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Team 1:
"Revisiting the Socio-ecological, Socio-technical and Socio-psychological Perspectives"
(TEAM REPORT)

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Abstract: In this paper we address selected but basic concepts and models created in the Tavistock Institute that seem to offer insights into active adaptation and organizational design, especially those that have established track records for establishing open and democratic organizations. We revisit the socio-ecological perspective, including turbulent environments, as well as the socio-technical and socio-psychological perspectives. Firstly, we introduce the background and history of these concepts and give a short description of each, along with further developments in the area. We address transitions between Design Principle 1 (DP1) and Design Principle 2 (DP2) organizational structures through selected examples, and later apply these concepts in the current dynamic and fast changing organizational structures emerging in the globalized service economy.

Keywords: Tavistock Institute, socio-ecological system, social-technical system, socio-psychological system, turbulent environments, organizational design, Design Principle 1, Design Principle 2, change management, empowerment, Living Labs, innovation

"The choice is between
whether a population seeks to enhance its chances of survival
by strengthening and elaborating special social mechanisms of control
or increasing the adaptiveness of its individual members."
(Emery and Trist 1973, p. 71)

The Conversation within Team 1 began around a general triggering question: *"In which ways is the Tavistock legacy still relevant, and in which ways might these ideas be advanced and/or refreshed (for the globalized/service economy)?"* The thought at the time that the team was being formed was that the legacy of Tavistock and the material that came out of it were quite well known, but that the ideas had fallen out of use and possibly even currency. Through the contributions of Merrelyn Emery to the team, it became apparent very quickly that there were many gaps in information (at least by the other four team members), and varying interpretations of both the history and the theories. That turned the focus for the first part of the week into clarifying and correcting what was known and understood.

Our aim was to revisit and discuss the background and history especially related to the three original perspectives of open systems theory (OST), the socio-ecological, socio-technical and socio-psychological. Within and across these perspectives we explored changing environments, particularly

the current turbulent environment, the genotypical organizational design principles (DP1 and DP2), the methods of search conferences and participative design workshops as well as the conditions for successful implementation. The intent was to understand more about the time and the people who developed these concepts and methods, how they worked together and the original inspirations for both theoretical models and empirical applications.

Figure 1a Team 1 – working at IFRS Conversations 2012 at Linz, Austria

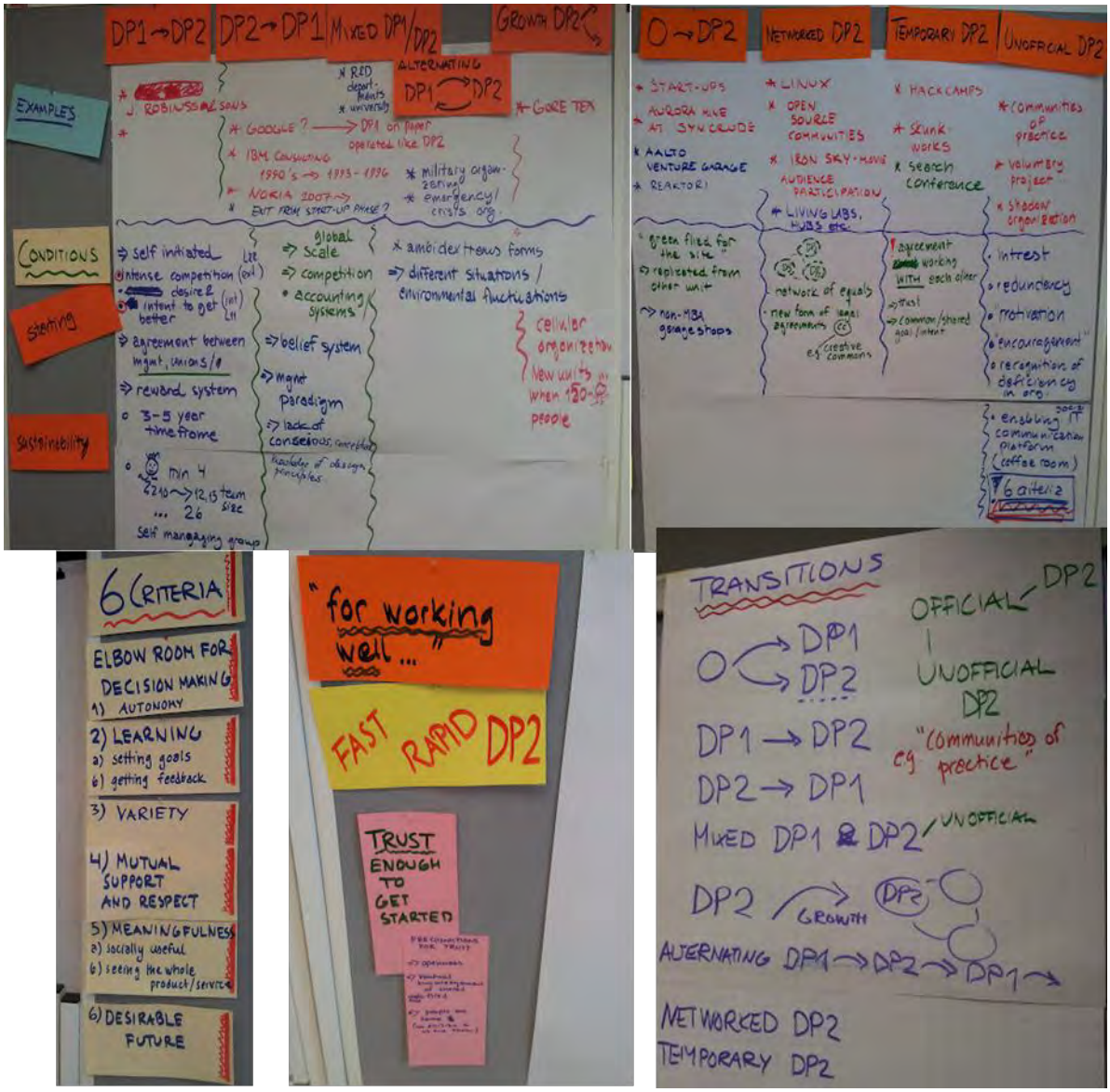

Figure 1b Team 1 – working at IFRS Conversations 2012 at Linz, Austria

In Brief

The work done at the Tavistock institute in its creative period was characterized by Eric Trist as comprising 3 perspectives:

- The ***socio-ecological*** in which the social system transacts with an environment, external to itself but co-implicate with it such that system and environment are mutually self determining and jointly produce outcomes. At the organizational level, a structure created to explore its environment is a socio-ecological organization.
- The ***socio-technical*** which consists of social and technical or technological systems which may or may not be jointly optimized, i.e. may or may not have been designed to ensure that the two systems jointly contribute to the best possible human and organizational outcomes.

- The ***socio-psychological*** differs from the socio-technical only in the fact that it is people rather than technology that constitute the second system, i.e. it is a people-to-people system. As people are all purposeful systems while technology in all its forms is only goal-seeking (Ackoff & Emery, 1972), working with socio-psychological systems to jointly optimize them is more complex and demanding.

As Team 1 learnt during its conversation, the original work done at the Tavistock has evolved into a coherent and comprehensive conceptual framework known as Open Systems Theory. It has also spawned many different variations in different continents and cultures. However, it is a tribute to its pioneers and their cohort of collaborators around the world that it remains relevant and valuable to many attempting to solve today's systemic problems.

1. Background and history

Much of the history of Tavistock, and many articles by its members, can be found in the online version of the Tavistock Anthology: http://www.moderntimesworkplace.com/archives/archives.html. Seeing articles written to capture ideas formally, in retrospect, though, gives little indication about how the ideas came to be, or of the relationships between the people involved.

The Tavistock Clinic had been founded in 1920 by Dr. Hugh Crichton-Miller in London. (The name was apparently associated with the original location, close to the Tavistock Square in London.) It had been established to treat "shell-shocked" soldiers during and after World War I (along with other child and adult maladies). The group was taken more formally into the British military in World War II, where it continued its work with trauma and also expanded into other areas, including officer selection. Tavistock had been funded by the British military during the World War II, and after the war new funding sources were needed. Tavistock operated mainly in two areas. On one side the focus was on organizational development and the other side operated with mental health and psychology. Following WWII, the clinical portion of Tavistock became a part of Britain's newly formed National Health Service, with John Bowlby as its head. In 1946, the Tavistock Institute of Human Relations was founded as a separate organization, funded initially by the Rockefeller Foundation, and headed by Eric Trist. The Tavistock Institute focused on organizational development, and turned towards governmental and business organizations.

Lewin, Lippitt and White's (1939) research on group climates, as well as the initial concepts about action research developed by Kurt Lewin (1938), contributed to the early work at Tavistock Institute. Kurt Lewin had immigrated to the US in 1933 (the same year that he met Eric Trist, briefly, in Cambridge). Working at the time in Iowa, he conducted a series of studies on group climates, using groups of school children. That classic work of Lewin et al (1939) was widely known to social scientists around the world, and was foundational in the development of group and organizational work, particularly socio-technical systems and later the design principles underlying autocracy, participative democracy and laissez-faire. As stated by Merrelyn Emery,

> *These laboratory experiments established that there were only three group climates, now known to be structural genotypes; autocracy (now technically termed bureaucracy) democracy, and laissez-faire (essentially a non-structure). In addition, they established that these structures have profound and predictable effects on the people who live and work within them, regardless of the personalities involved (personal communication.)*

Lewin founded the National Training Labs (NTL) in Bethel, Maine, in 1947, just a year after the Tavistock Institute was formed. Despite the timing and collaboration, there was no formal connection between Tavistock and NTL.

Apart from Lewin and his group, there was also a great deal of international exchange and collaboration which helped to develop the concepts associated with socio-technical systems and open systems more generally, which happened in and around professional meetings and conferences. This included people such as Russ Ackoff, Ross Ashby, West Churchman, Lou Davis and Einar Thorsrud, in addition to Eric Trist, Fred Emery, and others who are typically associated with the work. This collaboration continued well into the 1980s until serious divergences between the continents were confirmed (Emery, 2000).

Another foundational figure in this history was Andras Angyal (see: http://en.wikipedia.org/wiki/Andras_Angyal). While Ludwig von Bertalanffy is the name associated with open systems for most people today, as Merrelyn explained, “everyone had read Andras Angyal, and almost no one [in those groups] spoke of Bertalanffy.”

As Merrelyn explained in her keynote talk to the 2012 European Meeting on Cybernetics and Systems Research (http://www.emcsr.net/) ,

> *There is one other property of human beings and that property creates the need for a genuinely open systems social science: it is the demonstrable fact of consciousness defined as “awareness of awareness” (Chein, 1972, p95; Emery M, 1999, pp70-80). von Bertalanffy’s (1950) formulation of an open system was a brilliant step forward and probably still covers the great mass of animate creatures on Earth. He is rightly called the Father of Open Systems but his conceptualization deals only with people as bodies. There can be little doubt that we are physically adapted to our planet but when we contemplate consciousness, it becomes obvious that we must go beyond von Bertalanffy. (http://www.bertalanffy.org/2011/wp-content/uploads/2012/04/Vienna.OPEN-OR-CLOSEDSYSTEMS.pdf, p. 6.)*

It was primarily the theories of Angyal, then, rather than Bertalanffy, on which Open Systems Theory, with its three perspectives, was founded. Angyal acknowledged systems in an environment where an organism is always subject to the forces of autonomy, acting on the environment, and heteronomy, the environment acting on the organism. These relations are dynamic and ever-changing so "life is an autonomous dynamic event which takes place *between* the organism and the environment" (Angyal, 1941, p. 48, added emphasis). *A system* is defined by its *system principle, unitas multiplex* or construction principle (Anygal 1941, p. 259). This principle expresses the unique relation between the entity and the environment, governs the behaviour of the system and the arrangement of its parts. For human beings, there are two major tendencies, autonomy which asserts the individuality of the person and homonomy which expresses the need to participate in or belong to a unit larger than the self, such as a group or community. Mentally healthy people have a relative balance between the two tendencies.

Emery & Trist (1965) took Angyal’s exposition one stage further as follows (Fig. 2): The open system shows that system and environment and their interrelations are mutually determining and governed by laws (L) which are able to be known. When the system (designated '1') acts upon the environment (designated '2') we say the system is planning (L12). Environment acts upon the system and is known to us through ecological learning (L21). L11 and L22, express the intrinsic natures of the system and environment respectively. The laws that govern them are implicitly learnt about in the Search Conference. The environment, the L22, is defined as the extended social field of directive correlations with a causal texture (Emery & Trist 1965; Emery F, 1977) where the nature of the extended social field affects the behavior of all systems within it. This conceptualization provides both a conceptual, historical and practical framework for cultural change and its fluctuating adaptivity.

The social field is a directly observable, objective entity in its own right. As a field, not a system, its laws are very different from the laws governing systems. The inclusion of a discrete social environment is the major defining difference between an open and closed systems social science. What Emery & Trist achieved in 1965 was the completion of the conceptualization of the open system that von Bertalanffy so admirably started (Emery, 2012, p. 6)

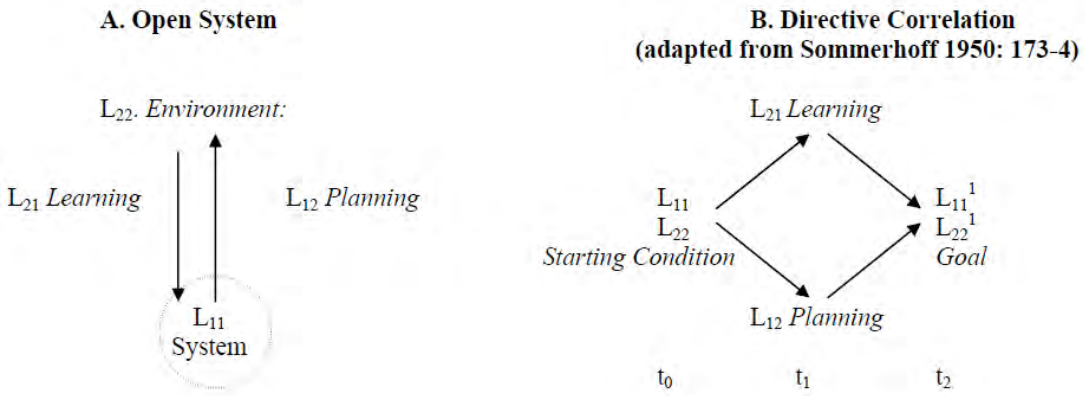

Figure 2. The Open System and Directive Correlation (From Emery (2012).

The two parts of Figure 2 illustrate the only differences between the open system and directive correlation which are that the open system is a picture of a point *in time* with change expressed through learning and planning while the directive correlation is a picture *over time*. The open system includes adaptive and maladaptive relations while the directive correlation expresses precisely when adaptation is or is not occurring.

According to Merrelyn, the strict reliance on Angyal's, Sommerhoff's and Emery & Trist's formulations distinguished the work that she did with Fred Emery and others in Australia from later work by Trist or Ackoff.

> We stuck with the time-based Search Conference where probabilities of various scenarios change over time while Ackoff went with time-free 'idealized design' (Ackoff, 1974, p30). Neither Ackoff nor Trist ever used the design principles which underpinned all our work (Trist, 1986). The Australian group stayed with Angyal's system principle, the unique relation between L22 and L11, and the organizational design principles that determine the shape of the L11…while Trist worked on referent organizations and domain theory (Trist, 1983) (pp. 3-4).

The study most often associated with the Tavistock Institute and socio-technical systems was done by Trist and Bamforth (1951). It began at the Midlands coal field in the UK, in the Haigmoor seam, in 1949. Essentially, it was the time in which mechanized equipment was being introduced into the coal mines in Britain. The changes in technology cut across the traditional social structures of the miners which consisted of self-managing groups without supervision. And while there was some division of labor within groups, there was also a fully shared responsibility for the processes and outcomes. This shared sense of responsibility extended beyond the mine itself into the families and communities. Imposing a factory-like structure on the mining operations created three shifts and seven separate roles. The new technology created high expectations of increased productivity but productivity declined. Rather than the dramatic economic benefits expected, there was an increase in mental illness, absenteeism and accidents amongst other phenomena (Trist and Bamforth, 1951).

"The social scientists discovered a pattern of four interrelated `defence mechanisms' against the new work patterns. Named Informal Organization (forming cliques), Individualism (competition, playing politics), Scapegoating (passing the buck) and Withdrawal (absenteeism, `psychosomatic' illness), they corresponded exactly to the effects of bureaucratic structure found in 1939, thereby demonstrating that the relation of structure and effect held regardless of artificial or real setting. Needless to say, the only cure was to design and implement a variation of the old team structure geared to the new technologies. Socio-technical analysis was born" (Emery M, 1993, p12).

Because of this development, Tavistock Institute was invited to work together with government, labor organizations and companies to revitalize industry and enhance productivity in Norway through the Norwegian Industrial Democracy program (1962 – 67, Emery & Thorsrud, 1969, 1976). They were continuing the work to develop socio-technical approach in a real context and it was during this program that Fred Emery discovered the genotypical design principles (Emery, 1967). These democratic structures were gradually picked up by other Scandinavian companies and spread around the world. In the late 1960's Russel Ackoff invited Fred Emery to his program Social System Science, Wharton Business School, University of Philadelphia. And in 1969 Fred Emery returned to Australia. There the ideas were developed further and elaborated in several areas such as the ideals, towards a fully consolidated theory and practice of active adaptation (Emery F, 1977; Emery M, 1999).

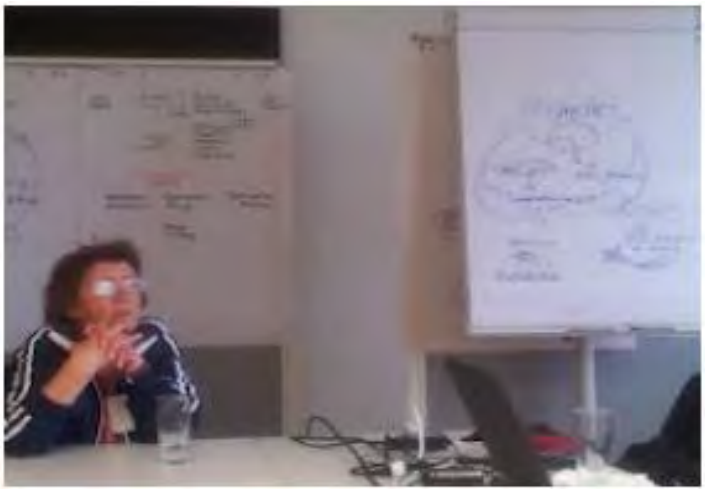

Figure 3 Merrelyn Emery sharing her experiences and views on the socio-ecological, socio-technical and socio-psychological perspectives

Table 2 Chronology of Tavistock Institute, Eric Trist and Fred Emery and the Socio-ecological, Social-technical and Socio-psychological Perspectives

1920: Tavistock Clinic Founded in the UK • Initial Focus on Shell-shocked Soldiers • Developed Expertise in Group Relations, Social Psychiatry and Action Research Military Funding through WWII	**1939:** Lewin, Lippitt & White, Group Climate Experiments • Establishment of Autocracy, Democracy and Laissez-Faire • Action Research
1946: Split after War • Tavistock Clinic (National Health System) – John Bowlby Tavistock Institute for Human Relations – Eric Trist	**1947:** Lewin Founded NTL (National Training Labs) • Applied Social Psychology • Interpersonal Dynamics • T-Groups

1954: Center for Advanced Study of the Behavioral Sciences (CASBS) Founded Bertalanffy, Boulding, Gerard, Rapoport Found SGSR/ISSS	**1951**: Trist and Bamforth, Coal Mining Experiment Owners brought in new technology that destroyed older more collaborative working arrangements – birth of socio-technical systems	**1951:** Fred Emery – One year fellowship at Tavistock **1957:** Emery comes to UK, joins Tavistock **1959**: First Search Conference
1965 – Trist and Emery paper paper on *"Causal texture of Organizational Environment*" **1962 – 1967**: Norwegian Industrial Democracy Program • Joint Project of Government, Labor & Employers • Reports published in English, 1969 and 1976	**Eric Trist** • **1966:** Trist to UCLA • **1967:** Trist to Penn w/ Russ Ackoff Social System Science (S^3) – Tavistock West at Wharton Business School	**Fred Emery**: • **1968**: Emery to CASBS • **1969**: Emery returns to Australia • **1971:** Development of First Participative Design Workshop (PDW) • DP1 -> DP2 • **1972:** First Search Conference (SC) in Australia • **1972:** Ackoff & Emery, *On Purposeful Systems*

2. Introduction of concepts

How people organize themselves to work collaboratively and towards shared or common purposes, continues to interest social scientists, management scholars and leaders. Cooperative work continues to be essential in micro businesses, the start-up phases of many organizations, large corporations, and in governmental as well as non-governmental organizations. When the world continuously changes around us, people and organizations look for new ways of working together, in order to change and adapt. This is increasingly important in the globalized service economy.

Currently we are facing global challenges that affect all our lives. These challenges include the 2009 financial crisis and a faltering global economy, climate change with the related deterioration of the biosphere, and at the local level unemployment, poverty and institutionalized disadvantage. At the same time there is an increased focus on innovation as people try to solve these problems. New organizational structures emerge to support entrepreneurship and new ways of working. The concepts originally developed in the Tavistock Institute seem to be very relevant and offer possible solutions for current challenges.

2.1. Socio-ecological, socio-technical and socio-psychological perspectives

As the Team 1 conversation developed we went further into the socio-ecological, socio-technical and socio-psychological perspectives and how they could be used, advanced and refreshed for the future. More of the week was spent digging into the basic constructs, understanding, for instance, exactly what was meant by Design Principle 1 (DP1) and Design Principle 2 (DP2), and their differences. There were also questions about how the Design Principles related to the different causal texture of environments which had been described (Types I to V, see the next page).

OST as a conceptual framework encompasses different levels of system and environment which are used in various combinations depending on purposes and the nature of the systems concerned, from the family to organizations and communities to the larger society. The immediate environment of an organization may be the global industry in which it operates and this is called the “task environment.” It is documented and analyzed in the Search Conference in same way as the global L22, with the emphasis on the most relevant trends, those elements which affect the relationships and functioning of the system in question, not “everything out there.”

The full conceptualization of active adaptation in practice involves both the socio-ecological perspective and one or more socio-technical or –psychological systems.

2.1.1. Socio-ecological perspective - Causal texture of environment

The basis of the socio-ecological perspective was first published by Fred Emery and Eric Trist in Human Relations (1965a/Vol.III), *"The Causal Texture of Organizational Environments."* In their paper they argued the need for a thorough conceptualization of the open system and documented the changing "causal texture of the environment" over historical time as these contexts have been impacted by technological and other change - at an ever-increasing rate, and toward increasing complexity. As causal textures change so organizations must change to remain adaptive.

As seen in Figure 2, L11 refers to processes within the organization - the area of internal interdependencies and connections. L12 and L21 refer to transactions between the organization and its environment - the area of transactional interdependencies, from either direction from inside out and from outside in; planning and learning. L22 refers to processes through which parts of the environment become related to each other - i.e. producing its causal texture.

Emery & Trist documented four types of environment and discussed the effect of these four environments upon an organization existing in each type of environment. Subsequently, much work has been done on these environments and Baburoglu (1988) explored the fifth type. The first four environments from the simplest through to most complex are explained next.

Environment Typologies

Emery and Trist, (1965) classified environments by the nature of their internal interlocking relations. They defined four environmental fields or external social environments (L22) by their causal textures:

- Type I – Placid, randomized environments
- Type II – Until 1793. Placid, clustered environments, clustered as in nature.
- Type III – 1793-1953. Disturbed, reactive environments, still with stable value systems although competition replaced cooperation
- Type IV – 1953 to the present. Turbulent or dynamic environments
- Type V – vortex environments, where focus is in mere survival (Emery and Trist 1972)

Type I - a placid, random environment is one in which value systems are stable with advantageous and negative resources occurring at random. In placid random environments there is no distinction between strategy and tactics (Emery and Trist 1965). Examples of Type 1 environment are e.g. flea markets and concentration camps where the best tactic is ‘grab it while you can’. Type I doesn’t exist in nature but humans can approximate it.

Type II lasted from the dawn of human history to roughly 1793, the birth of the industrial revolution. It is by far the most adaptive environment people have as yet created. It was characterized by

cooperation because people commonly employed the form of organization based on DP2 (see below). The ancient cultures, remnants of which still exist on most continents as our Aboriginal and First Nation peoples, have been extensively studied by archaeologists and anthropologists. Their work leaves little doubt that these cultures were socially sophisticated, peaceful, intimately tied to the land and highly knowledgeable about how the biosphere works (Emery M, 1982). These were social fields isomorphic with the physical world as the organizations and associated cultures mimicked processes seen in nature and were cooperative with laws of nature. Meaningful learning is all that is required for adaptation.

Type III came into being at the beginning of the industrial revolution because as the factory system was built, labour was recruited from the nearby towns and farms. These people worked in groups (DP2 structures) and lived in rhythms dominated by the sun and the seasons, whether in the fields or in cottage industries. They proved unreliable when required to abide by mechanistic factory time and rules. To ensure reliable behaviour, the owners introduced supervisors and when the supervisors proved unreliable, supervisors of the supervisors. For the first time in the West, we had the widespread application of DP1 with its inherent competition. As these DP1 organizations grew so we had large bureaucratic organizations competing for the world's finite resources. Strategy involves a win/lose game with the competition.

Type III came to a slow demise at the end of World War I with the breakdown of the assumptions that had governed the subjection of the people to the state. Since 1945-53 we have been living in a new environment, the Type IV, an unintended consequence of adopting the world hypothesis of mechanism (Pepper, 1942; Emery M, 1999). People finally reacted to the Type III environment, rejecting its assumptions and structures and increasingly taking things into their own hands (Emery F, 1978). As the rug was pulled out from the basis of the stable value system, people were left to derive their new value system and they are still in the process of sorting out what they really value. The Type IV environment is known as 'turbulent' because it is characterized by rapid value shifts and discontinuities.

Type IV, therefore is a dynamic rather than a stable environment. Emery and Trist (1965) argue that the dynamic characteristics arise not only from transactions between the systems within the environment but from the field itself - 'the ground moves'. It is characterized by relevant uncertainty on top of high complexity. Emery and Trist (1965) suggest that for organizations involved with a turbulent environment, the appropriate response is to establish a relationship that transforms the environment into one of the other kinds of environment where less uncertainty exists. These relationships could form organizational matrices or "relationships between dissimilar organizations whose fates are, basically, positively correlated" (p.29), e.g. suppliers or alliance partners. They further hypothesized that certain social values would emerge as coping mechanisms.

Type V, environment Vortex is a consequence of the dynamic processes set in motion by the unplanned consequences of actions taken by one or more stakeholders may develop into what Emery and Trist call "autochthonous processes" (Emery and Trist 1972)

Subsequently, a great deal of empirical and theoretical work has shown that it is the set of human ideals (Emery F, 1977) which only emerge in DP2 structures, that has the power to bring this field under control (Emery M, 1999). Adaptive strategy involves knowing and monitoring the L22 and becomes active adaptive when the strategy influences change in that L22.

Merrelyn presented examples of addressing the environment of the system as the first phase of the Search Conference – see Figure 5. . In the design of the event, it is essential that any system must examine changes in the world around us (the L22) and analyze these by projecting the most desirable and probable worlds. Without this work, a system has no chance of establishing an active adaptive relationship with the L22. Once this formative work has been done, the system can concern itself with its history, its current situation, its most desirable and sustainable future (the L11), the possible constraints and how to deal with them and finally integrate all its learning into action plans that will achieve that most desirable future.

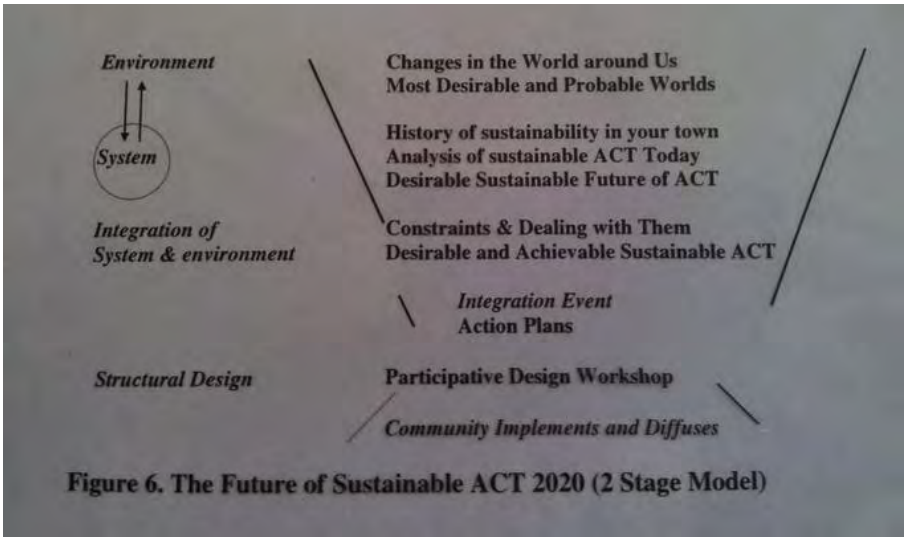

Figure 5 - Examples of addressing the environment of the system as the first phase of the Search Conference

A community emerging through the Search Conference is a socio-ecological system.

2.1.2. Socio-technical perspective

The socio-technical concept arose in conjunction with the first of several field projects undertaken by the Tavistock Institute in the coal-mining industry in Britain. The time (1949) was that of the postwar reconstruction of industry in relation to which the Institute had two action research projects. One project was concerned with group relations in depth at all levels (including the management/labor interface) in a single organization - an engineering company in the private sector. The other project focused on the diffusion of innovative work practices and organizational arrangements that did not require major capital expenditure but which gave promise of raising productivity. The former project represented the first comprehensive application in an industrial setting of the socio-clinical ideas concerning groups being developed at the Tavistock. For this purpose a novel action research methodology inspired by the work of Kurt Lewin was introduced. Nevertheless, the organization was approached exclusively as a social system. The second project considered the technical as well as the social system and postulated that the relations between them should constitute a new field of inquiry (Trist & Murray, Vol 2).

Socio-technical systems used to involve intensive work by teams of expert social scientists analyzing the social and technical systems with the outcome of jointly optimizing those systems to the benefit of both the workers and organizational performance, i.e. maximizing the best of both systems for those benefits. Since the discovery of the genotypical design principles and the development of the Participative Design Workshop, the design work is done by those who work in the organization while the social scientists work only to transfer their social science knowledge through briefings to these organizational members in the process of managing the workshops (Emery & Emery, 1974).

2.1.3. Socio-psychological perspective

Socio-psychological organizations are those where people replace the technical system. Examples are schools, hospitals and prisons. Historically, the source concepts which gave rise to the socio-psychological perspective are psychoanalytic object relations theory, Lewinian field theory, the personality-culture approach and the theory of open systems. An ideal was to keep alive in one's experience the reality of the person, the group, the organization and the wider society, so that one could sense their interconnections. It was also thought desirable at the Tavistock to maintain contact with projects in more than one social sector - not, for example, to spend all one's time in industrial projects. The experience of these projects has led to further conceptual developments. Usually more than one of the source concepts had been drawn on in order to obtain a better understanding of what was taking place or what had to be designed (Trist & Murray, 1993, Vol I).

The original Tavistock Clinic members came from a wide variety of backgrounds, and as noted earlier, worked on projects ranging from “shell shock” (now known as Post Traumatic Stress Disorder) to candidate selection of military officers, to organizational functioning. During the early years, though, all recognized the value of psychological understanding and self-awareness. Even after the split between the Tavistock Clinic and the Tavistock Institute, following World War II, the practitioners in the Institute continued to undergo psychoanalytic training as part of their self-development. Only later was that practice abandoned.

Today, socio-psychological organizations are turned into active adaptive, jointly optimized systems in exactly the same way as are socio-technical organizations but are more complex with more steps involved.

2.2. Design Principles DP1 and DP2

In the IFSR Conversation we discussed the organizational design principles DP1 and DP2 with Merrelyn in detail in order to understand how they affect the ways in which people work together. Since the 1970s, these principles have been one the key concepts of active adaptation as expressed in planning and design. It is, therefore, critical that they are clearly understood.

The first design principle (DP1) is called 'redundancy of parts' because there are more people than are required to do whatever, the activity is. Its other critical feature is that *responsibility* for coordination and control is located one level above where a particular activity is being performed. People are treated as replaceable parts, cogs in the machine. DP1 produces the organizational structures called 'bureaucratic' or 'hierarchical' where the hierarchy is one of dominance. A DP1 structure is one in which everyone, except the person at the top, is licensed to be irresponsible (Emery, M, 2000).

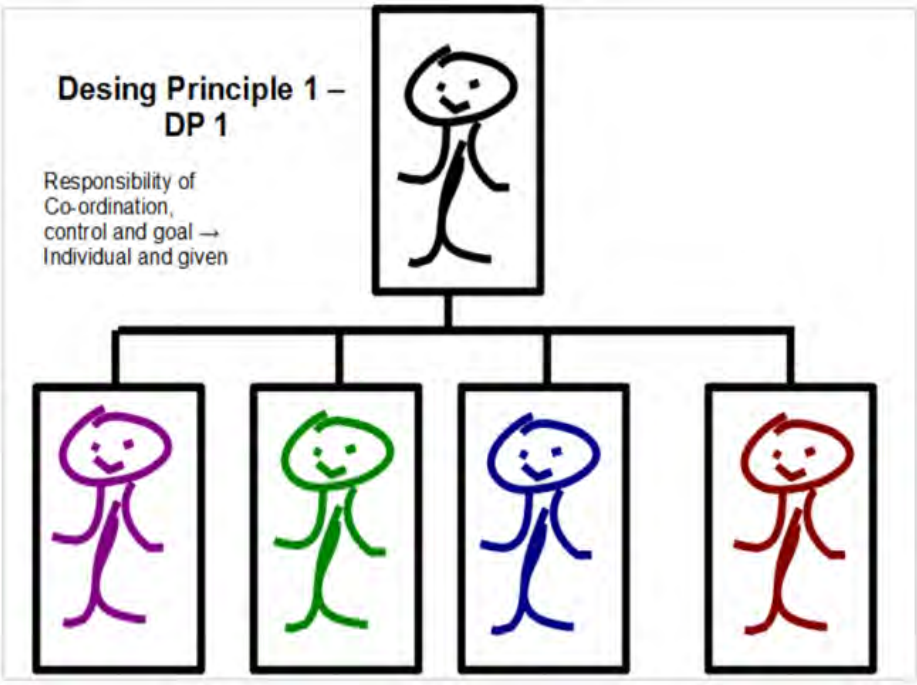

Figure 6 - Design Principle 1 – DP 1

The second design principle (DP2) is called 'redundancy of functions' because more skills and knowledge are built into each person than they can use at any one given time. *Responsibility* for coordination and control is located where activities are being performed. It produces organizational structures called 'democratic', participative not representative. Participative democratic organizations, particularly large ones, may still contain a flat hierarchy but this is a hierarchy of functions, not dominance, where different levels negotiate as peers in order to accomplish the goals of the whole. Contrary to DP1 structures, DP2 structures motivate.

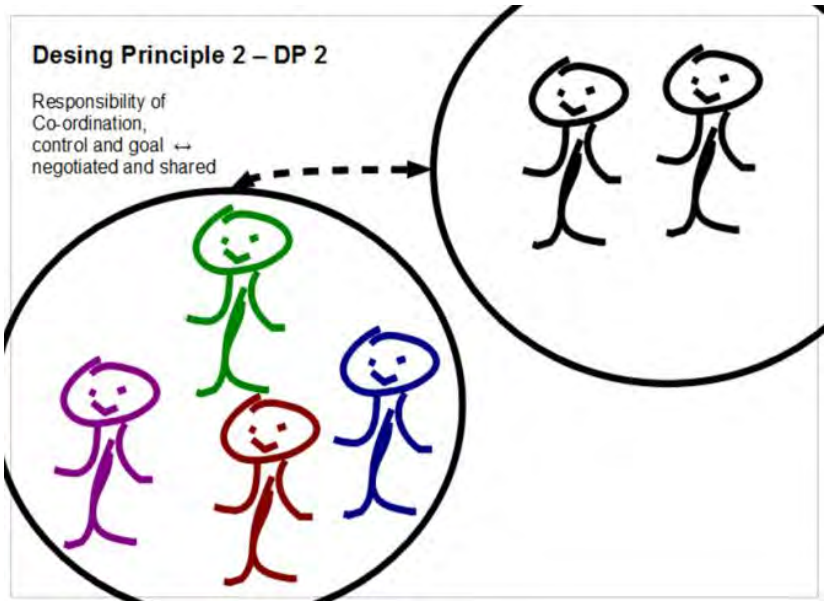

Figure 7 - Design Principle 2 – DP 2

The design principles are very powerful and affect many human behaviours, competition versus cooperation, the quantity and quality of communication, group dynamics and the human affect or emotional system which contributes in turn to the quality of mental health.

These design principles operate at all levels and sectors of society. They underlie the nature of political or governance systems in the same way as the structure of single organizations. Representative political systems derive from DP1. Alternatives flowing from DP2 have existed and currently exist (Emery F 1976a & b, 1989). A participative democracy, therefore, is a system structured entirely on DP2. That is, all subsystems (organizations and communities) and their interrelationships are democratic as well as its overall system of governance. A participative democracy is an open responsible system. (Emery, M. 2000)

2.3. Participative Design Workshop

The Participative Design Workshop (PDW) – was developed in 1971 to replace the old method of STS that had been developed from 1949-1967. It was tested in many organizations and continuously modified until it became fully reliable and fully flexible to change the design principle throughout any organization. There are two versions of the PDW, one for the redesign of existing structures and one for design from scratch. The PDW produces an active adaptive (DP2) system, one in which all people are responsible and motivated to achieve shared goals, and who know how and why to maintain it. Different phases- analysis, change and practicalities, required briefings and the main tasks in each phase are introduced in the Table 3. The version of the PDW for redesign is given in Table 3.

Table 3 Phases of Participative Design Workshop – PDW

Phase 1. Analysis	**Phase 2. Change**	**Phase 3. Practicalities**
Briefing 1 - Design Principle 1 and its effects	*Briefing 2 - Design Principle 2 and its effects*	*Briefing 3 - What Is Required to Make the Redesign Work*
• Groups complete matrix for 6 psychological requirements of productive activity. • Groups complete matrix of skills available. • Reports and diagnostics.	• Groups draw up work flow for information and learning. • Groups draw up organizational structure and redesign it. • Reports.	Groups spell out: • a comprehensive set of measurable goals • essential training requirements for start-up (from skills matrix) • other requirements, e.g. mechanisms for coordination, changes in layout or technology, etc. • first draft of career paths based on pay for skills and knowledge. • how the redesign improves scores on the 6 criteria.

For designing from scratch (greenfields) a modified PDW is hung onto the Search Conference. Unless the system affords the learning and support for learning that is required for implementation of the new system principle that welds the previous community or the new organization into an active adaptive system, the work of the Search Conference will ultimately be wasted. The PDW following a search Conference, therefore, answers the question 'how do we organize ourselves to ensure that we reach our Most Desirable Future?'

2.4. Search Conference method

Since the first Search Conference in 1959 (Trist & Emery 1960) theory and practice have undergone intensive integrated development. The first version of Search Conference was conducted in the UK and it was developed further over many years. The first Search Conference in Australia was held in 1972 and again tested and modified to meet the full range of communities, organizations, industries and issues that could benefit from its application.

The Search Conference is an intensive event in the middle of an extended period of preparation and planning and an infinite implementation. Its success depends upon the quality of the preparation and the structures consciously understood and built into the implementation phase as well as design and management of the event itself.

The external structure (design) of the SC is a translation of the open system into practice. The content consists of learning about (and also learning how to use) the environment (L22) and system (L11), and integrating them for active adaptation between changing system and the changing environment. The process consists of integrated learning (L21) and planning (L12).

The Search Conference (SC) establishes an active adaptive relationship between the system and the environment through the creation of a new system principle. The system principle is contained within the new set of strategic goals, the Most Desirable Future of the system. The Search uses our inbuilt capacity to directly extract meaning from the environment and creatively combine that meaning with our ideals. It answers the question 'where and what do we want to be in year X?'

3. Application into current organizations

As the week progressed the team moved from a focus on history and theory (though those continued to be revisited) to questions about where and how the concepts and principles showed up today, in different kinds of organizations and circumstances. Indeed, many of the examples where self-managing work groups had been instituted no longer existed because they came into being before it was learnt how to secure them. This led to questions about transitions of structures within and between organizations. It was apparent that some groups (e.g. some kinds of start-ups) began as self-managing organizations and became more hierarchical as they grew and evolved. Sometimes large corporations or projects experimented with such structures in their efforts towards innovation. One specific example discussed was the building of Terminal 5 at Heathrow Airport, which seemed to function as a DP2 structure throughout the construction phase, but then dissolved entirely when it was handed over to operations. (This was explained in more depth by Hillary Sillitto, visiting from another Conversation team.) This example created an opportunity to discuss a number of aspects about design principles and organizational structures: ways in which the principles may be present in organizations with no connection to Tavistock or socio-ecogical work; transitions between structural forms in organizations, etc.

3.1. Transition between DP1 and DP2 structures

During the IFSR conversations we were discussing the organizational design principles in different contexts, different variations and different transitions between organizational structures. We were sharing examples of organizations and their development from the past as well as current transitions which are on-going. Possible transitions include transition from DP1 to DP2 structure as well as transitions from DP2 to DP1 structure. There are also mixed DP1 and DP2 structures as well as alternating DP1 and DP2 structures. We also discussed growth in DP2 structures. Some of these examples are described in the Table 4 below.

Table 4: Transitions between DP1 and DP2 structures

	DP1 → DP2	**DP2 → DP1**	**Mixed DP1& DP2 Alternating DP1↔DP2**	**Growth DP2**
Examples	J. Robins - footwear Heathrow Terminal 5 (build stage) Harley Davidson SOL	Mining company in UK IBM consulting 1993-1996 Google, on-going Nokia 2007 → exit from start-up phase	R&D departments universities military organizations emergency organizations	Gore Tex
Conditions for starting / for sustaina-bility	→ Self initiated * intense competition (L22) * desire and intent to get better (L11) * 3-5- yrs (no turning back) agreement between management and union (employees) in Australia (EBA) Enterprise Bargaining Agreement → reward system is payment for skills and knowledge held ;comprehensive set of goals for each group → min 4 people, usually 10 – 15, max 26 self managing group	→ search for efficiency → global scale → competition → accounting systems ? belief system management paradigm - must be conscious, conceptual knowledge of design principles	* ambidextrous forms * different situations and environmental fluctuations	* cellular organization, new units when more than 150 people

3.2. Modern and temporary DP2 Structures

Organizational design principles DP1 and DP2 also apply to modern and temporary organizations. We were discussing examples when organizations are created and planned to operate according to DP2 structures and the conditions for starting and required for working well and sustainably. The organizational forms discussed were organizations in the start-up phase, when they are created to operate as DP2 structures, networked DP2 structures, temporary DP2 structures and unofficial DP2 structures. Some of examples are described in the Table 5.

Table 5: Modern and temporary DP2 Structures

	0 → DP2	**Networked DP2**	**Temporary DP2**	**Unofficial DP2**
Examples	Start –up companies Aurora mine at Syncrude Aalto Venture Garage Reaktori	Open source communities Linux Iron Sky movie & audience participation Living Labs Entrepreneurial Hubs	Hack camps / hack athlons Skunk works Search conferences	Communities of practice Voluntary projects Shadow organizations behind official DP1 structures
Conditions starting / for working well	→ green field for the site, replicated from other unit → new ”garage shops” (with no MBAs) → small entrepreneurial team	→ network of equals → new form of legal agreements e.g. CC - creative commons and open source licensing	→ agreement working WITH each other → enough trust to get started → common shared goal / intent	→ common interest → redundancy → motivation → encouragement → recognition of deficiency in organization → enabling communication platform, social IT

4. Conditions for Success

During the sessions we also discussed the conditions for success and Merrelyn introduced us to the 4 conditions for influential communication and the 6 Psychological Requirements for productive work (known as the 6 Criteria, for short). The following four conditions have been identified as important for organizations and their operations, for starting, for sustaining and for working well. The four conditions are openness, basic psychological similarity, shared field and trust.

4.1. Four conditions for influential communication (from Asch, 1952)

4.1.1. Openness

Openness is critical for honest discussion and trust and it should be addressed on two levels. Good designs and methods have features to maximize openness. Wherever possible, the planning for an event must be itself participative. The roles, values, and expectations of designers and managers, and the underlying strategy and long term goals, must be also open to inspection and clarified before work proper begins (Emery 2000). Secondly, all notes of joint discussion and plans are made clearly visible to all participants during the sessions. Such openness encourages trust and hence participation as all participants grow in confidence and become more open themselves.

4.1.2. Basic Psychological Similarity: We Are All Human with the Same Human Concerns

When working together towards their most desirable future, people realize they all share basic humanness and concerns. This session elicits the set of ideals and by allowing people an opportunity to share their ideals it not only makes them visible and real but it also almost inevitably confirms that

there is an underlying level of concern with humanity and the state of the world. The usually unspoken presence of human ideals is no respecter of gender, race, status or age. By discussing and deciding upon a desirable future in either global or nearer terms, a modus vivendi for working together has been established; a benchmark for the possibility of more creative cooperative work towards common purposes. (Emery 2000)

4.1.3. Emergence of a Mutually Shared Field: we all live in the same world

Shared understanding of the L22 as a context for planning and action helps participants to create common ground. As everybody contributes to the emerging picture of the L22 with the items of data going up on flip charts, people recognize the reality that everybody perceives the same changes in the world around them, and that indeed, they do share a world. These notes then become the fundamental data available for analysis and then synthesis into most desirable or probable futures. Here they further realize that they all make the same meaning out of the data reinforcing the commonality. The data and scenarios remain in full view to function as check point and reality test for any subsequent proposals or plans. Accessible to all, this “big picture” of the environment (L22) serves amongst other purposes that of establishing the validity of the notion that we all live in the same world. Making shared notes can also help participants to question their own hidden assumptions and get on with the task of planning and redesigning their future along more desirable and adaptive lines. (Emery 2000)

4.1.4. Trust: The Development of Individuals as 'Open Systems'

When the above 3 conditions are in place, trust accumulates over time as an individual comes to experience the openness of the world s/he shares with others and the mutual respect and consideration which is accruing from initiating greater depth in communication with the other. As such trust accumulates so do interpersonal relations strengthen and deepen, increasing the probability of mutual learning. For the management of any learning environment the emergence of this trust is an overarching responsibility, involving as it does the individual's trust in his or her own perceptions and learning and the confidence of the group as a whole in its ability to assume responsibility for their futures (Emery 2000).

Trust accumulates to the extent that people find an opportunity to exercise care about their own and shared concerns and can put away gradually, without risk, the masks of passivity and dissociation. The resultant release of energy enhances challenge and consciousness and intensifies interpersonal engagement towards association with the task at hand. Therefore, it leads to more mutually supportive action. Without this spiral of trust, learning, energy and commitment, the process of implementation would be impossible. The three conditions - openness, our shared ideals with no division into us and them, and the acknowledgement of a shared objective field, are the essential preconditions for the development of trust. (Emery 2000)

4.2. Psychological Requirements for the 6 Criteria for DP 2 organizations

We also discussed the 6 Criteria for productive and creative activity which have been identified as important criteria for the successful implementation of DP2 organizational structures. They are invariably correlated with DP2 and inversely correlated with DP1 regardless of how much effort has been poured into ensuring employees have excellent pay and working conditions. The first three pertain to the individual who can have too little or too much and are measured from -5 to +5 where 0 is optimal. The second three pertain to the climate of the organization and of these you can never have too much. They are measured from 1-10. They have been routinely measured in countless surveys and Participative Design Workshops (PDWs) since 1971 (Emery, M., 1993). They provide a highly reliable measure of intrinsic motivation and quality of work regardless of the purpose or nature of the organization, including universities (Emery, M., 2000b). The criteria are presented in the Table 6.

Table 6: The 6 Psychological Requirements (6 Criteria)

	Scale
1. Elbow Room, optimal autonomy in decision making	-5 ….. **0** ….. +5
2. Continual Learning for which there must be a) some room to set goals b) receipt of accurate and timely feedback	-5 ….. **0** ….. +5
3. Variety	-5 ….. **0** ….. +5
4. Mutual Support and Respect, helping out and being helped out by others without request, respect for contribution rather than IQ for example	0 …… **10**
5. Meaningfulness which consists of a) doing something with social value b) seeing the whole product or service to which the individual contributes	0 …… **10**
6. A desirable Future, not having a dead end job.	0 …… **10**

4.3. Complementary approaches

During the IFSR conversations we also addressed various ways in which the socio-ecological, social-technical and socio-psychological perspectives might be advanced. The original concepts seem to be still very powerful for addressing the social challenges in global and in local contexts. However, a lot has happened since the 1950s, 1960s and 1970s when these concepts were originally created.

Information and communication technology and software development has provided new possibilities for communication, working and learning together. The recent development related to social computing and social media can offer new possibilities for implementing Participative Design Workshops and Search Conferences.

During the session we addressed the concepts of “hacker ethic” by Steven Levy 1984 and Pekka Himanen. The idea of a "hacker ethic" is perhaps best formulated in Steven Levy's 1984 book, *Hackers: Heroes of the Computer Revolution*. Both Levy (1984) and Himanen (2000) stated values by hackers related to work itself and about working together with others. Levy’s list consisted of sharing, openness, decentralization, free access to computers and world improvement. Himanen (2000) brought up passion, hard work, creativity and joy.

Figure 8 - The Principles of Management 2.0 – hackathon m2 principles

These principles of management are divided into elements – openness, community, meritocracy, activism, collaboration, meaning, autonomy, serendipity, decentralization, experimentations, speed and trust - are currently used in hackerfests, hackathons and hacklab events, where programmers come together to work, collaborate and compete. These new temporary and emergent organizational

structures are clearly based on DP2 structures and they are applying similar principles as recommended in the original concepts of Tavistock Institute.

During the week several other possible views to complement the original socio-ecological socio-technical and socio-psychological perspectives were brought up by the participants. We discussed commitment and language action by Fernando Flores. Alexander Lazlo visited the team and introduced us to Flores' views of assertions, assessments, requests, promises, offers and declarations, narratives, vocabularies, conversations and speech acts. We discussed Tim Allen's work on 'complex' and 'complicated' as well as life cycles of organization, different stages, sabotage and unintended consequences. Themes related to resources: matter and energy in natural systems and power in social systems were addressed. We also briefly addresses Kenneth Boulding's 10 Images of change, which could provide an interesting framework, for looking into what has changed over the past 50 decades since the socio-ecological, socio-technical and socio-psychological perspectives were delineated. We considered operating with excess of resources and scarcity. We briefly visited human perceptions as well as beliefs, understanding, credibility, responsibility, ignorance and the limits of perception, knowing and understanding. The 'communities of practice' approach by Etienne Wenger was also brought up to address modern knowledge work in contemporary organizations.

5. Conclusions and the next steps

By the end of the week there were, as always, more new questions and possibilities than final conclusions and answers. It provided, however, a strong foundation for more research into active adaptive and self-managing systems.

After the IFSR meeting team members have been developing materials further. Materials have been used in several educational sessions and research projects. We are looking forward to investigating the area further both with complementary theories as well as empirical examples.

Acknowledgement

We would like to thank all the participants for their active discussion and valuable comments at the IFSR 2012 meeting at Linz. Participants provided information about other organizations that have applied DP2 practices in their structures – including Handelsbanken in Sweden, SEMCO in Austria and SOL in Finland.

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Expanding Scope of Systemic Innovation and Socio-Ecological and Socio-Technical Perspectives

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Summary: In this paper I will introduce an expanding scope of stakeholders involved in innovation activities, especially new institutions for innovation, which include open source communities, Living Labs, development labs, hacker events and crowds. Social computing practices enabling interaction especially crowdsourcing practices will be presented. These new emerging phenomena will be discussed from socio-ecological and socio-technical perspectives, and images of change –framework created by Kenneth Boulding (1956).

Keywords: crowdsourcing innovation, open innovation, systemic innovation, stakeholders, social computing, socio-ecological environment, socio-technical system

Abstract: The seminal research work by Fred Emery, Eric Trist and Tom Burns (1961) by Tavistock Institute was addressing themes related to innovation and collaboration. Socio-ecological, socio-technical, and socio-psychological perspectives introduced in relation to organizational change as well as organic and mechanistic views. Innovation still offer valuable views to current business challenges. Also Kenneth Boulding's Images (1956) offers a framework to describe change and currently evolving practices. In the ISSS conference 2011 at University of Hull Mike Jackson brought up in his keynote speech, that it would be very relevant revisit original thoughts of systems thinkers, and see how they would apply in the current business context. IFSR Conversations 2012 at Linz has provided a great opportunity to revisit these original thoughts and enabled inquiry to apply these concepts to current phenomena and challenges.

Recent development of global business networks, emerging new technologies, accelerated speed of development and enhanced access to data, information and knowledge challenge traditional business practices and ways of working. Sustainability has become essential and increasingly important element to long term business success, consumers are becoming more environmentally conscious on socio-ecological issues. There is a shift towards more user-centric development, focus on usability and user experience address socio-technical challenges in earlier stages of development. Social computing and social media application enable interaction with users at earlier stages and in more meaningful ways. Working with communities of practice, user communities and crowds bring up new challenges from socio-psychological perspectives. Wider group of stakeholders are included in innovation practices and new technologies are enabling interactive relationships.

1. From closed towards open innovation systems – expanding scope of stakeholders

The concept of open innovation by Henry Chesbrough (2003) refers to the fact that both internal and external sources can and should be used for innovation. This notion was already brought up by Tom Burns and George Stalker (1961) when they addressed mechanistic and organic structures related to innovation management, whereas mechanistic organizations were bureaucratic, rather rigid

and more slow in decision making and in operations; and organic structures were more flexible, dynamic and open. Unfortunately for several decades traditional management practices were applied also to innovation activities and they were considered to be highly secretive and were operated in closed systems mainly within organizations. However, during the past decades, especially companies have been opening up their innovation activities to both directions in the supply chain: towards customers and end-users i.e. downstream and towards suppliers i.e. upstream part of the supply chain. As a result, companies are increasingly dealing with many external parties including suppliers, customers, end-users, governmental organizations and research organizations (see Figure 1) for the pursuit of new knowledge. Also some new institutions for innovation are emerging globally, offering an interesting potential set of new stakeholders for innovation activities.

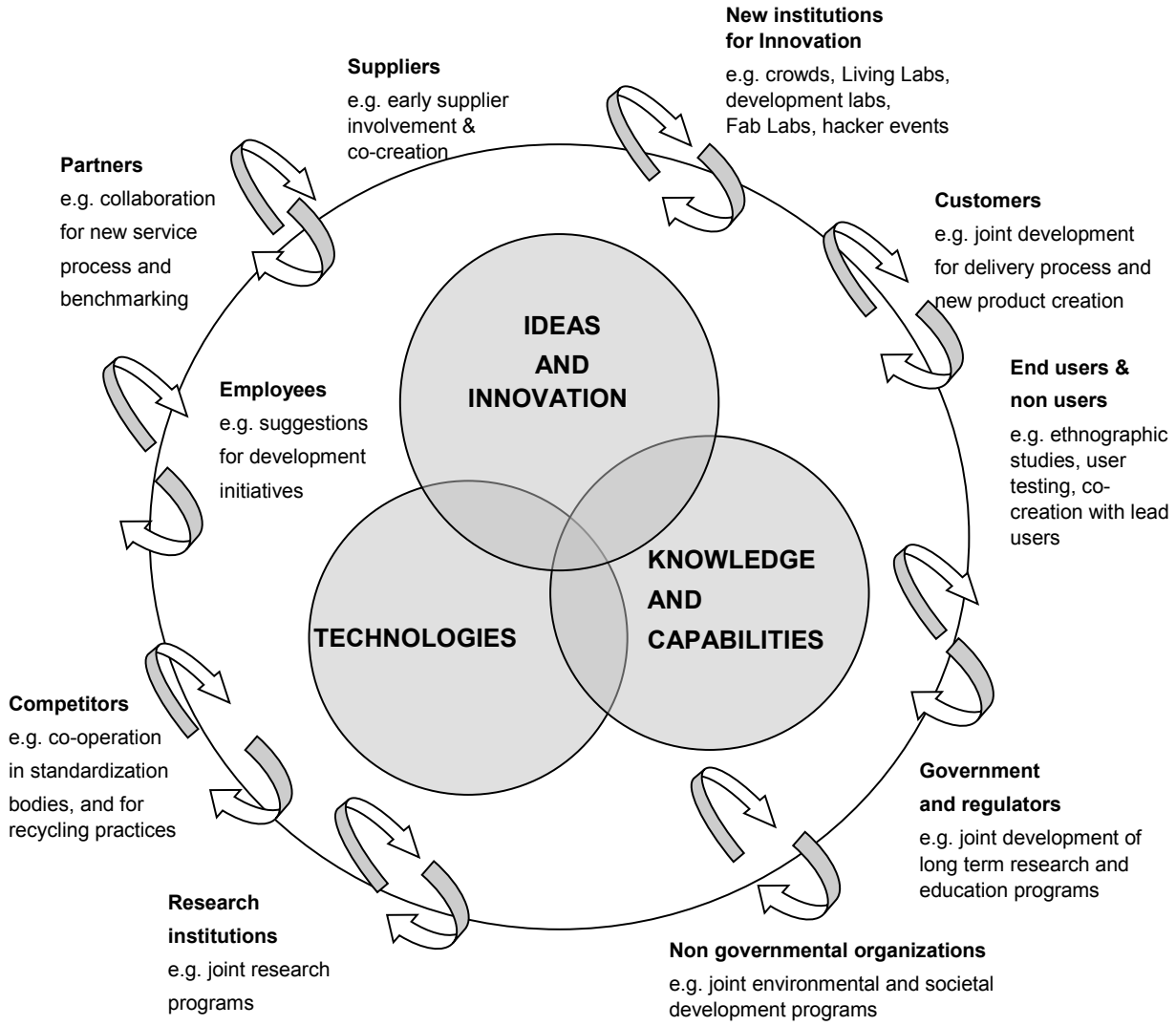

Figure 1 Stakeholder view to collaborative innovation and examples of interactive relationships

With the digital information technologies including social computing as Web 2.0, social media and crowdsourcing it has become easier for organizations to engage these external stakeholders in innovation activities. However, whilst these parties can be regarded as potentially valuable providers of novel knowledge, it may prove challenging for an organization to manage all these inter-organizational relationships as they may differ in relationship focus and in the ways of collaboration. Accordingly, organizations are faced with the challenge of managing and structuring their innovation

activities in a distributed environment. The first challenge for an organization is identifying relevant stakeholder groups in the external operating environment (L22) and developing ways to engage them in the innovation activities (L12 and L21).

Systemic Innovation has been defined by Chesbrough and Teece (1996) as an innovation whose benefits can be realized only in conjunction with related complementary innovations. According to Teece (1996) systemic innovation requires coordination throughout the system in order to realize the gains from innovations and it requires significant adjustment of parts in the business system they are embedded in. Teece (1996). For systemic innovation it is very relevant to identify related stakeholders and interaction with them.

1.1. Stakeholders for innovation

Stakeholder theory by Edward Freeman (1984) argues that there are many parties involved in corporate management and related business, including governmental bodies, political groups, trade associations, trade unions, communities, financiers, suppliers, employees, and customers. Sometimes in addition competitors are listed among stakeholders - their status being derived from their capacity to affect the company and its other stakeholders. Originally stakeholder view of the firm was addressing business ethics, morals and values. However, it has later been applied in other areas of management.

In innovation activities suppliers can be engaged with early supplier involvement, they can participate in creation of new products and services. Customers can be invited to participate into joint development for delivery process and new product and service creation. End users & non users are very valuable stakeholders for user testing. Also co-creation with lead users can provide novel insights for new product and service creation. With collaborative ethnographic user studies products and services can be developed to better serve the needs of users.

Different partners are need to new service processes and benchmarking. With research institutions including universities joint research programs can bring novel ideas and technologies into new product and service development. Employees are encouraged to participate via idea competitions and suggestions for development initiatives. These activities are also conducted with ex-employees, retirees and alumni.

Government and regulators are important stakeholders for joint development of long term research and education programs. And companies are increasingly working with non-governmental organizations for example in joint environmental and societal development programs as well as local development initiatives. Competitor collaboration has become more common e.g. via co-operation in standardization bodies, and in some industries for recycling practices.

1.2. New institutions for Innovation

Turner (1997) has defined institution as a complex of positions, roles, norms and values lodged in particular types of social structures and organizing relatively stable patterns of human activity with respect to fundamental problems in producing life-sustaining resources, in reproducing individuals, and in sustaining viable societal structures within a given environment.

New institutions for innovation – open source communities, Living Labs, development labs, Fab Labs, hacker events – have emerged in various contexts since 1980's and they have been enabling new roles, norms and values, new structures and new ways of working. These new institutions have been expanding into other area and countries. Following open innovation principles the original institutions have offered openly information about their activities for interested stakeholders, and new initiatives have emerged globally across the world.

New institutions and practices enable creativity and adaptive approaches for development, addressing both social and economic issues. Open source communities originally operated mainly in the area of software development. Later practices have been applied in other areas as well. The first Fab Lab was established at MIT in 2002, and now there are ~100 Fab Labs globally and ~30 under

development. The first Living Lab was established in 2004, and now there are ~300 of them globally and ~50 under development. While other organizations seek new sources for innovation in collaboration with these institutions their own practices need to change as well. New approaches are needed especially for mutually value-added and respectful collaboration between firms and new emerging institutions.

1.3. Crowdsourcing

One stakeholder group that has been gaining importance lately are crowds, anybody willing to collaborate. Various types of classifications have been done to understand the nature of crowdsourcing phenomenon. Originally, Howe divided crowdsourcing activities into four primary types 1) crowd wisdom; 2) crowd creation; 3) crowd voting and 4) crowd funding. Crowd wisdom relates to scientific and professional problem solving (e.g. Innocentive since 2001), collecting geographic content, aggregating location based data and information (e.g. Open Street Map since 2004) and collecting health and medical data (e.g. Patients Like Me since 2004). Crowd creation relates to distributed work (e.g. Mechanical Turk since 2005, Freelances since 2004) and crowdsourcing platforms for design and art (e.g. 99design since 2008; Express in Music since 2009). Crowd voting is an often embedded element in idea crowdsourcing platforms, as for example in Threadless.com, where people can share, score and comment on T-shirt designs; most popular designs are awarded. Crowd funding relates to funding small businesses and investing in new product and service development (e.g. Kiva since 2004; Kickstarter since 2009) for example in the area of music and art (e.g. ArtistShare since 2003). A similar type of categorization for crowdsourcing activities distinguishes between five main application domains cloud labor, crowd funding, crowd creativity, distributed knowledge and open innovation (see www.crowdsourcing.org).

2. Socio-ecological and socio-technical perspectives

Socio-ecological perspective provides framework for describing, analyzing and planning how a system, a company or an organization, (L11) is interacting with its environment (L22). These interactions have been defined as planning (L12) and as learning (L21). This approach can be used to analyze and explain how companies interact with innovation stakeholders and new institutions for innovation.

The concept of "the causal texture of the environment" created by Emery and Trist (1965) noting that the environmental contexts in which organizations exist are themselves changing under the impact of technological change - at an ever-increasing rate, and toward increasing complexity. This phenomenon seems to be still continuing. The rate of technological change seems to be still increasing, yet at the same time technologies enable people to have enhanced access to information and knowledge globally, and provide new opportunities for collaboration and sharing.

Both Participatory Design Workshop (PDW) and Search Conference (SC) methods offer opportunity of mixed stakeholder groups to plan and learn together. And new communication technology and collaborative IT platforms can offer common ground for discussing shared values, missions and goals, planning and reporting activities, as well as working together.

Socio-technical perspective can address the actual work design, how people work together in collaborative settings, how their work related to the whole organization and to relevant stakeholders. It is also possible to connect the activities to macro society and to global challenges.

3. Change in innovation systems – change in images

We need to revisit our beliefs about existing organizations, practices and ways of working, in order to understand the changes happening in the global society. Kenneth Boulding (1956) asserted that the behavior in the society depends upon the images. These images lie behind the actions of individuals, organizations and societies. The recognition of different images and basic assumptions are important

for societal development. Boulding (1956 pp.3-18, 45-63) classified different aspects of images in ten elements. These elements and application to current context is presented below:

- *Spatial image* - the picture of the individual's location in the space around him. This dimension addresses changes in physical environment as well as in information and communication technology - ICT supported virtual environments.
- *Temporal image* - an individual's picture of stream of time and his place in time. This dimension looks into changes in time-based practices, for example short and long term connections, and synchronous and asynchronous connections.
- *Relational image* - the picture of the universe as a system of regularities. This dimension focuses on relations between organizations, and relationships among stakeholders.
- *Personal image* - the picture of an individual in the midst of the universe of people, roles and organizations around him. This dimension views personal aspects and changing roles.
- *Value image* - the ordering of the scale of better and worse of the various parts of the whole image. This dimension invites us to investigate what are the value systems in use, how we appreciate wealth, health, beauty and truth in our activities.
- *Emotional image* - various items in the rest of the image are imbued with feeling or affect. This dimension addresses human behaviors based on emotions, for example the passion for innovation and the fear of failure or success.
- *Conscious, unconscious & subconscious image* - an individual is capable being conscious of all parts of the image with the same degree of intensity, ability to perceive varies, a very small part of an image is exposed to our internal view at the same time. This dimension looks into sources of creativity, imagination beyond rational thinking.
- *Certain / uncertain, clear / vague image* - every aspect of an image is tinged with some degree of certainty and uncertainty. This dimension relates to the vagueness of fuzzy front end of innovation process. Risks are always related to new innovative activities.
- *Real / unreal image* - an image of the correspondence of the image "itself" with some "outside" reality. This dimension challenges us to investigate deeper levels and leads to implementation in real contexts.
- *Public / private image* - whether the image is shared by others or is peculiar to the individual. This dimension provides us an opportunity to address the themes of open innovation and transparency.

Each image is rich and complex. The dimensions above provide a framework for description of complex phenomena. Boulding emphasized that the image is a property of the individual person, so he described different images in the individual level. However, he noted that different dimensions of image could be used by the way of metaphor or analogy for organizations and societies. Some image dimensions are more certain in their nature, some of them are more uncertain e.g. the relational image, value image, emotional image.

Change can be perceived as a mutation of the image created by the true entrepreneurs of society. This change is happening based on emergent activities rising on people's own initiatives. Without this mutation of the image, societies would rapidly settle down in a stagnant equilibrium. As the world moves on, the image does not. This has happened in many societies. In the INSCO project Boulding's image framework is used to describe difference between traditional and emerging new institutions for innovation. The new images can be seen as extensions and modifications of the old.

4. INSCO Project – Innovation in Sourcing Competencies

This paper is based on research done for INSCO Project, which is a TEKES (the Finnish Funding Agency for Technology and Innovation), university and industry funded parallel research consortium project, conducted at Aalto University during 2011 – 2012. The project is carried out with co-operation with researchers from Aalto University, Oulu University, Kasetsart University (KU) (Thailand), CSIR / Meraka Institute and Rlabs, ReConstructed Living Lab (South Africa). Collaboration with Finnish

industry is conducted with three partners: Konecranes, NSN and Teleste. These industrial partners have also their own parallel development projects, derived from specific and concrete development and business needs. Collaboration between the industrial partners and research team form a natural platform for research and benchmarking. Research methods included case studies, interviews, participatory workshops, development projects and identification and benchmarking of new practices.

The INSCO Project includes six work packages: 1) collaborative practices with suppliers in early life cycle phases, 2) management of innovation focused sourcing relationships, 3) use of demos, prototypes and pilots, 4) practices for indirect sourcing, 5) approaches with developer communities, living labs and practices for early customer involvement and 6) approaches for crowdsourcing. Research methods include case studies, interviews, participatory workshops, development projects and identification of and benchmarking with new practices. INSCO Project is looking into new practices for sourcing and new practices for sourcing innovation.

5. Conclusions

Expanding scope of innovation addressing both systemic and social perspectives is elementarily important for addressing global and local societal and environmental challenges. There are more and new kind of stakeholders involved in innovation activities. Socio-ecological and socio-technical perspectives provide good approach for collaboration towards desired future.

Further work is needed on understanding how these new institutions are managed and how they can successfully collaborate with more traditional institutions. Also the creation of sustainable financial models is an important theme for further studies. Next step will also include research on the creation of global community -based Hub network for entrepreneurs. More research activities, interviews and workshops will be conducted during spring 2012 together with selected Living Labs and other new institutions.

Other approaches to organizational design e.g. heterachy by Gunnar Hedlund, holographic organizations by Arthur Koestler, democratic organizations by Russ Ackoff, fractal organizations by Margaret Wheatley, living organizations by Rene Dubos and network organizations by Manuel Castels will be addressed to investigate this further.

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Janie Chroust, 2010

International Federation For Systems Research

"Systems and Science at Crossroads"

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SEA-Publications: SEA-SR-32

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Sept 2012

ISBN 978-3-902457-32-5

JOHANNES KEPLER
UNIVERSITY LINZ
Research and teaching network

Impressum

Schriftenreihe: SEA-Publications
of the Institute for Systems Engineering and Automation

J. Kepler University Linz

Systems for Education, Engineering,
Service and Sustainability -
Proceedings of the
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Printing sponsored by the
International Federation for Systems Research (IFSR)

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Printed:
WLK Druck, A-2340 Mödling, Austria
ISBN 978-3-902457-32-5
Institute for Systems Engineering and
Automation
www.sea.uni-linz.ac.at
(version 1.01)