, their histories and their abstract learnings into new creative syntheses.*”

Whilst we agree with Emery, we find that DP2 tends to be focused more *within* the organization, aimed at delivering a design for effective work behavior in it. We argue in the next section that DP2 does not adequately explain the kinds of interorganizational collaboration that we are seeing in many industries and fields around the world today. Moreover, DP2 fails to embrace adequately the ecology of organizations around any one socio-technical system, nor does it focus on *potential* (for the future) connectivity.

Interestingly, Merrelyn Emery's quote above calls attention to an aspect of the design principles which can easily be neglected. Those principles are commonly understood as having to do with the operations of a work system (at team, divisional and organizational levels), and have implications for governance and power at each of those levels. That is, the design principles are widely seen as operational-level principles; they deal mostly with internal behaviors and relationships, and to a much lesser extent with the transactional environment.

However, work systems are not designed in a vacuum; work system design is done for some purpose, such as a strategic goal. Indeed, in most conventional strategy textbooks, organization design is framed as strategy implementation. Thus, DP1 yields a design for the purpose of control *relative to an organization's strategy*, and DP2 yields a design for the purpose of autonomy *relative to the strategy* (see Keidel, 1990).

Now in a turbulent context the contextual environment becomes a much more important consideration in strategy than in "normal" competitive contexts (Selsky et al., 2007; Ramirez et al., 2008), because the contextual environment can intrude into the transactional environment of an organization and thence affect both the organization's internal operations and its ability to strategize effectively. Emery and Trist's suggested response to a turbulent environment, collaborative endeavors, means that organizations seek to work collaboratively with others to push back against this intrusion of the contextual

environment. Essentially, players try to enlarge the boundary of the system (organization), in collaboration with others, to take in some of its transactional environment and to push the contextual environment away (Ramirez and van der Heijden, 2007). If successful, the collaboration stabilizes conditions for the participants. How might they do this? Emery's quote above points to the wide distribution of knowledge in DP2 arrangements. We can extend this to the transorganizational work system created by the collaboration, and we can also note that this distributed knowledge may be *strategy*-relevant, not simply *operational* or inward-focused. When organizations in the same field collaborate in response to shared turbulent conditions, strategy becomes a more inclusive process than in a non-turbulent context. This is because the transorganizational work system contains multiple sources of knowledge about the contextual environment that may be strategy-relevant, and also because the realm of interactons that the system can leverage for strategic purposes is expanded. In effect, a work system designed so that this distributed knowledge can be brought to bear on the contextual environment expands the transactional environment and decreases the uncertainty that remains in the contextual environment accordingly.

This is where the need for a third design principle becomes evident. DP3 yields an explicit, testable, and examinable design for potentiality, that is, the future potential of the organization and its relations with others relative to its strategy considered from a future point of view. We believe this reframing of the design principles as strategic-level principles and not just operational ones makes them particularly relevant to today's challenges.

5. DESIGN PRINCIPLE THREE

5.1. System Requirements

What would such a re-framed design principle look like? The design requirements of situations (as in (c) above) for DP3 to be operative are as follows:

First, the set of actors in a social field are able to constitute and re-define that field, not just function within it. This includes the ability to enlarge the transactional part of the field, as discussed above. Recall that a social field consists of a set of systems, transactions among them and their relevant environments. A set of actors forms and organizes a social field out of an unorganized network of actual and potential connections. That is, the field unfolds from a latent or enfolded state as potentialities are activated (Bohm, 1996; Morgan, 2006) by the actors, converting actants into actors and relations into offerings that then become actors in their own right, as described above. In social ecology terms, the actors are active subjects of the field with a capacity for active adaptation.[3] Examples are those linking parties involved in the fight against poverty; or agencies working together after the 2004 South Asian tsunami; or software developers collaborating on Linux (Weber, 2004). In these examples actors do more than self-control and auto-coordination; they dynamically co-produce, build or develop the very field that they constitute. This implies that the actors must have a sense of the possible future states of the field which may emerge from their co-production; we explain why below.

Second, a wide set of potential inter-organizational connections exist in the field and are imagined by some actors in it. In DP1 and DP2 the relevant criteria centre upon control and coordination of existing work systems. DP3 extends the design criteria to building in the potential for relating and/or connecting with a broader set of entities in the field that are not yet linked and which may not be aware of each other. The control and coordination is aimed at enhancing the possible future regulation of the field and the linkages constituting the field. Thus, the focus in DP3 moves from the current set of actors, the linkages among them and

[3] That is, they are purposeful (Ackoff and Emery, 1972; Ackoff, 1999).

their governance to a broader and more diverse set of potential linkages among a broader potential set of actors and their governance.

Third, at least one value constellation spans across the boundaries of two or more organizations in the field. The actors in the field create a trans-organizational work system, that is, a system of two or more organizations plus arrangements (e.g., division of labour, authority relations, decision rules) designed to produce some output jointly. A value constellation is an example of such a work system, such as the Android-centred one supported by Google and the iPhone-centred one supported by Apple in the global smartphone industry. DP1 and DP2 can be applied across the boundaries of organizations because socio-technical systems form around natural work units, and natural work units may consist of members from multiple organizations. Examples include joint ventures, construction projects that involve subcontracting, and global supply-chain arrangements (Sinha and Van de Ven, 2005; see also Motamedi, 2012). However, in an era where innovation may be 'open' (Chesbrough, 2003) and 'boundaryless' structures and relational capital may be crucial to strategic success (Nahapiet and Ghoshal, 1998), the locus of capability building shifts from intra-organizational relations to inter-organizational field relations (see Selsky et al., 2007; Pascal et al., 2012). The design principle underlying these relations needs to take this shift into account. We believe DP3 does so in ways that DP1 and DP2 do not.

5.2. Redundancy of Potentialities

Potentials are options that might become available to actors to be exercised; they are not (yet) options that *can* be exercised. A potentiality may exist for a long time, or it may be short-lived. It is likely that all open systems have this feature of latent potentials built-in, and hence they are redundant. To be consistent with the terminology of the Emery design

principles we call this feature of DP3 the *Redundancy of Potentialities* (RoP). It involves the actors' aspirations and fears of what the field that they constitute might become in its context and in relation to other fields.

RoP is shown in an empirical study of the fast-changing nanotechnology industry. In that industry Meyer et al. (2005) found that "a... startup doesn't construct an alliance network – the startup's alliance network constructs the nascent firm" (p468). Essentially this means that the nanotechnology field is implicitly designed with many potential connections. Under some conditions some of these connections coalesce into a firm that at birth has a ready-made network of alliance partners and other connections.

Can this emergent process be improved upon by deliberately designing a field to catalyze its potentialities for creative collaboration, and if so, how?

This is the promise of DP3, to enhance the strategic capabilities of value constellations, trans-organizational work systems and other types of inter-organizational fields, not those of single firms. This is *not* what DP2, with its main focus on the single organization, is geared to deliver. RoP does this by instilling excess capacity for connectivity in a field (or in an unorganized network that has the potential to become a field, as in the first system requirement above). It aims at creating, developing and/or activating new links between and among organizations inhabiting or potentially inhabiting a field or network. This occurs as the actors continually constitute the field/network by imagining, devising, testing, prototyping, and conducting their relationships on an ongoing basis. New competencies and capabilities may develop from these links. Le Masson, Weil and Hatchuel's (2010) approach to innovation and design illustrates this. Their design approach explicitly 'reaches out' to ignorance with multiple prototype-centred iterations to link known capabilities with known ignorances, trying to map each better in each iteration. Untraded and unlicensed patents that may be resting in corporate R&D files is another example (Rivette and Kline, 1999).

In DP3 mode, a designer working with an existing value constellation attends to how changes in the wider context may affect the potential collaborations s/he may want to make. Thus, a field such as a value constellation designed according to DP3 is future-oriented; its designers have images of its possible future states. In those futures some of today's potentialities would have been (in that future) activated and actualized. Thus, while designing-in RoP must be done *on* a specific field in the present, it is done *for* potential value constellations whose decision makers want to imagine potential links and consider which of these they may want to enact in the future to enhance the constellation's adaptive capacity in its context (e.g., its competitive advantage vis-à-vis other constellations). DP3 deals with questions of 'what if' and 'what might,' that is, questions of possibility, risk and opportunity. What might happen includes the unforeseen and not immediately identifiable constellations in the field's interstitial spaces, but it is centred on the imaginable. DP3 involves rehearsing the future, not to 'future proof' the present, but to produce viable value constellations today that are better able to become responsive to the future (Normann, 2000). From a DP1 and DP2 perspective DP3 puts the locus of control and coordination in possible futures; but from a DP3 perspective RoP design opens up spaces for linkages that would not be available with DP2 and DP1 and fosters innovation more explicitly than DP2.

Managers try to capture and deploy potentialities in terms of capabilities which are tradable (Blois and Ramirez, 2006). In this sense DP3 embraces many well known types of *public* routines; e.g., plans and policies for evacuation in the event of natural disasters; medical plans for dealing with epidemics; or networks of open innovation or even collaborative consumption (Botsman and Rogers, 2010). In addition, many kinds of strategic *corporate* routines may manifest RoP design, such as risk assessment and mitigation, cooperative partnerships, strategic issues management, public relations, lobbying, and scenario planning.

As discussed above, employers often pay a premium for connective potential in those they recruit. If one has a rich rolodex or is well connected (as senior political figures or public servants tend to be), headhunters will ensure that one's new employer pays more than if one is unknown to potentially important colleagues. Similarly, good reputation, whether personal or corporate, is valued because it carries the potential for further positive or valuable connections. DP3 is what keeps alumni groups lively, and why universities and consulting firms, famously McKinsey, invest so much in promoting their vitality. Essentially such investments represent strategists' desire and choice to build the potentiality into the firm or university as an important player in an ongoing working field. In doing so they are acting in accordance with the RoP design of DP3, whereas DP2 and DP1 do not capture this aspect of design.

6. ILLUSTRATIONS

We offer two brief illustrations of DP3: 'bazaar' governance in the open-source software community; and catalytic organizations in institutional fields.

6.1. Governance in Open-Source Software

Demil and Lecocq (2006) used the open-source software community as a case for inductively identifying a new form of governance, which they call *bazaar governance*. They identify characteristics of this form which are associated with creative collaboration, including anonymity of contributors/participants, non-excludability, free riding and unequal contributions.

Bazaar governance resonates with our characterization of DP3, as follows. Hargrave and Van de Ven (2006: 873-874) conclude that "[o]pen source software developers meet greater success by 'running in packs' than by going it alone." The open source software

community is explicitly and strategically designed by means of a specific “governance institution” to activate potentials to improve software products through affordances for collaboration among the developers. That institution is the open source license (Demil and Lecocq, 2006); it specifies property rights for developers of software innovations, but constrains those rights by requiring open publication of the innovation’s source code.

In the open source community the actors are the ‘free-agent’ software developers and they constitute the field. They activate linkages among themselves as they work on specific problems encountered or innovations dreamed up. In this way they create temporary work systems across traditional proprietary boundaries. At any particular time many linkages in the community remain latent. Thus, RoP is built into the open-source community as a field-level strategic capability, and the design of the field is emergent in the sense described in Section 7 below. Wikipedia is another example of this design principle in action.

The issue of free riding in such governance arrangements is important, for free riders also represent potentiality in a system. However, it is a potentiality for creative shirking, not creative collaboration. Usually free riding is considered problematic in collaborative arenas (e.g., Olson, 1965; Ostrom, 1990). Yet, although von Hippel and von Krogh (2003) discovered massive free riding in the open-source software community, they found it was not a problem in terms of performance of the overall field. The massive redundancy in the field, namely, the productive and creative capacity of an army of potential software developers, appeared to create more than enough potential in the field to overcame the usual drag of free riding. Hargrave and Van de Ven (2006) also offer a cogent description of

the free rider problem and show how the usual explanations are overturned in cases of open source software.[4]

6.2. Catalytic Organizations

The Paris Club is an insititution for rescheduling government-to-government debt (Paris Club, 2006). There is no physical office for the Paris Club; it is called the Paris Club because the meetings are held in Paris. The French Treasury acts merely as the secretary for this institution only when a country (usually a less developed one) cannot meet its oligations to a creditor country(ies). The creditor countries are bound by a set of gentlemen's rules that amount to no unilateral action on the debtor nation and a system of interventions mediated by the World Bank and the IMF in order to bring the debtor nation back to the international finance system without causing a major international crisis.

The Paris Club is a design manifestation of DP3. It embodies a potential which is unlimited regarding the number of "cases" it can absorb. It satisfies the three requirements for DP3 to be operative. That is, the members of the Paris Club, well-off creditor countries like Germany and France, are able to act upon the field and change the rules governing the Club if necessary. In addition, all creditor and debtor countries participating in the Club are potentially connected to each other. Finally, the set of rules for settling inter-nation debts enables the Club to function as a distinct value constellation.

A body that functions in a similar way is a consortium of diverse biotechnology organizations in an Australian state (Marot et al., 2005). The purpose of this consortium is to

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[4] 'Open' and 'free' fields have expanded much in recent years. Following on the heels of such celebration of open sourcing come critiques from adjacent fields, e.g., 'traditional' newspapers whose content – hard-won and expensive – is being pilfered by bloggers, news consolidators like Google, etc. See Anderson (2009). Perhaps this is the dark side of DP3.

forge linkages among the organizations in order to broker specific funded projects and create collective capacity to win funded research contracts in the future. Selsky et al. (2005) used this case to build understanding of collaborative capability at a field level. They suggested that collaborative capability could be explored "as a potentially designable field-level dynamic process [that] has important implications for managing innovation more holistically" (p19). Cases like this are manifestations of DP3, embracing RoP to the extent that they focus on future as well as current inter-organizational collaboration and how to build out collaborative capacity for innovation from the existing base.

We call bodies such as the Paris Club and the Australian biotech consortium *catalytic organizations*. They serve the catalytic function in their respective fields only when called for and when needed by the organizations or individuals that need the adaptive capacity that the catalytic organization can provide. They may be considered latent referent organizations (Trist 1983a).[5] The design prinicple underpinning such trans-organizational work systems has strategic and not just operational implications.

7. IMPLICATIONS

This study has important implications for both the analysis and design of trans-organizational work systems. Regarding analysis, DP3 is offered as a new tool for the analysis of inter-organizational fields. Some scholars view inter-organizational fields as emergent outcomes of the actions of many actors, not overseen by single designers who

[5] Trist (1983a) found referent organizations to be the *de facto* 'rule makers' of fields, not by 'hard' law (Medjad) but through 'soft' law influences that come to be adopted. Ramirez and Wallin (2000) relabelled them 'prime movers', and analyzed how companies such as Tetra Pak, Visa, Nokia, and Xerox have acted as referent organizations and have been the *de facto* designers of their respective fields. We use the working term 'catalytic organization' rather than a referent organization because it concerns a latent function that comes to be seen by third parties only when it unfolds (Bohm, 1996). Nevertheless, the proper relationship between referent organizations and our term remains to be worked out.

can impose order on an entire field (e.g., Selsky et al., 2005: 20; Hargrave and Van de Ven, 2006; Aldrich, 1999). Others see a 'prime mover' that deliberately designs and shapes a value constellation (e.g., Normann and Ramirez, 1991; Iansiti and Levien, 2004). Deliberate designs at the field level are visible in several ways: in government regulations to steer industries and shape the behaviour of actors in them; in the attempts of public and corporate foundations to steer the evolution of ideas in the philanthropic fields in which they operate (see Gilmore et al., 2007); and in the "ecologies" of private and public organizations working together to stimulate "complex innovation" to address societal problems (Dougherty and Dunne, 2011).

Another analysis related implication is that the locus of innovation and learning from a DP3 perspective is seen to be the field of connections, and not the 'ideas' or 'creativity' that executives may try to stimulate solely within their organizations, as conventional 'closed-source' innovation theorists suggest (Dougherty and Dunne, 2011). This is consistent with Selsky et al.'s (2007) proposition that in turbulent environments the locus of strategic advantage is the field, not the individual firm. The not yet unfolded network and the potential connectivity that resides there contains potential capabilities and stimulates innovation in new communities of practice (cf. Hirschhorn et al., 2001: 249; Brown and Duguid, 1996; Wenger, 1998).

Moving to implications for the practice of designing, this study enriches understanding of design at a field level in several ways. It highlights that whether emergent or deliberate, the way some fields are designed does catalyze or enable creative collaboration, and does stimulate potentialities for it. However, the design of other fields promotes or catalyzes other processes, such as competition, conflict, and/or the status quo of prevailing institutions. This is why we argue that DP3 is a distinct design principle and that the design principles have strategic-level importance. For example, a designer in (or of)

a field may wish to dampen competitive processes and promote collaborative ones In order to forestall turbulence in the contextual environment.

Thus, this study is to understand how actors in fields may make choices to activate field potentialities. The role of leading, prime-mover firms is crucial (Ramirez and Wallin, 2000; Iansiti and Levien, 2004). In addition, Hargrave and Van de Ven (2006: 873-874) point to the pivotal role of institutional entrepreneurs who may work a field, "undertak[ing] a stream of activities to gain the resources, competencies, and endorsements necessary to develop an economically viable enterprise". When the activities of these entrepreneurs intersect, they "provide occasions for recognizing areas for establishing cooperative and competitive relationships..." (ibid.: 874; see also Fleming and Wasguespack, 2007).

DP3 becomes visible by uncovering sources of potential connectivity lying latent in a network. When potential connections are activated, that part of the network becomes a working transorganizational system. One can think of DP3 as enabling an open-ended trajectory of constantly expanding potentialities. However, at any particular time these potentialities may be bounded or limited by the DP2 and/or DP1 characteristics of some players in the field. Thus, some potentialities may be closed off for periods of time by certain system design configurations based on DP1 or DP2. For example, Stelios Haji-Ioannou could not open up EasyJet as a viable commercial venture in Europe until European air travel had been liberalized. Historically that field was deeply rooted in DP1-based bilateral deals among countries. The mid-1990s liberalization allowed Stelios to import a version of SouthWest Airlines' design and strategy into the European market.

Finally, this study sheds light on field-level institutions. The design of a field, whether emergent or deliberate, is revealed in its institutions and how its stakeholders relate to each other through those institutions (e.g., in partnership, in competition). For example, in the Australian biotech field mentioned above, the consortium formed as a new institution to

organize and regulate interactions among the various stakeholders – universities, venture capital firms, research institutes, etc. In a health care case in Minnesota discussed in Selsky et al. (2007), a self-selecting group of hospital executives and state officials initiated a forum which undertook to redesign the state's disjointed health care sector into integrated health systems to improve epidemiological outcomes. In our terms the biotech consortium and the healthcare forum were DP3-based governance institutions that promoted creative collaboration by enabling actors to relate in new ways as they co-created the future of their field. In contrast, the global proprietary software industry dominated by Microsoft appears to have institutions with the characteristics of DP1. Examining a field's existing institutions and its built-in mechanisms for change, or its "generative mechanisms" (Pascal et al., 2012; see also Emery, 1999), may point to missing institutions (Perlmutter, 1965) or dysfunctional arrangements that might be redressed through redesign in order to promote creative collaboration (see also Jenson and Saint-Martin, 2006).

8. CONCLUSION

In this paper we have outlined how a socio-ecological design principle, redundancy of potentialities, might be used to explore and identify potential connections and capabilities residing in trans-organizational work systems. Arguably the need for creative collaboration is greater now than in the past due to the growing turbulence experienced by organizations. We have made the case that this newly uncovered design principle DP3 becomes salient when unprecedented collaboration is needed to address the interlinked global crises – from financial crises to ecological catastrophes – besetting the developed and developing worlds today. These crises are the drivers of the turbulence currently experienced. In turn, the need to engage turbulence compels a refocusing of the Emery design principles at a more strategic and inter-organizational level.

Further research on DP3 might explore how it can be effectively built into an inter-organizational field to stimulate new paths for creative collaboration. Our understanding of redundancy of potentialities is still in its infancy. Much research remains to be done to clarify its properties, range of applications, and implications for such issues as corporate social responsibility and power.

We believe that DP3 is not only suited to designing or redesigning inter-organizational fields but to social fields at *any* 'level' – inter-organizational, organizational, team. Thus, we postulate that it is a multi-level design principle left undeveloped in the evolution of socio-ecological thinking. In this paper we have concentrated on perhaps its most obvious level of relevance, the inter-organizational social field. The recent explosion of collaborative relationships has made redundancy of potentialities more observable and salient but it is an essential design principle necessary for designing structures and processes broadly in the socio-ecological paradigm.

REFERENCES

Ackoff, R. L. (1999). *Re-Creating the Corporation: A Design of Organizations for the 21st Century*, Oxford University Press.

Ackoff, R. L. and Emery, F. E. (1972). *On Purposeful Systems*, Aldine-Atherton, Chicago.

Aldrich, H. (1999). *Organizations Evolving*, Sage, Thousand Oaks.

Anderson, C. (2009). *Free: The Future of a Radical Price,* Hyperion.

Babüroğlu, O. (1988). The vortical environment: The fifth in the Emery-Trist levels of organizational environments. *Human Relations*, 41, 181-210.

Babüroğlu, O. (1992). Tracking the development of the Emery-Trist systems paradigm (ETSP). *Systems Practice*, 5(3), 263-290.

Barton, J., Emery, M., Flood, R., Selsky, J. and Wolstenholme, E. (2004). A maturing of systems thinking? Evidence from three perspectives. *Systemic Practice and Action Research*, 17(1), 3-36.

Barton, J. and Selsky, J. (2000). Toward an Emery model of management: Implications and prospects of Emery Open Systems Theory. *Systemic Practice and Action Research*, 13(5), 705-720.

Beck, U. and Holzer, B. (2007). Organizations in world risk society. In C. Pearson, C. Roux-Dufort and J. Clair (eds.) *International Handbook of Organizational Crisis Management*, Sage, Thousand Oaks. p3-24.

Beyerlein, M., Johnson, D. and Beyerlein, S. (eds.) (2004). *Complex Collaboration: Building the Capabilities for Working Across Boundaries,* Elsevier.

Beyerlein, M., Beyerlein, S. and Kennedy, F. (eds.) (2005). *Collaborative Capital: Creating Intangible Value*, Elsevier.

Blois, K. and Ramirez, R. (2006). Capabilities as marketable assets: A proposal for a functional categorization. *Industrial Marketing Management*, 35(8), 1027-1031.

Bohm, D. (1996). *On Dialogue*, Routledge, London.

Botsman, R. and Rogers, R. (2010). *What's Mine Is Yours: The Rise of Collaborative Consumption*, HarperCollins, New York.

Brown, J.S. and Duguid, P. (2000). *The Social Life of Information.* Harvard Business School Press, Boston.

Chesbrough, H. (2004). Managing open innovation. *Research-Technology Management*, 47(1), 23-26.

Clegg, S., Pitsis, T., Rura-Polley, T. and Marosszeky, M. (2002). Governmentality matters: Designing an alliance culture of inter-organizational collaboration for managing projects. *Organization Studies*, 23(3), 317-337.

Davis, G. and Marquis, C. (2005). Prospects for organization theory in the early 21st century: Institutional fields and mechanisms. *Organization Science*, 16(4), 332-343.

Demil, B. and Lecocq, X. (2006). Neither market nor hierarchy nor network: The emergence of bazaar governance. *Organization Studies*, 27(10), 1447-1466.

Dougherty, D. and Dunne, D. (2011). Organizing ecologies of complex innovation. *Organization Science*, 22(5), 1214-1223.

Dunbar, R. and Starbuck, W. (2006). Learning to design organizations and learning from designing them. *Organization Science*, 17(2), 171-178.

Dyer, J. and Singh, H. (1998). The relational view: Cooperative strategy and sources of inter-organizational competitive advantage. *Academy of Management Review*, 23(4), 660-679.

Emery, F. (1967). The next thirty years. *Human Relations,* 20, 199-237.

Emery, F. (1969). Introduction. In F. Emery (ed.) *Systems Thinking, Volume 1*, Penguin, Harmondsworth.

Emery, F. (1976). The second design principle: participation and the democratization of work. *Futures We Are In.* Martinus-Nijhoff. 1976. Reprinted in Trist and Murray (eds.) (1993). *The Social Engagement of Social Science, Volume 2*, University of Pennsylvania Press, Philadelphia. p214-233.

Emery, M. (1999). *Searching: The Theory and Practice of Making Cultural Change,* John Benjamins, Amsterdam.

Emery, M. (2000). The current version of Emery's Open Systems Theory. *Systemic Practice and Action Research*, 13(5), 623-641.

Feibleman, J. and Friend, J. (1969). The structure and function of organizations. In F. Emery (ed). *Systems Thinking, Volume 1.* Penguin, Harmondsworth.

Fleming, L. and Waguespack, D. (2007). Brokerage, boundary spanning, and leadership in open innovation communities. *Organization Science*, 18(2), 165-180.

Friedman, T. (2005). *The World Is Flat*, Farrar, Strauss and Giroux, New York.

Golfetto, F. and Gibbert, M. (2006). Marketing competencies and the sources of customer value in business markets. *Industrial Marketing Management,* 35(8), 904-912.

Granovetter, M. (1985) Economic action and social structure: The problem of embeddedness. *American Journal of Sociology,* 91(3), 481-510.

Greenwood, R. and Miller, D. (2010). Tackling Design Anew: Getting Back to the Heart of Organizational Theory. *Academy of Management Perspectives*, 24(4), 78-88.

Hargrave, T. and Van de Ven, A. (2006). A collective action model of institutional innovation. *Academy of Management Review*, 31(4), 864-888.

Hirschhorn, L., Noble, P. and Rankin, T. (2001). Sociotechnical systems in an age of mass customization. *Journal of Engineering and Technology Management,* 18, 241-252.

Iansiti, M. and Levien, R. (2004). Strategy as ecology. *Harvard Business Review*, 82, 69-78.

Jenson, J. and Saint-Martin, D. (2006). Building blocks for a new social architecture: the LEGO™ paradigm of an active society. *Policy and Politics*, 34(3), 429-451.

Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network Theory*, Oxford University Press.

Le Masson, P., Weil, B., and Hatchuel, A. (2010). *Strategic Management of Design and Innovation*, Cambridge University Press, Cambridge.

Lusch, R. and Vargo, S. (2006). *The Service-Dominant Logic of Marketing: Dialog, Debate, and Directions*. M.E. Sharpe.

Marot, M., J. Selsky, W. Hart and Reddy, P. (2005). Research teams in an Australian biotechnology field: How intellectual property influences collaboration. In M. Beyerlein, S. Beyerlein and F. Kennedy (eds.) *Collaborative Capital: Creating Intangible Value*, Elsevier, 1-31.

McCann, J. (1983). Design guidelines for social problem solving interventions. *Journal of Applied Behavioral Science*, 19(2), 177-189.

McCann, J. and Selsky, J. (1984). 'Hyperturbulence and the emergence of type 5 environments. *Academy of Management Review*, 9(4), 460-470.

Meyer, A., Gaba, V. and Colwell, K. (2005). Organizing far from equilibrium: Non-linear change in organizational fields. *Organization Science*, 16(5), 456-473.

Morgan, G. (2006). *Images of Organization*, New Edition, Sage, Thousand Oaks.

Motamedi, K. (2012). Trans-organizations: Managing in a complex and uncertain world. *Graziadio Business Review*, 15(2),

Nahapiet, J. and Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Normann, R. (2000). *Reframing Business*. Wiley, New York.

Normann, R. and Ramirez, R. (1989). A theory of the offering: A step towards a post-industrial business strategy. in Snow, C. (Ed.). *Strategy, Organization, Design, and Human Resource Management*, JAI Press, Greenwich, CT.

Normann, R. (2001). *Reframing Business: When the Map Changes the Landscape*, Wiley, New York.

Olson, M. (1965). *The Logic of Collective Action*. Harvard University Press, Cambridge.

Ostrom, E. (1990). *Governing the Commons,* Cambridge University Press.

Paris Club (2006). Fifty Years of Orderly Sovereign Debt Restructuring. *Proceedings of the International Policy Forum*, 14 June, Paris.

Pascal, A., Thomas, C. and Romme, A.G.L. (2012). Developing a human-centred and science-based approach to design: The Knowledge Management Platform Project. *British Journal of Management*. Doi: 10.1111/j.i467-8551.2011.00802.x

Pava, C. (1983). *Managing the New Office Technology*, Free Press, New York.

Perlmutter, H.V. (1965). *Towards a Theory and Practice of Social Architecture: The Building of Indispensable Institutions*, Tavistock Publications, London.

Porter, M. (1985). *Competitive* Advantage: Creating and Sustaining Superior Performance, Free Press, New York.

Ramirez, R. (1999). Value co-production: Intellectual origins and implications for practice and research. *Strategic Management Journal,* 20(1), 49-65.

Ramírez, R. and K. van der Heijden (2007). Scenarios to develop strategic options: A new interactive role for scenarios in strategy. In W. Sharpe and K. van der Heijden (Eds.), *Scenarios for Success: Turning Insights into Action,* Wiley, Chichester.

Ramirez, R. and Wallin, C. (2000). *Prime Movers*. Wiley, Chichester.

Rivette, K. and Kline, D. (1999). *Rembrandts in the Attic: Unlocking the Hidden Value of Patents.* Harvard Business School Press, Boston.

Sawhney, M. and Prandelli, E. (2000). Communities of creation: Managing distributed innovation in turbulent markets. *California Management Review*, 42(4), 24-54.

Selsky, J., Goes, J. and Baburoglu, O. (2007). Contrasting perspectives of strategy making: applications in 'hyper' environments. *Organization Studies*, 28(1), 71-94.

Selsky, J., Marot, M., Hart, W. and Reddy, P. (2005). Building field level collaborative capital: The case of an Australian biotechnology consortium, presented at Academy of Management annual meeting, Honolulu, August 2005.

Simon, H. (1969). *The Sciences of the Artificial*, The MIT Press, Cambridge.

Sinha, K. and Van de Ven, A. (2005). Designing work within and between organizations. *Organization Science*, 16(4), 389-408.

Stacey, R. (2001). *Complex Responsive Processes in Organizations: Learning and Knowledge Creation,* Routledge, London.

Trist, E. (1977). A concept of organizational ecology. *Australian Journal of Management*, 2(2), 161-175.

Trist, E. (1983a). Referent organizations and the development of inter-organizational domains. *Human Relations,* 36, 269-284.

Trist, E. (1983b). Pava's extension of socio-technical theory to advanced information technologies. Reprinted in E.Trist and H. Murray (eds.) (1993). *The Social Engagement of Social Science, Volume 2*. University of Pennsylvania Press, Philadelphia, p662-673.

Van de Ven, A. and Hargrave, T. (2004). Social, technical, and institutional change. In M.S. Poole and A. Van de Ven (Eds.) *Handbook of Organizational Change*, Oxford University Press, 259-303..

Vargo, S. and Lusch, R. (2004). Evolving to a New Dominant Logic for Marketing. *Journal of Marketing*, 68(1), 1-17.

Vargo, S. and Lusch, R. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of Marketing Science*. 36(1), 1-10.

Von Hippel, E. and von Krogh, G. (2003). Open source software and the 'private-collective' innovation model: issues for organization science. *Organization Science*, 14(2), 209-223.

Weber, S. (2004). *The Success of Open Source*, Harvard Business School Press, Boston.

Wenger, E. (1998). Communities of practice: Learning as a social system. *Systems Thinker*, 9(5).

Table 1. Two views of value production

INDUSTRIAL PERSPECTIVE	*CO-PRODUCTIVE PERSPECTIVE*
• Value creation is sequential, uni-directionally transitive, best described in 'value chains'	• Value creation is synchronic, inter-active, best described in 'value constellations'
• All managed values can be measured in monetary terms	• Some managed values cannot be measured or monetized
• Value is added sequentially	• Values are co-invented, combined and reconciled
• Value is a function of utility and rarity	• Exchange is the source of utility and rarity
• Values are 'objective' (exchange) and 'subjective' (utility)	• Values are 'contingent' and 'actual' (established interactively)
• Customers destroy value	• Customers (co-)create values
• Value 'realized' at transaction, only for supplier (event)	• Value is co-produced, with customer, over time - for both co-producers (relationship)
• Three-sector models pertinent	• Three-sector models no longer pertinent
• Services a 'separate' activity	• Services a framework for all activities considered as co-produced
• Consumption not a factor of production	• Consumers managed as factors of production (assets)
• Economic actors analyzed holding one primary role at a time	• Economic actors analyzed as holding several different roles simultaneously
• Firm and activity are units of analysis	• Interactions (offerings) are unit of analysis