DIGITAL TRANSFORMATION CHANGES THE STSD FOUNDATION
Towards SMART ORGANIZATION DESIGN

1. A New Value Proposition – SmarT Organization Design

Our heritage was born out of *foresight* about the technological imperative (as its effects were just starting to show in the early 1950s), highlighting that we are at the *crossroads of social evolution* as we face a new environmental context of turbulence. Now, the "digital era" underscores how we are at a defining moment in our world that depends on the wisdom, and effects, of human choices we make. This is our CALL-TO-ACTION - to generate a new value proposition from our heritage - so we may take impactful action with others to shape a better world.

Fortunately, Emery and Trist left us a philosophical guide to help us 'see' a **new way to adapt** through ***systemic learning*** **that is adaptive** versus simply *coping* with change, which is maladaptive. Furthermore, Emery and Trist clarified that maladaptation takes two forms – (1) active (command-and-control) and (2) passive (laissez-faire), both of which undermine human thriving. Adaptation in our hyper-connected, time-compressed world requires insight that can support systemic processes and structures of social learning and co-creation.

This adaptive (eco) systemic learning is based upon a backbone of interactions—a common substructure—underlying all adaptive organizations and ecological networks, namely, **THREE PERSPECTIVES** or lenses that filter through billions of pieces of data so participants can see whole system choices about **IDENTITY**, about framing of challenges and opportunities for **VALUE CREATION**, and about organically emergent designs to enhance **ECOSYSTEMS**. The complexity of this whole system choice-making is facilitated today by digital technology and data that open up new opportunities to create evidence for, raise awareness of, and engage people with the three critical information-processing perspectives (socio-ecological, socio-technical systems, and socio-psychological).

What enables a whole transformational learning experience and helps people transition from one perspective to another is an integral system **PARTICIPATIVE DESIGN** process. The process is dynamic and able to shift as people decide how to transform and adapt in a continuously changing environment. The goal is not to design only one intervention in one perspective, but to design a flow of worthwhile interventions woven into a meaningful and uplifting organizational design journey.

Our value proposition for STS design reinvented in the 21st century – what we call **SmarT Organization Design** – is to share this information processing backbone of three perspectives and its integral system participative design process so that through action research we may learn from a community of practice what tools and methodologies can make adaptive design effective.

The urgency of this renewed conceptual foundation for organization design is driven by the speed and complexity of change in our everyday lives. We as social human beings are in a race to catch up with the third phase of a digital revolution that we must shape and incorporate institutionally in ways that the new technologies can positively impact us as individuals, organizations, and societies.

2. The Nature of Change – From Linear to Exponential Adaptation

Our society has a pattern of adapting to change with human-made laws, regulations, customs and arrangements that govern what should and should not occur in society – what we call *institutional logics* – in a slow, episodic linear way. From our very early history on the planet, social change wasn't evident because it occurred over a period of five hundred to a thousand years. Then, with the Industrial Revolution, the pace of change accelerated to fifty to one hundred years and so within a lifetime, major transformations became evident and we experienced it as a revolution because we were now living in ways we never had before.

For most of the twentieth century, with increasing innovation, we have lived a trajectory of about thirty years to go from an initial discovery in the lab to a significant economic impact in the real world. Every technology followed a similar linear path of discovery, engineering and transformation because true transformation takes more than a single technology. First, people need to perceive change and adjust their habits and then secondary innovations need to come into play. When companies first try to explore the potential of new technology, they tend to think within current frameworks, but often miss its deep implications. They start using new technology to improve what they already do before realizing that they must question what they do in the first place. They assume a linear pace of change, concluding with a new steady state rather than continuous and accelerating change.

For electricity, factories needed to be redesigned and work itself had to be reimagined to leverage the flexibility that the new technology offered, and only then did it begin to have a real economic impact. Then household appliances, radio communications and other things changed life as we knew it, but that took another few decades. Automobiles, a concurrent innovation with its own impacts on social life (e.g. changing shopping from corner stores to superstores and shopping malls), improved the economics of manufacturing further by allowing mobility of factories to where labor and land were cheaper, but not before it too saw a similar evolution from initial product to infrastructure, such as roads and gas stations. This transformation didn't fix what was broken in the current system and didn't improve what was disliked about current products or services, rather it reimagined the system and its products and services. It wasn't any particular invention that made the difference, but an ecosystem that built up over years. As Robert Gordon explains in *The Rise and Fall of American Growth*, these changes resulted in a 50-year boom in productivity between 1920 and 1970. (Princeton University Press;1st Edition, Princeton, 2016).

This is the nature of **exponential change – transformation at the whole (eco) system level – of institutional logics, organizational design/culture and individual/group behaviors all at the same time, not linearly**. There is 'alchemy' when these three levels of *social engagement* reinforce each other; it is a continuous cycle or spiral that continues upward as long as there is *stabilizing scaffolding (e.g. new institutional logics, organization designs and new behaviors/culture)* to hold the gains along the way. These three aspects of exponential change mirror our information-processing backbone of three perspectives whose purpose is to reveal the underlying operating assumptions and interaction dynamics that limit the rates of both technical and social change to co-evolve. For example, one big rate limiter is the operating assumption that one must conceal problems for fear of being blamed. However, a new operating assumption has evolved from the digital revolution – *fail*

fast, fail often – that has shifted culture to support shared learning and continuous (often disruptive) innovation that is vital to keep pace with exponential change.

Digital technology has truly become transformative because everything and everyone is in a constant state of change with fundamental shifts happening every five to ten years, clearly an order of magnitude greater than what we experienced during most of the twentieth century. And this pace of change is not abating but accelerating with some sectors experiencing dramatic shifts in months, not years. But our institutions are not evolving their 'institutional logic', our organizations are not evolving their designs, nor are individuals/groups changing their behaviors at this same pace; in fact, they have become maladaptive – either rigid and controlling to maintain the old social order or passively reacting in idiosyncratic ways when forced to change that can result in harmful consequences for all others in the ecosystem. We believe our heritage of information-processing backbone of three perspectives and integral system participative design process can help people guide exponential change to develop effective organizations and **collaborative ecosystems** with the humanistic values we espouse.

3. The Digital Revolution

The digital revolution, which started in the 1960-70s, is complex. There are several frameworks that describe this "revolution" including the three-phase evolution from digitization, then digitalization, and finally digital transformation (Govers & vanAmelsvoort, 2019). Another three-phase model alerts us to both the opportunities and the societal challenges that this technology will generate (Gershenfeld et al, Designing Reality – How to Survive and Thrive in the 3rd Digital Revolution, Basic Books, NY, 2017). The first phase is currently a way of life; the second we are beginning to experience in its full impact; while the third is still nascent. Each phase comes more quickly and with broader impact than the one before, demonstrating exponential change in action.

The first phase is about COMMUNICATION – the Internet makes connection possible anywhere, anytime. While at first seemingly empowering and convenient, it has also resulted in some of the social issues we confront today where technology is being used to drive polarization, amplify racial bias, increase inequality, even distort our democracy, yet at the same time, it is evolving new collaborative socio-economic relationships such as the 'sharing economy'.

The second phase is about COMPUTATION – super-powerful computers making data a new resource for value creation and data-driven digital technologies becoming the mainstay of everything an organization does. This is radically changing the nature of work (e.g. gig work and job displacement) and life (e.g. SMART phone and digital apps of all kinds to simply life) AND fundamentally the economy itself, changing it into an open and robust marketplace of platforms, which are the 'vehicles for discovery, sharing, buying and selling digital fabrication designs, products and services'. For example, Apple is known for its products of computers and Smartphones, but its most valuable and fastest-growing assets are its app store marketplace and distribution platform. This change is also raising ethical issues of who will shape the ecosystems operated by these platforms as we realize that the organizations that control the primary platforms, like Google and Amazon, are shaping culture through the values built into their algorithmic and curatorial processes. The

paradoxes mount, while society's institutions that normally govern how we respond to these paradoxes weaken, increasing the turbulence of the environment.

Having not yet fully resolved how we will deal with the issues arising from the first and second phases of the digital revolution, we are thrust into the third phase – FABRICATION – which is built on the shaky foundation of the first two phases. It is the next innovation phase built through ecosystems. In the context of exponential change, the future will always surprise us because it is not any one great event or particular invention that tips the scales to a new way of being in the world, but some hardly noticeable connection that completes the ecosystem network. Greg Satell in Mapping Innovation says, "Network scientists call this type of thing an *instantaneous phase transition* and there's really no way to predict exactly when it will happen, but we can learn to look for telltale signs." Our information-processing backbone of three perspectives can act as an early warning system so that we can prototype work system, organization and ecosystem designs that co-evolve with the new technologies. (Satell, Greg Mapping Innovation: A Playbook for Navigating a Disruptive Age, McGraw-Hill Education, NY, 2017)

FABRICATION can only succeed with social and technical co-evolution. The current operating assumption, called the *technological imperative,* believes that technology can fix all problems so technology innovation proliferates unabated today. And as Alvin Toffler so aptly pointed out in Future Shock, "future shock is the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time." The signs of this are visible in our society today, yet we need all members of society to feel they are stakeholders in helping to shape how these technologies can positively impact themselves, their families and communities – social change succeeds better when the beneficiaries become key drivers of the desired change. This is the premise that underlies our "*integral participative design process*".

The two drivers – social and technical – of FABRICATION that need to coevolve are:
First, democratization of Innovation where users of products and services – both firms and individual consumers – are increasingly able to innovate for themselves. We see examples of this developing as SMART social entities – Smart factories, Smart Cities – who envision becoming a fully realized digital socio-technical interoperable ecosystem of machines and human partners. "Users that innovate can develop exactly what they want, rather than relying on manufacturers to act as their (often very imperfect) agents. Moreover, individual users do not have to develop everything they need on their own: they can benefit from innovations developed and freely shared by others, using the sharing economy base already in place. User-centered innovation processes are very different from the traditional, manufacturer-centric model, in which products and services are developed by manufacturers in a closed way, with the manufacturers using patents, copyrights, and other protections to prevent imitators from free riding on their innovation investments. In the manufacturer-centric model, a user's only role is to have needs, which manufacturers then identify and fill by designing and producing new products. This traditional model does fit some fields and conditions. However, a growing body of empirical work shows that users are the first to develop many and perhaps most new industrial and consumer products. Further, there is good reason to believe that the importance of product and service development by users is increasing over time". (Eric von Hippel in Democratizing Innovation, MIT Press, Boston, 2005)

The second drive is: Using computing to drive advancement in the physical rather than the virtual world, in fields, such as genomics, nanotechnology and robotics, to spur innovation in industries like energy, manufacturing and medicine. Satell says that new inventions, such as quantum computing, neuromorphic chips, synthetic biology and advancements in materials science already exist. We are learning to manipulate individual atoms and molecules as well as to work with massive amounts of data and create machines that can do jobs previously thought to be uniquely human. As we have learned, it is not those inventions, but the ecosystems they spawn that will shape the decades to come.

"For the first two phases of the digital revolution, speed and agility were the key attributes. Techniques like rapid prototyping and iteration greatly accelerated development, and often improved quality, because we understood the underlying technologies very well. Yet with the nascent technologies that are emerging now, that is often not the case. You can't rapidly prototype a quantum computer, a cure for cancer or an undiscovered material. Furthermore, there are serious ethical issues surrounding technologies like genomics and artificial intelligence. For this new era of innovation, LEARNING through exploration and discovery will once again become prominent." (Satell, 2017)

This is a social challenge we have just begun to realize – how to manage the paradox of social order and social innovation. How do diverse stakeholders (both individuals and organizations) operate in a collaborative ecosystem where no one person or organization is in charge? This requires a learning process of constant balancing and iteration of the paradox so that ecosystem participants can advance their shared and separate interests and futures. It is a new form of governance where decision-making and coordination capabilities are collectively agreed to while maintaining for every node (individual, team, organization, network) within the ecosystem its distributed and independent nature.

This is the design challenge for us as organization designers in the digital era of exponential change. As van Amelsvoort and Hootegem have asserted. "ICT systems profoundly determine organizational design choices" (2017:295). And, to help us analyze and understand (work) systems under these different circumstances, "we need new concepts and theories" and specifically, it is "necessary to reinvent an STS position to address contemporary and future organizational realities" (Claussen et al.,"Socio-Technics and beyond", 2019).

4. A Renewed Foundation for STS Design in the Digital Era

"SmarT Organization Design" (STS Design in the 21st century) relies upon a renewed conceptual foundation or steppingstones that put us on a new path for addressing "humanity's techno-social dilemma", described by Frischmann & Selinger in *Re-engineering Humanity* as an imbalance with the 'techno' being the dominant driver and the 'social' subservient to it.

Our "heritage" from Trist and Emery opened up such a path (in a 3-volume Tavistock Anthology called "The Social Engagement of Social Science"), which rallied the social sciences to engage in a normative approach (action research/participative design) with the pioneers of the digital technology revolution, versus just observing and addressing its impacts after the fact. Trist and

Emery understood the transformative power of "tools" (physical and conceptual) to shape human behavior as they witnessed how the Industrial Revolution's Taylorism, embedded with capitalism, became the basic philosophy that continues today to support the techno-social engineering of humans. As early as 1976, the Emerys foresaw "the growing alliance between telecommunications and computers would increasingly form networks in which the collective information and processing capabilities will be available to all users…We took the view that we were probably already into our future; but in such a small way that it was not easily recognized….the new technology would allow for the spontaneous generation of content itself, which would make providers and users one and the same" (Fred Emery & Merrelyn Emery, *A Choice of Futures*, Martinus Nijhoff Social Sciences Division, 1976). Eric Trist wrote similarly: "The oncoming information technologies, especially those concerned with the microprocessor and telecommunication, give immense scope for solving many current problems – if the right value choices can be made" (Trist, 1981).

Their followers, whether practitioners or theorists, did not anticipate or grasp the complexity of the challenges accelerating technologies/exponential change posed, nor the importance of proactively shaping them. Now the challenge of co-evolving social and technical systems at all levels – macro, meso, micro – in the 3rd digital revolution is much more complex because technology innovation is so far ahead of social innovation. We are still living with "Taylorism" now in the form of data-driven efficiency management that has rapidly spread from the workplace to nearly every environment within which we develop and live our lives. Furthermore, the ways that techno-social engineering can mold our beliefs, preferences and even values is subtle (buried in the black box of algorithms and curated processes) and goes unnoticed, and unchallenged, by most citizens because we willingly accept the ease and convenience that comes from minimal thinking. This form of Taylorism and greed capitalism is of great concern because it is more insidiousness than the early Taylorism thinking of humans as objects. The algorithms and curated offerings based on our personal data is being used to manipulate our agency through addictiveness to these apps both as consumers and in the workplace. This makes us the agents of our own repression and maladaptation. We need to understand how to use technology – not to exploit people – but instead to develop and nurture people for greater contribution.

Now SMART environments are poised to significantly exacerbate this minimal thinking and interaction through increasingly seamless technical interconnection and integration of consumer and workplace experiences. The normative agenda of optimal efficiency, productivity and 'cheap pleasure' of convenience and ease will evolve through this increasingly tighter woven techno-social fabric of secondary digital innovations in every ecosystem.

Our heritage is in opposition to a view of human beings as fully predictable and programmable people who perform rather than thrive. Immanuel Kant best expressed the universal truth we hold – *all human beings are worthy of respect and deserve to never be treated exclusively as a means to an end*.

The intent of "Smart Organization Design" is to change the path by empowering every entity (in the collaborative ecosystem to be designed) with understanding about why and how this is happening in their system so they may collectively transform their humanity to be adaptive – one ecosystem at a time – until we become an adaptive world. The Gershenfelds, in *Designing Reality*, call this propagating emerging communities of individuals and organizations with purposeful agency and

vision to effectively leverage, adapt and extend the digital platforms, tools and practices being created in the digital era with this ideal.

It is because we have evolved to the point where we can shape ourselves and our society with these new tools that we now must address philosophical questions such as:

- *How should we exercise such power?*
- *Who should decide?*
- *What about us should we sustain and cultivate?*
- *What should we let go to machines?*
- *Who should we aspire to be in this new digital era?*
- *How should we engineer ourselves, or not?*
- *What type of society should we build to allow everyone to thrive?*

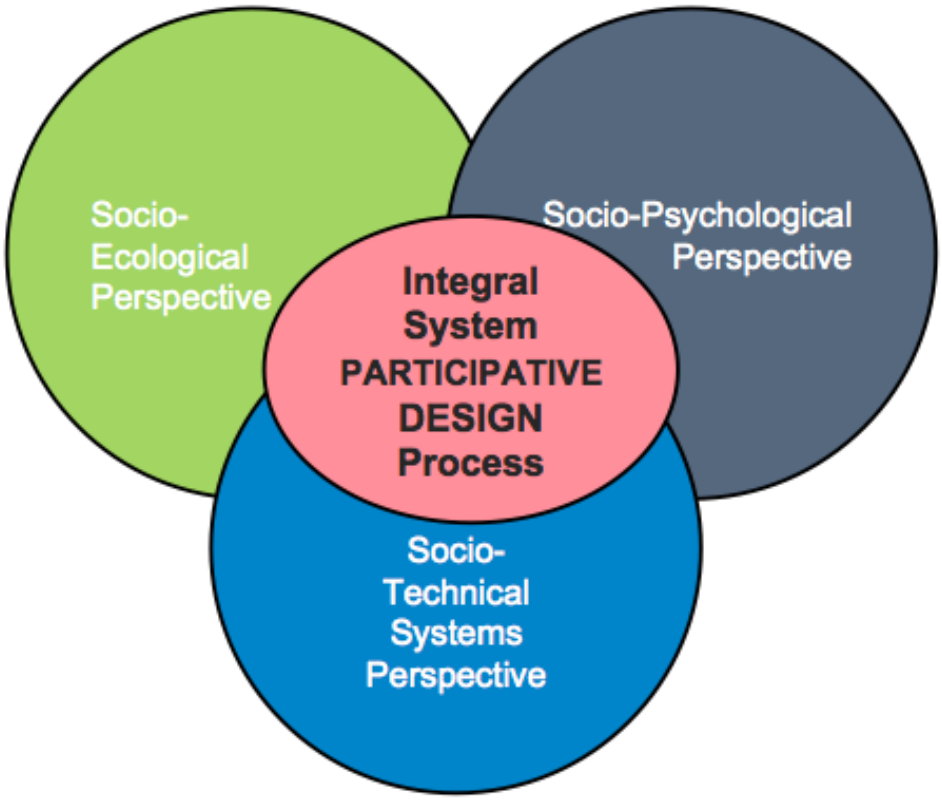
Our humanity is a set of ideals about who we are and aspire to be. Humanity that stems from the answers to these fundamental questions acts as both a normative concept, embedded in culture, institutions, infrastructure and environments we build and sustain AND a collectively produced and shared resource that we use everyday to act and make commitments.

Our renewed conceptual foundation is a guide to help us 'design' this humanistic co-evolutionary path with the following interconnected steppingstones:

A. 3-Perspective Information-processing Backbone

B. Integral System Participative Design Process

This path orients experienced and neophyte organization designers alike in profound thinking about, and translation of, the learning regarding what makes us human into testable hypotheses, questions and experimental objectives. The tools for doing this need to both align with the ideal while supporting the unique context being designed. Our hope is that we as organization designers will build a repository of such tools for everyone in our community to draw on.



A. 3-PERSPECTIVE INFORMATION-PROCESSING BACKBONE

Emery and Trist were prescient in understanding that rapidly evolving information systems would require a co-evolving social information processing construct and provided it to us in the form of the three perspectives – socio-ecological, socio-technical systems and socio-psychological. They foresaw that what separates contemporary society from previous societies is the digital nature of information that makes it more than a basic condition for economic and capital development, but rather the foundation of a new kind of society.

Originally, the perspectives were presented in the order of Emery and Trist's own learning, with socio-psychological being first as they realized how central GROUP RELATIONS were to the development of our humanity in the form of culture. This was followed by a novel perspective, socio-technical systems, about how ORGANIZING for value creation further enhanced or constrained our humanity. They concluded with the socio-ecological as they began to see the growing importance of inter-organizational relations and their inherent INSTITUTIONAL CONFLICTING LOGICS as the deepest structure that shaped our humanity. All three are necessary to effect transformation of our society, but today, it is the socio-ecological, with its concept of community of systems or collaborative ecosystem as an innovative social arrangement that is foundational to adaptive co-evolution.

In SmarT Organization Design, we start with the socio-ecological perspective to discover the "edges" Hagel described upon which to grow a new framework of institutional adaptive logic, then move to the socio-technical systems perspective to design this initial framework to create value in a mutually beneficial whole systems way and end with the socio-psychological perspective to support a thriving culture at the heart of the collaborative ecosystem – the ultimate test of transforming our humanity to be adaptive versus maladaptive.

The World of Knowledge Flows

John Hagel argues in The Big Shift that "we are shifting from a world where the key source of strategic advantage was in protecting and extracting value from a given set of knowledge stocks — the sum total of what we know at any point in time, which is now depreciating at an accelerating pace — into a world in which the focus of value creation is effective participation in knowledge flows, which are constantly being renewed. Finding ways to connect with people and institutions possessing new knowledge becomes increasingly important since there are far more smart people outside any one organization than inside. And in today's flat world, you can now access them all. Therefore, the more your company or country can connect with relevant and diverse sources to create new knowledge, the more it will thrive. And if you don't, others will. The future belongs to those who promote richer and ever more diverse knowledge flows and develop the institutions and practices required to harness them." (Hagel, John, (2009), *The Big Shift, Harvard Business Review, July-August).*

Emery and Trist understood the criticality of these knowledge flows and developed the ecosystem archetype to bound them and most importantly, the 3-Perspective information processing backbone, as the knowledge flows' central structure, containing the vital interactions underlying all adaptive organizations and ecological networks.

The World of Paradox

Knowledge flows depend on diverse sources to create new knowledge but in doing so they also give rise to a paradoxical organizational context of both stability and disruption that co-exist in a natural cycle of learning, "creativity and sense-making" (Claussen et al., 2019). One STSD theorist, Cal Pava, a student of Eric Trist called this learning the new nature of work – **nonlinear**– and described its new form as deliberations within networks of diverse participants (Pava, 1983). Pava recognized that with ever-growing interconnections and speed of interaction, there would be ever-greater polarization and that factions of every kind, such as professions, political interests, and organizational units, would find it progressively harder to cooperate. He predicted this would intensify maneuvering for exclusive gain wherever people had to adapt to change, but especially where the introduction of new technology would work against the degree of collaboration needed for innovation. (Austrom & Ordowich, 2018)

Charles Handy wrote in the Age of Paradox about the nature of some of these paradoxes, for example, "that technology has increased wealth and consumption among a few while reducing employment and incomes for many; opportunities for personal fulfillment are complicated by demands for ever-greater efficiency; and the new freedom to pursue more flexible lifestyles that account for our personal and professional lives only increases the inequities between the skilled or talented 'haves' and the less fortunate 'have-nots'. Handy saw the harmonizing of these paradoxes could only result through reconstituting in some way the social fabric of a 'village', with both independent and interdependent social entities and their richness of interactions — what Emery and Trist called the ecosystem archetype in which the rich interactions are the information processing of these three perspectives.

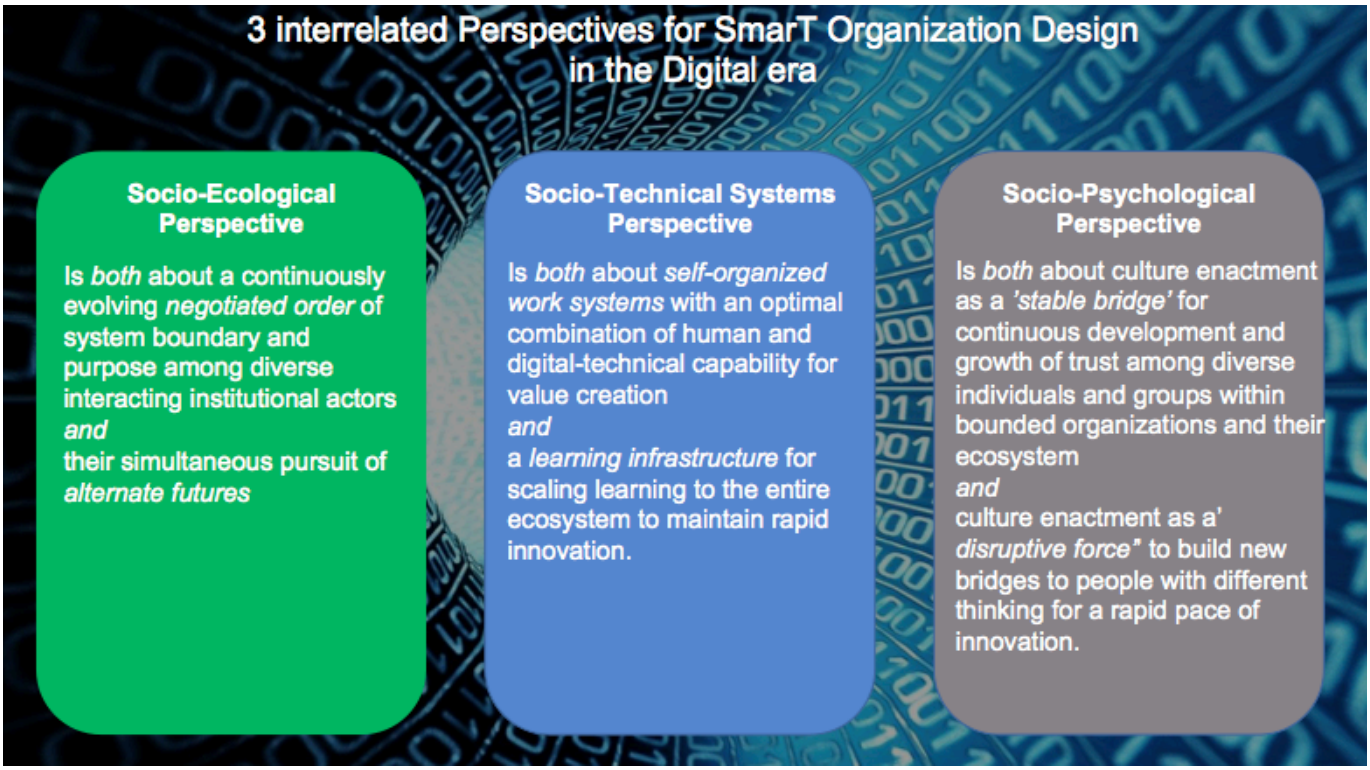
The maladaptive pattern is to stay in the vicious circle of programming and vulnerability that the techno-social engineering is constantly driving towards. The more programming is involved, the more vulnerable a system becomes, which then needs and justifies increased programming. The adaptive pattern is to grow the richness of diverse interactions as Handy, Pava and Emery and Trist suggest into a virtuous cycle of repeated discoveries, collective learning and greater impacts for the good of humanity – a never-ending cycle of hope and imagination.

The Value of the 3-Perspective Information-Processing Backbone

Our PERSPECTIVES give clarity to proactively designing a world together that shapes our shared future. Emergence teaches us that observation is neither passive nor neutral – every living creature sees the world through its own lenses and creates from that lens the future that it feels is right. The first two digital revolutions provided us with powerful data-driven technologies to exponentially improve our insight.

Now, the third digital revolution is showing us how reality is a consensual construct in which we are all entangled in the whole process of creating space, time, matter, and energy in a constantly changing context. Furthermore, we need to design this reality to be BOTH resilient to all kinds of attacks and failures while at the same time being agile – fast and lean – to respond quickly to both. The exponential change paradigm shift is from predict-and-control to sense-and-respond. Our perspectives are the information-processing backbone for designing the 'sense-and-respond' mechanisms so that each social entity – at micro/meso/macro levels– can design its own fit for its context in an integrated way.

Each of the three perspectives describes the overarching dilemma of social innovation and social order in terms of a paradox within a particular lens – socio-ecological, socio-technical systems, socio-psychological – that makes resolution possibilities easier to see, integrate and act on quickly.



Understanding the Perspectives for SmarT Organization Design

1. The Socio-Ecological Perspective for the Digital Era

The Socio-Ecological Perspective is BOTH about a continuously evolving NEGOTIATED ORDER of system boundary and purpose among diverse interacting institutional actors, AND their simultaneous pursuit of ALTERNATE FUTURES.

The meaning of this perspective has shifted FROM being "static context" or "monolithic macro environment" for a bounded organization TO a multi-organizational complex system (of systems), an ecosystem in continuous evolution. Moreover, the work system(s) of individual bounded organizations now extend into the expanse of the ecosystem and cross the boundaries of multiple individual organizations and consist of all levels of social entities – gig workers, project teams, and whole organizations and subunits of them – all networked in a rich, dense pattern of interaction to create value together (Winby & Mohrman, 2018). Indeed, modern ICT have greatly increased the flow of 'resources' among these social entities (Winter et al., 2014).

Thus, the socio-ecological perspective provides dual insight into both the transactional relationship(s) between each bounded organization and its environment, as well as the relationships and flow of 'resources' among a set of organizational entities that together we now describe as a whole complex system. The system purpose and boundary become transformative through continuous deliberation of the deep operating assumptions (institutional logics) by a fluid set of coalitions/networks with short time spans – course correcting in real time.

Ecosystems are the new societal arrangement (or the new 'field of organizing') for dealing with exponential change. These complex systems can be adaptive or maladaptive, but they are always made up of interconnected, autonomous entities, acting and reacting to one another, without centralized control. In the context of exponential change, nothing in an ecosystem is predictable and knowledge itself is redefined as multiple truths as the system cannot be described from only one perspective. Constant change means no one person or entity can understand everything or fully know anything, thus requiring the participation of all viewpoints for effective implementation of any innovation.

Based on insights from this socio-ecological perspective, Emery and Trist anticipated ways to develop and co-creatively design an adaptive form of these complex systems. They left us with what might be described as the key design parameters for collaborative ecosystems:

- systemic processes and structures of social learning and co-creation (of artefacts and meaning);
- semi-stable network configuration of stakeholders;
- stakeholder commitments to mutually beneficial, pragmatic social innovation initiatives;
- socio-economically/politically viable relationships.

The first prototypes of this design approach were the Emerys' Search Conference & Participative Design Workshop, and Trist's organizational ecology domain concept (Eric Trist, "A concept of organizational ecology." *Australian journal of management* 2.2 (1977): 161-175. p. 161; abstract). These prototypes offered a new adaptive way to anticipate technological progress and mitigate its social repercussions by balancing stability and continuity (social order) with unprecedented foresight and agility (social innovation). The complexity of actually executing this design has been the challenge until the digital revolution itself evolved the concept of ecosystem enabled by new digital technologies and an economic prototype called platform. The digital platform created the socio-technical-economic viability that has allowed the ecosystem concept to develop and become a new institutional and organizational arrangement, albeit one that many are still struggling to understand and adapt to today.

NEGOTIATED ORDER

The negotiated order of an ecosystem is the pattern of activities that emerges over time as an outcome of the interplay of the variety of interests, understandings, reactions, and initiatives of the individuals and groups involved in the ecosystem. The sociotechnical ecosystems that stakeholders must analyze, understand, and improve are often partially designed and partially evolved. This requires stakeholders to grapple with system complexity that they only partly understand, and interpret emergent behavior that was not anticipated. The function and structure of such systems is viewpoint dependent—in other words, two stakeholders might each view the function and structure of the system from different points of view. The viewpoint that stakeholders adopt can be determined by where they draw the **system boundary**, what entities they attend to within and beyond that boundary, the details they perceive in those entities and the scales that they are considering (e.g., timescales as well as spatial scales). The stakeholders' viewpoint depends on a range of different factors, including their domain knowledge and their roles and responsibilities with respect to the system.

Both defining a system boundary and defining a system purpose are important because the former broadly frames the problem and the latter points to the types of social and technical subsystems a stakeholder has in his or her view. It is only by making these factors explicit that we can understand how stakeholders perceive ecosystem adaptive capacity or the ability to evolve multiple futures. There is a tension among stakeholders between some using higher level "dreams" or aspirations to define system boundary and purpose and others who are more concerned with the delivery of pragmatic technical solutions so they define boundary and purpose more narrowly. This is why the ecosystem is a negotiated order. During the lifetime of an ecosystem, its purpose and boundary will evolve and deliberations will be needed to bridge the different viewpoints as a continual process as new realities emerge.

ALTERNATE FUTURES

New realities will emerge partly because individual entities within the ecosystem will continue to pursue—in addition to the negotiated order--individually specific futures that will often be divergent from the specific aspirations of other entities within the system. Also, advances in technology are playing a big role in bringing "institutional logics" or the context of the ecosystem to life through access to real-time data, customer feedback, and customer/partner/stakeholder interactions.

Organizations could afford to ignore this 'ecosystem context' in a world of standardized products and services because understanding and adapting to unique contexts wasn't part of how they created value. Today, demand is both more specific to the individual and evolving more rapidly, making context more central to value creation. Thus, all members of the ecosystem can use their enhanced digital ability to reimagine institutional logics (i.e. assumptions, values, beliefs, and rules considered appropriate within a particular realm of social life) to develop new relationship architectures in the ecosystem that will expand knowledge flows and the realm of what is possible.

We need to imagine various futures, both good and bad, and utilize socially progressive and ecological visions as ethical and institutional maps, to guide us in the constitution of a future mutually beneficent to all in the ecosystem. The philosophy and values of our heritage do not espouse any single inevitable destiny for people. Rather it promotes agency, the notion that individuals, communities, or organizations, can by using their foresight, creativity and decision-making powers, select from many different paths and possibilities to reach the life they want for themselves collectively. It requires a new paradigm for planning – collaborative and anticipatory – versus standard forecasts and trend analyses based on history. Alternate futures require imagination to create potential environments in which participants have to operate and what they need to do in the present to realize those environments. There is an innate tension between present actions and future benefits.

2. The Socio-Technical Systems Perspective for the Digital Era

***The Socio-Technical Systems Perspective is BOTH about SELF-ORGANIZED WORK SYSTEMS with an optimal combination of human and digital-technical capability for value creation AND a LEARNING INFRASTRUCTURE for scaling learning to the entire ecosystem to maintain rapid innovation*.**

This perspective is about recognizing the archetypes of organizing that are different for stable and turbulent environments. For a stable environment, in which industrial-era organizations were formed the design is role-centered, closed, slow-and-tight, hierarchical, and backward-focused. In a turbulent environment, like our current 'digital-era', a new socio-economic-technical form is emerging that embeds organizations in collaborative ecosystems that are human-centered, open, fast-and-loose, heterarchical, and forward-focused. Using the knowledge gained about its environment from its socio-ecological perspective and negotiated as a purpose and system boundary, the work of value creation can now be self-organized within those affordances.

We are still focused on 'structures' and 'processes' for value creation but the meaning of 'structure' and of 'process' has changed significantly. "Structures" are now very fluid, temporary, metamorphic networks of interaction. In what Pava referred to as a "reticular organization", increasingly "transient decision networks" of interdependent parties in "discretionary coalitions" are formed to do the work of resolving problematic issues required to move "non-routine" knowledge work forward to value creation (Pava, 1983). Tasks are continually changing, defined roles may be non-existent, and relationships among people are less hierarchical and more peer-to-peer. Overall, "the transforming nature of digital technologies…has "blurring" effects on system and work relations…[and] differentiation between executive and regulation tasks performed by man and machine becomes more fluid" (Govers & van Amelsvoort, 2019).

At the 'micro' level of organization in the digital age, the socio-technical relationship has been joined by the cyber-physical relationship, or what may be called the digital-technical relation. Information from the physical world is captured and creates a digital record that is shared with information from other sources and machines, allowing for advanced analytics, to which algorithms and human decisions can be applied and translated into a new series of movements in the physical world.

Indeed, the meaning of the "technology" concept has changed in the digital age. Technology is still all about the artifacts that humans invent and deploy to meet our needs, but significantly different types of technology co-exist in most modern organizations. Historically, there has been physical "hardware" often arranged in the form of "long-linked technology" in manufacturing processes or routine office work (Thompson, 1967). This physical hardware is governed by the laws of nature; one implication is that this physical structure must eventually break down. However, there is now also what has been referred to as "intensive technology", "information processing technology", "cognitive technology" or software and information systems. By comparison to physical structures, the structure of data in information systems is not governed by the laws of nature but rather by logic (Berniker, 2016). Another distinction is that historically, work has been done *with* physical tools and technology, whereas "we now work more *in* digital technology"(Govers & van Amelsvoort, 2019).

The relationship between humans and technology in the digital form is changing, from one of complementarity to 'symbiosis'— a much more "entangled" relationship (Kramer, 2019)-- where the human is embodied or amplified by the machine, while the machine is trained and sustained by humans (Daugherty & Wilson, 2018).

An optimal combination of human and digital-technical capabilities is based on both art and science. The science is based on an understanding of the distinctive contributions primarily made by human activity, on the one hand, and machine activity, on the other hand. The art in combining human and machine capabilities is in weaving together the support that humans can provide to machines, on the one hand, and the ways that technology can augment humans, on the other hand (Jesuthasan & Boudreau, 2018). Finally, "because the technology used to perform work will constantly evolve, the idea of joint optimization between social and technical systems will require continuous change and adjustment, rather than designing a social system around a fixed technology" (Pasmore et al., 2019).

We are also in a new 3rd wave of business "processes", moving from standardized processes and automated processes to adaptive processes based upon real-time data. Adaptive processes enable a heightened emphasis on continuous "learning" organizationally and individually, as value creation has shifted from an emphasis on predictable, repetitive production to creative and entrepreneurial activities.

Also, now there are "two kinds of designing" required in a hyper-speed world – (a) responding immediately with innovative products and services to meet customer need and (b) learning from all those responses how to adapt the sociotechnical system infrastructure (deep structure or institutional logics) to be more effective in its immediate responses.

A structural necessity for a highly creative and collaborative organizational design is to allow a very high degree of autonomy to subsystems and to tolerate wide difference of viewpoint. Contributors to value creation need to be free to move in and out as needed to innovate in specific areas but within a coherent purpose. Every ecosystem needs governance to create clarity in the ecosystem as the foundation for coherent action, but this coherence needs to happen, not through control but through learning together. The paradox is that the greater the 'alignment' created through a learning infrastructure, the more autonomy that can be granted to self-organized work systems.

SELF-ORGANIZED WORK SYSTEMS

In times of exponential change and particularly in the age of digital revolution, new arrangements and ways of working emerge that are better suited to value creation that relies upon rapid problem-solving and innovation. We believe the new arrangement is increasingly self-organized work systems.

An individual owns the design of their own work. In a world powered by AI, they bid for what they want to work on, and come together to work in diverse project teams. Up pops a hand as someone has the energy to lead this piece of work, no bosses in sight. A backlog is created, and people get to work on stuff that brings them alive and utilizes all their skills, not limited to a job description. What gets done is more important than who does it. When the team disbands, a period of reflection ensues; lessons from mistakes, including new skills and experiences, are carried forward. This is a

workspace where people are always evolving, always learning and it happens with variety and collaboration in abundant supply and demand.

Nevertheless, tension underlies a culture built on group creativeness because subject matter experts can feel undervalued and undermined even though their collaboration is essential for interdisciplinary work to succeed. The temptation is to resort to a renewed emphasis on individual talent. However, more and more it is being recognized that high performance comes from frontline self-organizing work systems (not individuals or departmental groups), comprised of people from different kinds of skills and experience sets that can maximize "collective intelligence". According to Tom Malone, the key is an understanding of the *conditions* for collective "intelligence" (versus the collective "stupidity" of group-think), as well as an appreciation of the new power of people and computers thinking together (Malone, 2018).

These new dynamic socio-technical arrangements are becoming pre-eminent in operations, still co-existing, however, with transformed and leaner hierarchies that are the backdrop for the total organization, providing support, coherence and governance.

LEARNING INFRASTRUCTURE

If an organization is to remain an open system in its environment, it has to maintain an open democratic system of learning within itself by maintaining a constant look at its own infrastructure – deep structure of values, principles and assumptions interwoven into a philosophy and methodology of organizing – because in a turbulent environment, fresh appreciations have to be made frequently and conflicts worked through openly and regularly.

Moreover, in an age of exponential change, what will make the organization or enterprise thrive tomorrow is most often very different from what makes it succeed today.

Therefore, the infrastructure must provide a foundation for "learning". A learning infrastructure enables an organization to remain "vital", preserving the capacity for growth and renewal, risk-taking and disruptive innovation. Although in the short-term, organizations can create value by optimizing processes and assets, new growth has become essential for "sustained value creation". Survival depends upon a will to "self-disrupt before being disrupted" (Reeves et al., 2018).

The key building blocks of a "learning" infrastructure in a "vital" organization are:

- a continuously developing portfolio of future growth options—"a pipeline of potential bets";
- strategic thinking that includes "exploration" and a long-term orientation—allocating sufficient resources to effectively place "bets" on the future; and,
- a willingness and ability to develop, recruit, and incorporate adaptive, agile, and diverse capabilities in people and technology—taking a risk on new talent and leading edge technology.

Nevertheless, vitality is itself not sufficient for an organization to thrive and grow sustainably. The organization must also embrace the paradox of "ambidexterity"—the need to optimize present

performance while developing disruptive potential and vitality for longer-term growth. Ambidexterity is difficult for any organization to execute well. However, a self-organized work structure provides flexibility and openness that can help organizations manage and incorporate these dual approaches of optimization and exploration, tailoring solutions to specific situations.

Social systems must propagate learning to match the exponential growth possible with technological systems, inspiring the work system and ecosystem contributors to observe, experiment and **learn individually, but most importantly, collectively**. The best way to do this is to facilitate informal ties through networks, optimizing organizational platforms for connection. And today's dynamic business environment requires a different kind of learning through synthesis not just analysis in a psychologically safe culture that help us see through the fog of complexity and constant distractions.

The learning infrastructure fuses the distinction between strategy (long-term) and operational tactics (short-term) by utilizing rapidly evolving technology to 'scale learning' to generate richer innovations more quickly in many aspects, including products, services, business models, and management systems. Hagel says that 'scalable efficiency' has been a winning model for the past two centuries with strategy done through centralized governing systems, rigid hierarchies, and a paradigm of long-term planning and forecasting. While effective in times of stability and predictability, these systems are massively inefficient during times of uncertainty and change. Today, competitive advantage is based on having access to flows of knowledge to enable up-to-date information to flow rapidly to self-organized work systems — "creation spaces" that help facilitate (rather than limit) interactions and relationships, allowing all ecosystem entities to learn and adapt.

3. The Socio-Psychological Perspective in the Digital Era

The Socio-Psychological Perspective is BOTH about culture enactment as a 'STABLE BRIDGE' for continuous development and growth of trust among diverse individuals and groups within bounded organizations and their ecosystem AND culture enactment as a 'DISRUPTIVE FORCE' to build new bridges to people with different thinking for a rapid pace of innovation.

The huge changes in technology and the economy that are driving changes in the values of people have not yet been mirrored by a corresponding change in business culture. Professor John Van Maanen at the MIT Sloan School sees culture as a problem-solving conversation created by humanity to solve its common problems. Culture is a shared, systemic-level deliberation about how to stick to our principles in the face of constant change. It is not a conversation that happens once and is finished, but instead is a constant striving by the leadership of all ecosystem members to continually and sustainably evolve that conversation into accountability for a new way of being or identity.

A central meaning of this perspective is still "culture" but now it pertains to both the bounded organization AND the larger ecosystem. Values are still central to "culture", but the importance of purpose, passion, and "ideal-seeking" has increased. This is a development consistent with the foresight of Trist (1979) who anticipated that "we are entering the Age of the Person" when under Type IV environment conditions, (s)he will become "the agent of change...rather than any institution

or system". Indeed, culture has become a more significant coordination mechanism for both the bounded organization of value creation and the ecosystem. The stability and strength of the culture has become more important as the severity of turbulence has been accentuated to a point where adaptive capacity can be overwhelmed.

Culture has never been monolithic, but now the culture of organizations and ecosystems must promote diversity to increase experimentation and innovation for greater viability. "Diversity of views and experiences of an organization is an essential step in the direction of reflective practice and organizational learning" (Greenwood, 1991). Furthermore, drawing on Pava's understanding of non-routine knowledge work and non-linear conversion processes, individual professionals cannot come together as a team in the classical form of a semi-autonomous work group—"they are too specialized to be able to substitute for one another and too individualized to have an interest in substituting for one another" (Claussen et al., 2019).

Furthermore, the relevant nature of 'leadership' as the carrier and transmitter of culture has also changed, with an emphasis on "cultivation" vs. "command-and-control", engaging people in the continual reinvention of work (Malone, 2004). Edgar Schein whose influential model of organizational culture originated in the 1980's contends that a new leadership model is required to contend with today's exponentially increasing task complexity—"leadership in this environment is categorically humbling because it is virtually impossible for an individual to accumulate enough knowledge to figure out all of the answers…humility in the face of complexity has become a critical survival skill" (Schein, 2018).

Organizational ambidexterity requires the organization to use both exploration and exploitation techniques to be successful and this duality may be the bridge between the two cultures of stability and disruptiveness. A culture that promotes an agile mind, a lifetime love of learning, a capacity for positive adaptation through adversity, self-understanding and awareness, and an ability to connect with others will help individuals to manage the inherent tension in organizational ambidexterity.

Also, design thinking is a bridge as it relies on the human ability to be intuitive, to recognize patterns, and to construct ideas that are emotionally meaningful as well as functional. The elements of design thinking combine to form an iterative approach—one you can try out and adapt to suit your needs.

Digital workplace values are also a bridge between stability and disruption. These are:

1. **Autonomy** – allow people high levels of discretion to do what needs to be done rather than relying on formally structured coordination and policies.

2. **Speed** – move fast and iterate rather than waiting to have all the answers before acting.

3. **Impact/Action Bias** – transform the way the world works through constant innovation.

4. **Openness** – engage broadly with diverse sources of information and insight. Share advice and information openly rather than keeping knowledge to oneself. Moving from thinking primarily about resources inside to those outside organizational boundaries.

5. **Enabling Interactions** – who to choose, initial connection conditions, and managing dynamic interaction are keys to successful interactions

6. **Collective Learning** – using collaborative platforms to learn together and use collective influence to trigger significant changes across an ecosystem; the more this learning spreads, it becomes the new institutional logic.

CULTURE AS A STABLE BRIDGE

Moving ideas is critical to succeeding in a turbulent environment so this requires design to manage, monitor, nurture and encourage informal relationships with deep attention to hidden linkages. Today this can be revealed digitally through social network analysis for organizations. The new leadership imperative is not only to motivate employees, but also to foster the ties that bind them. While individuals can form loosely connected small groups, they can rarely form a shared purpose by themselves. So, the function of leadership now is less to plan and direct action than it is to empower and inspire belief. Culture now extends beyond a single organization to all those who contribute to the ecosystem.

CULTURE AS A DISRUPTIVE FORCE

Greg Satell in his book, Mapping Innovation: A Playbook for Navigating a Disruptive Age, describes the need for culture as a disruptive force. He says when people work together for the first time, everything is a bit chaotic and it's hard to collaborate effectively. However, when people work together too much, group think sets in and innovation stops. Connections between people don't occur naturally anymore, inner "cliques" form that alienate newcomers and information flow tends to get stuck in pockets. In general, as networks age, clusters tend to turn in on themselves and are less likely to make bridges to other clusters. This has negative implications for the diversity of knowledge and the likelihood of new combinations of knowledge that produce breakthrough products or services. In network terms, when clusters lose the critical links between them, small worlds are replaced by industrial islands**.** Closed clusters have a high level of knowledge homogeneity and this can develop into the 'not invented here' syndrome. This makes people within the cluster less likely to look outside the group that they know and will also make them be less attractive to outsiders. Consequently, this has implications for the long-term competitiveness of firms in these networks and for the health of the ecosystem itself. Sustaining the small world to encourage diversity and novel combinations of knowledge means creating the conditions for bridging the clusters. It's not a case of more connections are better; the focus needs to be on the bridges that optimize organizational platforms for connection such as training programs, communities of practice, and forced rotation as well as leadership nurturance such as mentoring and coaching.

B. INTEGRAL SYSTEM PARTICIPATIVE DESIGN PROCESS

Integral System

Design is critical to socio-technical co-evolution because it's the process that brings us as close to the edge as possible of where technology meets society. It is on those edges that we regenerate our humanity, not at the core of the system where the old operating assumptions are fiercely protected. Our job as organization designers is to inspire the world to tackle their operational challenges as 'system problems', not to just think about the short term of immediate customer satisfaction, but to think about the future world they want to create with the ever unfolding technologies. The total system explores how to articulate each constituent's beliefs and riskiest assumptions, and then designs experiments that help the community learn together what to put into practice. This makes strategy and operations much more tightly connected and thus argues for full participation of the system.

Tim Brown, CEO of IDEO, says that everything we design has to be a learning system; it just can't be an artifact. And all the technology today – sensors, smart software, machine learning, etc.– makes it possible to learn what's happening with designs, how people are behaving with them and what the effects on the total system are. Furthermore, the insights we glean from data analytics can become powerful learning that is applied to the design iteratively to create larger and larger system impacts and result in whole system transformation. Indeed, the process is no longer about "design"—it is about "designing"!

Nonlinear Design Process

Cal Pava understood emergence and exponential change was best described by a **nonlinear design process** where designing is comprised of *deliberations that identify the most critical interactions for an organization's viability*. Complexity theory tells us that the initial conditions set the dynamics for further evolution of interactions. Pava determined the ***initial conditions for interactions***.

His 'operating model' included relevance of topics, diversity of participants, forums of interaction (person-to-person, group-to-group, person-to-machine, machine-to-machine) and systemic information sources. He translated the structure of the organization into semi-stable social arrangements like *coalitions, temporary alliances or networks between diverse people around a particular purpose.* However, just bringing diverse people and multiple disciplines together isn't sufficient; how the invitation is issued, the quality of the welcome, the topics raised, the questioning style, the physical space all influence whether the collective becomes dysfunctional or if it forms rich diverse partnerships.

For Pava, deliberation is a manifestation of a deeper structure of dilemmas in which unseen feedback loops create unexpected consequences that deliberation resolution brings to the surface and makes visible so choices can be made that are equal, inclusive and sustainable solutions for all in the coalition at the time. Pava's design framework further strengthens the participative design process in the digital age as design now entails resolving the dilemmas raised by the philosophical questions listed above. "Pava reinforced the importance of the design process…[with] a whole new approach to nurturing holistic job design" (Haga, 2019).

Participative Design

Design must be participative because "*to design is to be shaped by the context of the system you are designing even as you are shaping it*". This is the principle of compatibility of design process with the design outcome of agency. Design must also be participative in order to enable the deep collaboration of disciplines and interests that is necessitated by our world's dynamic complexity. Deep collaboration must extend beyond interacting only with those whom one knows and trusts—otherwise, the same old groupings will provide the same old solutions and miss the unforeseen connections and possibilities for innovation.

John Kao (2002) says that in a world of complexity and constant change, "design is the ability to move from the existing to the preferred". Indeed, as organization designers, we have moved from a focus on existing problems to a search for desired futures. "Design thinking", Roger Martin (2009) says, has become a vital new discipline that is inherently participative as it matches "people's needs with what is technologically feasible and with what a viable business strategy can convert into customer value and market opportunities". Design thinking doesn't just search for an immediate solution; it first determines the real underlying needs, through empathy and participative inquiry with many others in the system. Then, the process stops to consider a wider range of potential solutions contributed from a diverse set of sources before converging upon one or more design proposals or prototypes that are tested, again participatively, with the whole community of stakeholders. Prototypes leverage feedback and new inputs, and may then move forward into execution, albeit *without attachment*, knowing that one day soon the prototype will inevitably have to change (D. de Guerre et al., 2012).

Therefore, our principle of incompletion that once said the consequences of design will generate the need for redesign can now be thought of as a commitment to ongoing discovery and experimentation – a continual search for how to address the system challenge more effectively with greater impact for all in the system and the world.

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