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Research Article

Theorizing Participatory Control Systems: an organizational control concept for enabling and guiding adaptivity in complex situations

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Abstract

This paper presents a theoretical framework for a new concept of organizational control, that stimulates organizational change and adaptation. It introduces Participatory Control Systems (PCS) as a distinct type of control based on the complex adaptive system literature. These control systems are fundamentally different from the traditional notion of (management) control. Building on the notion of complex systems and the concept of social learning, PCS increase organizational adaptivity by enabling and facilitating social learning processes that may emerge to transformational change over time. To illustrate the PCS concept in practice, three examples are given in this paper. Moreover, some key implications for internal auditors and suggestions for future research are provided.

Practical relevance

Contemporary internal control instruments and frameworks are based on a paradigm that is increasingly ill-suited for the main challenges that organizations face in the 21st Century. As a result, there is a strong need for new theories, mental models, tools, and frameworks to help internal auditors and others involved in issues of control and governance. In this paper, we provide a new, yet robustly theorized concept that provides in this need.

Keywords

Control systems, complex adaptive systems, transformation, social learning, internal audit

1. Introduction

In a world that we call Volatile, Uncertain, Complex, and Ambiguous (VUCA) (Schoemaker et al. 2018), climate change, rapid developments in technology, rising inequality, geopolitical tension, and political schism demand that organisations adapt to remain relevant. This means that Internal Audit also needs to adjust its capabilities, methodologies, and ways of working. Internal Audit often applies concepts developed within the management control systems (MCS) literature. Simons' (1995) four levers of control are a core concept herein. One of the four levers is the interactive control systems (ICS). Although this is a useful lever, pointing at the question 'is an organisation doing the right things' and thereby adhering to strategic uncertainties, this lever is poorly developed. Moreover, the MCS paradigm makes it inadequate in a VUCA world as we will argue in this paper.

Our claim is that Participatory Control Systems (PCS) are needed to help overcome these shortcomings. These PCS enable continuous learning in organisations and although this sounds all too familiar, the application is in its infancy. This paper elaborates on the outline of such systems and thereby offers another perspective on organisational control. It might help further the longevity of organisations because traditional MCS do not enable adaptivity sufficiently.

In this paper we present a new theoretical framework for control systems that will allow adaptivity and innovation. This framework uses ideas from Complex Adaptive

Systems (CAS), social (learning)system theory, strategic management, and behavioural theory of the firm. It will provide Internal Audit practitioners with new ideas for the way they look at their organisation.

This paper is structured as follows. First, since PCS is built on a different paradigm, we explain why organizational adaptation and innovation is not well addressed by management control. Second, we elaborate on the lens we applied for conceptualizing PCS, which embodies a view on the organization as a complex system of learning systems. Third, we introduce the basic concept of PCS. Fourth, we provide three different practical examples of PCS to illustrate its range in application. Fifth, we briefly discuss possible implications for internal audit. Sixth, we provide several suggestions for future research. Lastly, we end with a concluding remark.

2. Why adaptation and innovation are not an issue of management control

2.1. The problem with the traditional notion of control

The notion of a VUCA world requires concepts of corporate governance, enterprise risk management and management control that explicitly consider the complex and unpredictable nature of the social and organizational domain. Merchant and Van der Stede (2017, p. 15) have defined being in-control as a state in which "management can be reasonable confident that no major unpleasant surprises will occur". It suggests that management is capable of objectively and unambiguously understanding its environment in terms of both current and future conditions, as well as the implications of the actions it undertakes. It can be argued that such a state of control cannot objectively exist at all. Moreover, the behavioural theory of the firm argues that organizational power is known to be a bottleneck in developing 'adaptive intelligence' (Cyert and March 1963). Levinthal and March (1993) reason that organizational power typically stems from past success and, as such, organizations tend to keep doing what they have always done.

Traditional MCS instruments primarily seek to implement predefined strategies effectively, efficiently, and predictively (Merchant and Van der Stede 2017). Complex systems are unpredictable on the long term, but can very well prove to be relatively predictable on the short term (Axelrod and Cohen 2000). As such, traditional MCS instruments such as diagnostic control systems and boundary systems stimulate a type of learning that often provides positive returns on the short run (Kloot 1997; Martyn et al. 2016). However, in order to adapt and survive on the long run, organizations need to innovate and transform themselves effectively which requires paradigm-shifting or generative learning (Argyris and Schon 1996; Cuppen et al. 2021; Hartog and Paape 2020; Kloot 1997; Senge 2006). Due to wicked planning crises (Rittel and Webber 1973), increasing societal complexity, increasing pace of disruption and deeper levels of uncertainty, the balance between both types of learning must (and will inevitably) shift from a focus on short-term performance to ongoing transformation and adaptation. Societal demands are also increasing as shown by the annual Edelman Trust Barometer (2022). New regulations like the Corporate Sustainability Reporting Directive by the EU and the newly installed International Sustainability Standards Board will also require organisations to adapt significantly.

2.2. Interactive control systems to pursue transformative adaptation?

One of the most influential constructs of MCS that addresses the need for transformational change and innovation, is the construct of interactive control systems (ICS) (Koekoek and Corbey 2017). This distinct type of MCS is part of Simons' levers-of-control framework (Simons 1995) and is extensively studied in the context of crisis or disruptive competition (Martyn et al. 2016). ICSs have originally been defined as "formal information systems managers use to involve themselves regularly and personally in the decision activities of subordinates" (Simons 1995, p. 95). ICSs have a prominent place in empirical studies, mostly due to the ample empirical evidence for the existence of this type of MCS and its unique conceptual relationship with strategic change and innovation (Bisbe et al. 2019; Kruis et al. 2016; Martyn et al. 2016; Simons 1995; Widener 2007). However, the construct is also criticized for being insufficiently conceptualized which has resulted in fragmentation and vagueness about its nature and constitutive properties (Bisbe et al. 2007; Johnstone 2019; Lindsay 2018; Tessier and Otley 2012), as well as ambiguity about the relationship with organizational learning (Cuganesan and Donovan 2011; Koekoek and Corbey 2017; Widener 2007). For example, ICSs are control systems often used by managers in settings of strategic uncertainty (Bedford 2015; Martyn et al. 2016; Simons 1995), however how those systems effectively deal with deep uncertainties that arise from complex problems is unclear (Arjaliès and Mundy 2013; Pondeville et al. 2013). We concur with this criticism and provide three interdependent issues with the ICS construct from a complex systems perspective.

First, it can be argued that a root-cause for this problem is that the traditional notion of management and internal control are 'thing'-based and largely neglect the 'flow'-based nature of relational sense-making (Merchant and Otley 2020). ICSs supposedly drive organizational renewal and adaptation, as managers allocate attention to strategic uncertainties as if uncertainty manifests itself unambiguously as an explicit and objective 'thing' at some point in time. However, CAS literature argues that such knowledge doesn't present itself irrefutably but rather is being constructed in an active, complex and responsive process of relating (Stacey 2001). Moreover, the complex and chaotic nature of information processing is largely ignored in concepts of organizational, internal and management control. The notion of management control involves that once, in this case, strategic uncertainties have revealed themselves to managers, managers use ICS to address these uncertainties. This oversimplified and linear cause-and-effect relationship ignores the complex and chaotic reality of sense-making in organizations.

A second shortcoming from a complex systems view is the conceptual negligence of the notion of emergence in the MCS literature. A common property for all CAS is that, if such systems manage to successfully adapt and transform themselves, this happens by means of self-organized emergence. Emergence refers to a process of adaptation by which "at some time the architecture of information processing has changed in such a way that a distinct and more powerful level of intrinsic computation has appeared that was not present in earlier conditions" (Crutchfield 1994, p. 9). This is a process of self-organization in the sense that such new and emergent structures cannot be implemented but are spontaneously (not to be confused with serendipitously) generated over time by the system. In other words, transformational change is an aggregated outcome at some point in time, that results from a sense-making process that takes place at the individual level and for which the 'outcomes' have a meaning at the system level (Cilliers 1998). With regards to ICSs, how this process takes place and how ICSs exactly intervene in this process, is largely unknown (Lindsay 2018).

A third problem with ICS theory and research is that it disregards the fact that organizations are path-dependent, meaning that a company is unable to capture a new market and produce new products fast enough. In this regard, Lindsay (2018) argues that the ICS construct is insufficient in explaining and describing how ICSs overcome cultural lock-in, how path-dependence influences decision-making processes, and the precise roles played by senior management in this regard. At a more fundamental level, the notion of path-dependence implies that enabling the system to transform and adapt sufficiently, requires a timely and constructive processing of disruptive signals to respond effectively. Moreover, the notion of MCS and the inability for employees to activate such systems is problematic from this perspective, since such disruptive signals typically arise locally or peripherally (Arjaliès and Mundy 2013; Johnstone 2018).

2.3. What's next?

The key issue concerns what people in the organisation do to make sense of signals of disruption and how they explore new ideas to find out whether and how to develop them into innovations. Ashby's (1968) law of requisite variety implies that the extent to which a system can adapt itself effectively to its changing environment is critically dependent on the number of states (the variety) that system can attain. Translating this law to the social domain, Page (2007, 2017) demonstrates how cognitive diversity generally increases a group's ability to develop innovations, to predict accurately, and to identify, select and solve problems effectively. Utilizing the cognitive capacity of the entire organization and the ability for all people to communicate novelties effectively, essentially provides the organization with a larger adaptive capacity compared to when this is up to management to identify, select and communicate. Any notion of control in this regard should primarily involve employees, since they are in closer contact with customers, suppliers, processes etc. and therefore likely to be earlier exposed to signals of disruption and opportunity.

Moreover, social systems- and CAS theory states that a system's degree of freedom and adaptivity is related to the degree of integration in that system. Loosely coupled systems have a larger range of possible states and therefore a large adaptive capacity than tightly coupled systems (Luhmann 2013/2002, 2018/1978) and are better capable to effectively respond to disruptions (Boulding 1956). By taking this perspective, we enter a largely novel territory in the MCS literature that involves the complex and social system domain and embodies processes of social learning in the organization. Social learning has a profound place in the literature involving complex situations of transformational change and decision-making under deep uncertainty, and mainly stems from the (semi-) public domain (Boyd et al. 2011; Boyd and Richerson 2010; Cuppen et al. 2021; Marchau et al. 2019; Ostrom 1990; Pahl-Wostl et al. 2007; Snowden 2002; Steyaert and Jiggins 2007). Although the private, business context differs from the public sector, the basic concept of social learning systems applies here as well.

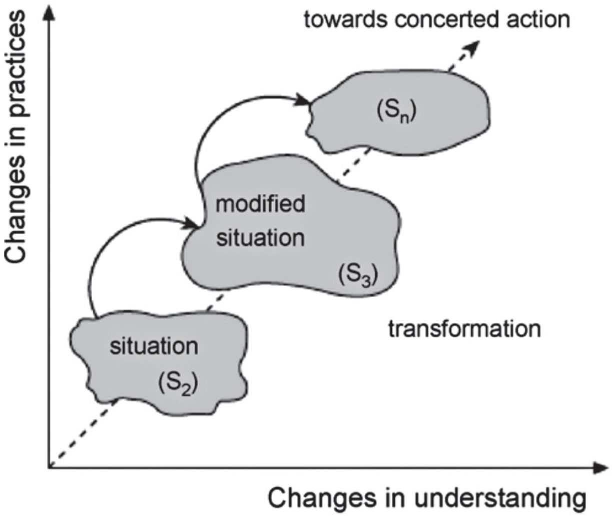
3. The organization as a complex system of social learning systems

3.1. Definition and properties of a social learning system

In this paper, we take a system-of-systems view of the organization (Ackoff 1971; Bourne et al. 2018). More precisely, we build on a theory of social learning in the organization in which the organization and its environment are considered to be systems of interrelated social learning systems (Wenger 2010). Social learning is a dynamic, complex process of developing knowledge that has meaning for people. It is a combination of personal experience and social standards of competence, both of which are distinct elements that are in interplay with each other (Wenger 2000). These social standards of competence are developed and maintained in social and cognitive 'containers', which are being referred to as social learning systems (Wenger 2000). Social learning systems have a shared cognitive repertoire that consists of language, artifacts, routines, models, frameworks, tools, stories, beliefs etc. Social learning systems serve to develop practices and competencies, and they serve to develop and exchange knowledge. Examples of which are departments, product teams, professional communities, and supply-chain members.

As a flip side of their identity, social learning systems consist of boundaries (Luhmann 2013/2002). Wenger (2000) asserts that for learning, these boundaries play a crucial role. He argues that within a learning system, learning takes place in a converging way for a community to exist. However, across the boundaries of a learning system, repertoire and understanding tends to diverge since they are exposed to other learning systems. As such, opportunities for transformative learning arise upon so-called 'boundary interactions' (Argyris and Schon 1996; Senge 2006; Wenger 2000). Another necessary condition for such learning to take place is the existence of some overlap between different learning systems, i.e., the existence of some common understanding. This overlap can take many forms and is usually referred to as boundary objects which serve to enable and facilitate dialogue across different learning systems (Cuppen et al. 2021). Examples of boundary objects range from jargon language to documents, models and processes (Wenger 2000).

Figure 1. Social learning as a relational process of constructing understanding and practice (source: Steyaert and Jiggins 2007).



3.2. The concept of social learning

Figure 1 shows the basic concept of social learning in complex situations over time and is based on Steyaert and Jiggins's (2007) synthesis of social learning informed governance approaches in complex situations of transformation. Social learning takes place around a complex issue which could represent both a problem as well as an opportunity. The essence is that the development of problem solutions and/or innovations happens in an active collaboration across various, stakeholding learning systems. These learning systems bring experience as well as competence which helps to frame and define a problem, identify potential solutions, and collectively develop innovations. This way, issue experiences are confronted with various forms of knowledge. Such a confrontation has the purpose of changing people's understanding of the issue domain and their relationship to that issue. This is reflected in the horizontal axis of Figure 1 and represents one aspect of social learning. The other aspect is reflected on the vertical axis and represents a change in cognitive repertoire and practices. Such a change may involve a co-created change in heuristic knowledge, tools, models, strategies, tactical approaches, know-how, technical skills etc. (Muro and Jeffrey 2008; Page 2017).

The effectiveness of social learning processes depends on several factors. Derived from Steyaert and Jiggins (2007) and Wenger (2000), we identify five factors: participation, facilitation, social capital, ecological constraints and institutional frameworks.

Participation can be both intra- and interorganizational. Steyaert and Jiggins (2007) show that due to participation, people's interests and social positions towards the issue evolve over time and that new stakeholders dynamically emerge as well. As such, they provide evidence that active participation and concerted action in social learning processes can result in a paradigm shifts by the people involved, also referred to as double-loop, triple-loop, transformational or generative learning (Argyris and Schon 1996; Muro and Jeffrey 2008; Senge 2006; Tosey et al. 2012). In turn, such paradigm shifts have the potential for diffusing over to other learning systems to which these people belong as well and in which these people participate.

Facilitation involves, according to Steyaert and Jiggins (2007, p. 580), a "combination of skills, activities and tools used to support and guide learning processes among multiple interdependent stakeholders [..], and is about the management of deliberative processes and social interactions that help the stakeholders involved to better understand 'what they are doing' (first order learning) and 'why they are doing what they do' (second order learning)." Examples of which range from qualitative and quantitative modelling techniques (Cuppen et al. 2021) to media technologies, metaphor exploration and performance arts (Steyaert and Jiggins 2007). Facilitation primarily serves to achieve understanding among participants involved and deals with the construction of boundary objects to facilitate boundary interaction (Cuppen et al. 2021).

Social capital involves various items that collectively create a notion of community. Examples of such items are trust building among the people involved and a cultural environment that provides safety to enable open, sincere, and respectful dialogues and discussions. Wenger (2000) highlights that social capital is also about how roles have been defined, which codes of behavior apply and which commitments have been negotiated. Furthermore, social capital involves the quality of the networks that the individual participants are part of. Wenger (2000) distinguishes between connectedness, e.g., the strength of the relationships that people have; expansiveness, e.g., the diversity in these relationships; and effectiveness, e.g., do people understand the big picture well enough to activate their relationships effectively?

Ecological constraints rely on the collective knowledge by the participants (and participatory learning systems) involved about the components, properties and processes of concerned ecosystems (Steyaert and Jiggins

2007). Typically, this knowledge is based on experiential interactions with these ecosystems and therefore limited by the parties involved. Thus, to concertedly enact ecosystems as part of collective sense-making, parties may face ecological constraints in the broadest sense. Bringing other parties to the table means bringing other experiences and practices to the table that may lift these constraints in some fashion. As such, changing social relationships changes understanding and social learning outcomes.

Lastly, Steyaert and Jiggins (2007) argue that institutional, organizational and regulatory policies and frameworks play a key role in shaping social learning processes. It provides norms, values, and boundaries for concerted action and, thus, social learning. For example, antitrust regulations that prohibit formation of cartels to fix prices are to prevent emergent changes that are considered to negatively impact society. In contrast, corporate governance frameworks that concern boardroom diversity is an example of a guidance policy to stimulate assertedly positive emergent learning outcomes.

4. The basic concept of Participatory Control Systems

4.1. Purpose and definition

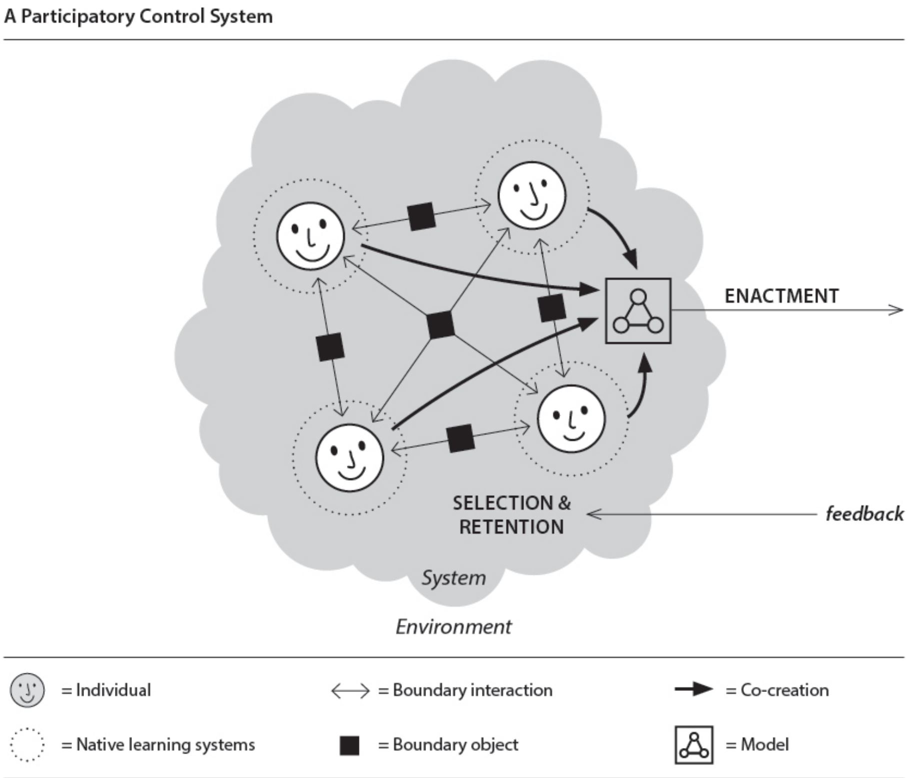
Snowden (2002) posits that the "nature of the complex domain is the management of patterns". He (2002, p. 107) argues that, while the nature of emerging transformational change is unpredictable, people can "break down existing patterns and create the conditions under which new patterns will emerge [..] by increasing information flow, variety and connectiveness." To this end, we introduce the basic concept of Participatory Control Systems (PCS) as a new form of organizational control to pursue emergent social learning and adaptation. We define PCS as interdisciplinary co-creating and sense-making systems to constructively process problems, ideas, and situations of high complexity. Its purpose is to enable and facilitate a process of social learning around issues of complexity and uncertainty that results in strategic innovation and organizational change.

4.2. Basic conceptual model

Figure 2 represents the basic conceptual model of a PCS. A PCS is an interdisciplinary learning system that spans and represents the domain of a complex situation, problem, or idea. The individuals in this learning system have a sense of community and common understanding that results from boundary processes (e.g., their interactions and boundary objects). The people involved in this PCS participate in a co-creation process that delivers one or more explicit models which serves as a representation of the complex issue in terms of the situation, problem, solution, or idea. As such, it is a boundary object as well.

This model is a formal system as articulated by Mikulecky (2001, p. 343): "If we call the world we are observing and/or trying to understand the *Natural System* and the events that make it change as we observe *causality*, then that represents our object of study. What we do in

Figure 2. A Participatory Control System.



our minds is to *encode* the natural system into another system that is of our making or choosing, which we can call a *formal system*." The nature of such models depends on their purpose and can be qualitative or quantitative. Their purpose may be descriptive, predictive, explanatory, exploratory, illustrative, or analogous (Edmonds et al. 2019). Examples of which range from flowcharts to business models, from product prototypes to process mining outcomes and from mission statements to agent-based models. In essence, these co-created models facilitate the development of knowledge by the learning system in the form of new practices and ideas. As such, it enables the learning system to respond to perceived disruptions to existing knowledge and understanding.

Next, these new ideas and practices are enacted by the learning system in the environment, for instance by means of experimentation. This allows the learning system to construct feedback and select which features and assumptions is considered plausible. Those features and assumptions that are retained in boundary processes and the modelling objects, altering both the identity and the co-creations of the learning system. In turn, through its actions, the learning system also perturbates other systems in its environment making. As such, the processes that form a PCS are ongoing and dynamic in the sense that participants may be added to or removed from the learning system, altering boundary processes and understanding of the complex situation. This ongoing process flow is visualized in Figure 3.

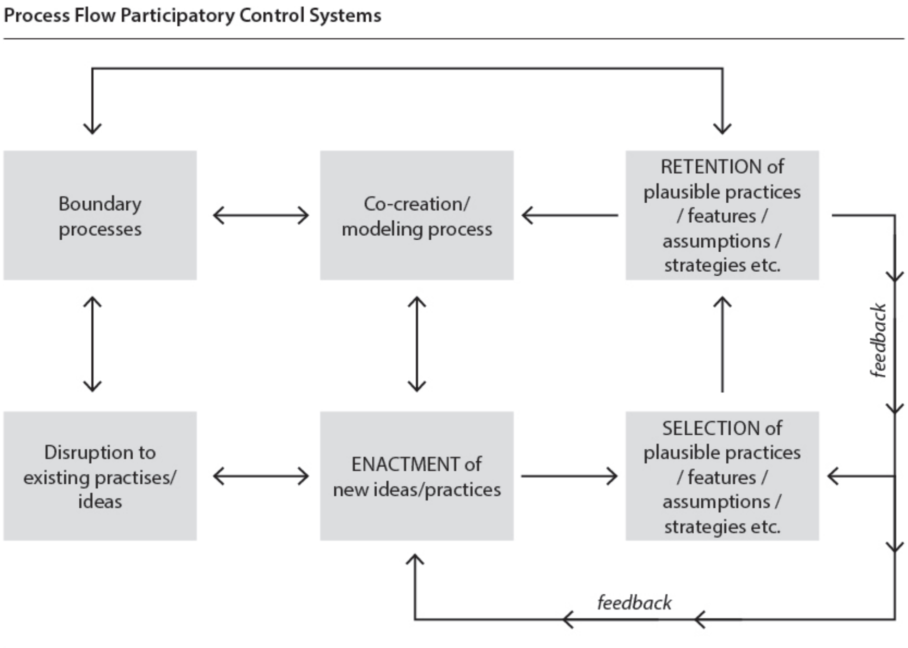
5. Three practical examples

In this paragraph, we provide three examples that serve to illustrate how PCSs work. These examples are based on the authors own practical and scientific experiences.

5.1. Assumption-based planning and analysis at Uber Technologies, Inc.

The first example deals with an assumption-based operational and financial planning and analysis approach applied at Uber Technologies, Inc. (Uber) during the period 2013–2016. This approach is also known as driver-based, collaborative, or extended planning and analysis. In the period 2013–2016 Uber rapidly launched in over 60 countries and nearly 500 cities across the world. Moreover, it explored and launched new services such as ridesharing and food delivery. Evidently, Uber faced enormous complexity and uncertainty resulting from e.g., regional, and local differences in competitive landscapes, legal and regulatory landscapes, rider and driver preferences, cultural habits, and safety considerations. A way for Uber to continuously learn and adapt from a financial, operational, and strategic perspective was by creating interdisciplinary learning systems centred around a co-constructed model that integrates operational, tactical and strategies assumptions with operational and financial outcomes. Basically, these learning systems were informal

Figure 3. Process flow PCS: based on Weick et al. (2005).



Moreover, upon positive feedback these features, and assumptions typically diffuse to other learning systems (Orton and Weick 1990). People belong to multiple learning systems and their experiential learnings therefore may diffuse across the systems to which they belong. As such, positive feedback as facilitated by PCSs may result in structural, emergent changes in practice and understanding.

teams that consisted of various domain specialists such as local business representatives, regional growth representatives, strategic planners, financial planners, and data analysts. Overall, several of such teams were created, all around a distinct domain (e.g., a specific market or a new business initiative). These teams were dynamic in the sense that the members were often changing, as well as the domain boundaries, depending on the issues at hand. The financial planning & analysis team were the ultimate owners of this planning approach and responsible for making sure all domains were sufficiently addressed from a corporate perspective.

On the one hand, the model serves as a boundary object in the sense that it facilitates constructive dialogues and planning processes across operational and financial domains. It helps local operational teams to understand how their operational assumptions result in expected operational and financial outcomes (or vice versa, trace back outcomes to underlying 'business drivers') and provides transparency about these assumptions to other internal stakeholders for the purpose of debate. On the other hand, the model is the outcome of a domain-spanning co-creation process:

- to develop a collective understanding about Uber's local business performance and local business environment, and
- to evolve its operational and tactical strategies based on that understanding.

The model facilitates ongoing learning as such, by continuously processing actual outcomes against expected outcomes and enabling the interdisciplinary domain-spanning participants to collectively make sense of its implications. For a broader theoretical background, we refer to Lempert (2019) and point out that the full concept of assumption-based planning (ABP) should be viewed in conjunction with robust decision-making approaches which embodies scenario discovery, sensitivity analysis, stress-testing and exploratory modelling, all for the purpose of continuous action-based learning.

5.2. Participatory modelling in energy infrastructures

Our second example involves social learning at the energy industry level and, as such, provides an example of an interorganizational PCS. A robust energy infrastructure (transport and distribution of electricity, natural gas, hydrogen, etc.) is an essential part of the transition to new and sustainable energy sources. Such an infrastructure should ensure the right type of energy is present at the right location, at the right time and that also allows for the required de-carbonization. Given that energy infrastructures are highly path-dependent and complex socio-technical systems composed of many different yet interdependent parties, these parties face the complex and uncertain challenge of fundamentally transforming the infrastructure, while maintaining an uninterrupted delivery of services.

The Windmaster (Wurth et al. 2019) and Gridmaster[1] projects are prime examples of transdisciplinary research in this context. They combine various research lines in a practical and actionable set of insights for practitioners. At their core are structured participatory sense making processes, allowing systematic collection and integration of knowledge of different stakeholders involved in a long-term infrastructure planning process. Via visioning, forecasting, and back casting methods, plausible scenario spaces are constructed which describe many plausible transition pathways for the future energy infrastructure. Multi-modelling methods allow stakeholder knowledge to be formalized in networks or interacting models that enable computing the performance of these integrated infrastructure systems under different scenarios.

In practice, these projects are having a profound impact on the ways how infrastructure providers approach their own work. Traditionally, two to four scenarios are selected from a two-by-two matrix, and individual models are constructed by infrastructure operators in isolation. If multiple models are used, the process is manual, and limited or no attention is paid to deep uncertainty aspects. In this case multi-models are applied to consider different infrastructure systems in concert, resulting in scenario spaces with more than 10^36 plausible pathways. Specific decision-making under deep uncertainty methods (Marchau et al. 2019) are being adopted in order to identify robust investment strategies. Traditional methods for creating optimal investments for a single predicted future are being replaced by notions of 'regret minimalization' through investments that can support a wide range of possible futures. This fundamentally changes the way how a future infrastructure will be developed, and the role infrastructure providers have in the energy transition.

Scientifically, these projects have pushed the boundaries of transdisciplinary knowledge through deep integration of participatory process design, modelling methodology, model analysis and collective sense-making process design. These different strands are not merely put together and applied at the same time but have been tightly integrated through the concept of a co-evolving boundary object ecology (Cuppen et al. 2021).

5.3. Hackathons

To illustrate that PCS may also consist of qualitative models, our third example is a hackathon. Hackathons are commonly practiced in the software development industry. They enable people to explore their potentially fruitful ideas together with people from other disciplines, which is typically required to develop an idea into a tangible innovation such as a new product feature. In this example, models of co-creation may range from flowcharts to create insight into technical or architectural interdependencies, to product prototypes (e.g., minimum viable products). These models help to develop understanding and practices within a participating hackathon team, but also helps to share this knowledge and innovative ideas in a more 'tangible' manner with others (i.e., across boundaries of other learning systems).

6. Possible implications for internal audit

First and foremost, the PCS concept provides a framework that can help internal auditors in understanding and evaluating how their organizations systematically pursue change and adaptation. For example, internal auditors should evaluate whether a sufficient and dynamic domain-spanning learning system is operating around an issue of complexity and uncertainty. By identifying boundary processes and boundary objects, internal auditors can judge whether a productive interdisciplinary understanding is being facilitated to enable social learning. Additionally, other aforementioned factors shaping social learning outcomes should be considered: participation, social capital, ecological constraints, and institutional frameworks.

Figure 4. Cynefin framework by David Snowden (2002).

Moreover, the internal auditor should pay attention to ensure the sense-making process of enactment, selection and retention is an ongoing process and not a one-off exercise. The frequency by which feedback is being measured, constructed, and debated could be a helpful indicator.

Secondly, we believe that the PCS concept helps internal auditors to understand the need for a different paradigm in complex environments. Although standards and objective norm setting – a prerequisite conform the standards of practice – are not really feasible, PCSs require a more comprehensive discussion with auditees to understand complexity and the need for adaptation and to come to grips with any situation. It will allow internal auditors to come to different conclusions that are more helpful for the long-term value creation of the organization and even its longevity. Furthermore, internal auditors tend to adhere to a more positivistic perspective based on an objectivist ontology. Words often used are objective, assurance, formal, documented, etc. This way of communicating fits nicely into the categories 'Clear' and 'Best Practice' of Snowden's (2002) Cynefin quadrant as shown in Figure 4 (Hartog and Paape 2020). However, this perspective does not align with how complex systems like organizations work. The uncertainties and dynamics that are inherent to the nature of complexity, require another approach, attitude and language of the internal auditor. Otherwise, it easily leads to miscommunication and frustration between auditee and auditor, all of which hampers social learning and adaptation. Acknowledging the different nature of complexity will not only foster a better understanding between auditee and auditor, but it might prevent auditors driving an organization into the abyss. As we have pointed out throughout this paper, a PCS particularly addresses the 'Complex' quadrant of the Cynefin model.

7. Further research opportunities

Our basic concept of PCSs as a way for organizations to systematically learn and adapt is based on practical experience and informed by a study to identify and select theoretical components from the CAS and social learning literature. As such, the PCS concept has a robust foundation, clearly more research is needed to understand PCSs to its full extent. For example, there is a need for more research to understand how PCSs originate and evolve over time. Moreover, we need to better understand how they can be activated by people in the organization and how they provide access to participants. To which extent do PCSs spontaneously emerge over time, and do they require a formal status in the organization to be effective? Empirical research is needed to understand the relationship between PCS, social learning, and adaption. Moreover, future research could focus on better understanding the relationship between PCSs and MCSs. In alignment with Burgelman's (2002) propositions, we expect that innovations emerge by means of PCSs and, at some point in time, may become part of an organization's official, intended strategy whereby its implementation is supported by MCSs rather than PCSs. Furthermore, more research is needed to understand the boundaries of PCSs. Following Snowden's (2002) Cynefin framework (Hartog and Paape 2020), we believe that it is doubtful that these control approaches work effectively in chaotic situations of high emergency despite that these contexts are also characterized by a VUCA nature.

For internal auditors to be able to identify and evaluate PCSs in their organization, more research is needed. In the Complex space of Figure 4, assessments in the traditional audit sense are rather useless. Research will be needed that focuses on the way an auditor could contribute on the way management deploys participatory ways of doing, aimed towards adaptation and innovation.

8. Concluding remark

There is still (a lot of) work in progress to develop the concept of PCSs. Nevertheless, we truly believe that the complex nature of organizations and their environments are not sufficiently addressed by current MCSs, potentially leading managers and internal auditors to take the wrong direction and diminish adaptivity and flexibility of their organizations. In turn, this will lead to shortening the organization's longevity, hampering long-term value creation and ultimately even bankruptcy. That doesn't need to be, if we extend our notion of control with the notion of complex systems and concepts such as PCS. Let us join efforts, both scientists and practitioners.

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Note

1. https://www.tudelft.nl/stories/articles/meer-grip-op-onvoorspelbare-energietransitie-met-gridmaster.

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