

Cyber-systemic thinking for a smart society

In a world of instant solutions, we feel sorry for not providing an easy fix for the world we are living in. In this special issue, we are trying to display some of the variety required to address the complex issues around us by connecting two complex topics: the social structures and processes and cyber-systemic thinking. The complexity and the dynamics of changes in our society are slowly being unravelled using systemic thinking, while cybernetics is used to design methods and toolsets for its sustainable management. Nevertheless, it goes far beyond that: it reveals the complexity of our existence in the Anthropocene and the need to understand the laws generating the societal dynamics to provide viable solutions for all subjects in our ecosystem.

Each paper in this special issue provides valuable insights in some of our society's biggest issues and proposes cyber-systemic methods to address them. More importantly, the selected papers vary considerably, and there is no evident "file rouge" among them at first sight. The variety of research topics, methods and level of abstraction try to mimic the complexity of the observed systems. However, it is important to find the connections between the various contributions, which rationalize the application of systems thinking at different levels. It is up to the reader to discover the multiple relations among the papers and find out that they all describe a larger system, where the partial solutions can and should be reused and combined to increase the level of our understanding and hence the ability to act appropriately. After reading the papers, you may get the notion of the requisite modelling complexity to understand the properties of a viable society and the need for variety of toolset to direct its dynamics.

1. The World Organization of Systems and Cybernetics 2017 congress

The special issue provides insights from the 2017 World Organization of Systems and Cybernetics (WOSC) congress, hosted by the Department of Management, Faculty of Economics, at Sapienza, University of Rome and organized by the Association for research on Viable Systems. At the WOSC 2017 congress, researchers, policymakers, professionals and students from all across the globe contributed to the debate around the rationales on the dynamics of contemporary societal issues from a cyber-systemic perspective.

In the special issue, a simplification of the complex network (more resembling a network of multi-layered communication flows) of discussions provided at the WOSC 2017 congress is presented. To provide an appropriate level of representation of such complexity, two layers of network grids are opened for the reader. At the first level, three topics are discussed.

1.1 People, technology and governance for sustainability

Human aspects of organizational systems, big data, smart technologies and governance in the Anthropocene (Ison and Shelley, 2016; Orecchini and Santiangeli, 2011) are elaborated with the aim of achieving smartness and sustainability. The complexity of human behaviour and its relations is re-examined using information technology (Barile *et al.*, 2014; Perko *et al.*, 2015; Polese *et al.*, 2017). The important aspect of such an analysis is to identify the drivers of all actors participating in the relations and to define new management methodologies that can encompass the complexity of the systems they manage (Gregory and Ronan, 2015).



1.2 Democracy, interactions and organization

To balance the institutional viewpoints on the social systems management, the democracy, interactions and organizations provide a bottom-up perspective (Espejo and Dominici, 2017). Bottom-up processes provide a new perspective of organizational systems, including non-directive approaches, to manage the complexity of social systems and the emergence of constraints in complex adaptive systems (Mazzega *et al.*, 2011). At the WOSC 2017 congress, the local-to-political multileveled decision-making process is elaborated, focussing on the communication and decision flows to align local and political needs and political processes (Saviano *et al.*, 2017). The self-organization, transparency and local influence in the global environment is at the hearth of the discussion (Mendiwelso-bendek, 2015). Focussing on the local perspective opens up to reflections about interactions, complexity management and constraints. Ethical issues that derive from the development of technologies in the world of e-government and law are also addressed.

1.3 Cyber-systemic thinking, modelling and epistemology

The systems thinking methodological and epistemological approach constitutes the third theme. The development of quantum modelling methodologies (Dubois, 2014), used to describe current social and environmental issues, such as social inequality, migration and climate change, predict future development and propose viable solutions, is essential (Schwaninger, 2015). Finally, at an epistemological level, discussions about reflexivity, the second- and third-order cybernetics, and conceptualization of context are proposed to bring together scientists from different countries and continents to challenge the traditional methods of cybernetics (Lepsky and Zadorozhnyuk, 2002; Umpleby, 2016; Rios, 2010) (Figure 1).

On the second level, a grid of multiple topics, focussed in direct interaction among the WOSC 2017 participants, emerges, which contains the following aspects:

- human aspects of managing systems;
- sustainability and the Anthropocene;
- smartness, Big Data and the brain of the future;
- democracy, transparency and social dynamics;
- interactions revolution;
- organization and knowledge;
- systems thinking and systems dynamics;
- quantum modelling; and
- reflexivity, second-order science and context.

At the WOSC 2017 congress, all such viewpoints connected to a multi-layered grid, not only providing single viewpoints but also bringing the peers at a higher meta-level of understanding the issues they are dealing with. The increase in understanding of the systems thinking and cybernetics toolset, the social and environmental implications and the redefinition of the research concepts has profound effects on the congress participants, and we think that this contributed to making better changes in the environment.

The debates on multiple perspectives, conducted at the WOSC 2017, are heavily reflected inside the papers presented in this special issue, as we can, in fact, witness a significant increase in the variety of ideas and a systemic thought on their implications. The reviewers and the authors admirably played their job in the process, identifying, communicating and formulating the systems thinking perspectives in each of the presented papers.



2 Selected papers

A connection between the types of scientific rationality (classical, non-classical and post-non-classical) and the stages of the development cybernetics is provided. Classical rationality can be related with first-order cybernetics dealing with observed systems (an external observer). Non-classical rationality is elaborated by second-order cybernetics dealing with observing systems (built-in observer). The newly elaborated post-non-classical rationality should be addressed with the third-order cybernetics dealing with self-developing reflexive-active environment (distributed observer).

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tools. We can expect that third-order cybernetics will promote development of civil society and provide new tools for designing the direct democracy. The provided initial theoretical conceptualization invites researchers and practitioners for a broader assessment and case studies.

In “Theoretical notes regarding the practical application of Stafford Beer’s Viable System Model”, Markus Orenko provides theoretical notes regarding the practical application of Stafford Beer’s viable system model (VSM). He attempts to capture current difficulties with the practical application of the VSM and provides six suggestions towards a more effective application of the model. He argues that a smaller number of better-trained VSM experts support a larger number of managers with a more generic know-how. On the other hand, he suggests that a more focussed but broader application of the VSM may lead to better societal organizations and therefore to a more efficient effective solution of societal problems. As a contrast to other attempts, which either simplify the VSM or extend it into a comprehensive methodology, a suggestion is made to focus on the very abstract topic of judging variety balances and, at the same time, to better connect the model with the suite of established methods and tools in management.

In its awarded contribution, Andrei Khrennikov elaborates on the “Social laser model: from colour revolutions to Brexit and election of Donald Trump”. The author develops the assumptions for creation of social lasers and attract attention to the problem of modelling of stimulated amplification of social actions (SASA). The model of SASA and its analysis are based on the mathematical formalism of quantum thermodynamics and field theory. The connection between laser and social systems in identifying the conditions in which the system can store social energy and the consequences of its sudden release is elaborated. The presented social laser model can be used to clarify these complex socio-political events and even predict their possibility. SASA, based on the social energy, is a powerful source of social instability. Understanding its informational structure and origin may help to stabilize the modern society.

German-Lenin Dugarte-Peña, Maria-Isabel Sanchez-Segura, Fuensanta Medina-Dominguez and Cynthia García de Jesús in the paper “System dynamics and agent-based modelling to represent intangible process assets characterization” address the use of modelling and simulation tools for enhancing intangible process assets management by simulating and automating their characterization depending on the quality and impact on organizational business objectives. They offer a solution for effective strategic decision-making and for leveraging prospective views based on the specification of the organization’s knowledge. Decision makers in knowledge-intensive organizations will be able to use very promising low-cost simulation-based tools to create practical scenarios and potential situations that generate inputs for debate and decision-making by senior and middle management.

Francesco Galofaro, Zeno Toffano and Bich-Liên Doan propose “A quantum-based semiotic model for textual semantics”. They provide a semiotic interpretation of the role played by of entanglement in quantum-based models aimed to information retrieval and suggest possible improvements. These models are capable of retrieving documents relevant to a query composed of a keyword and its acceptance expressed by a given context. Quantum approaches imply a particular point of view on meaning. Meaning is not a real, positive quality of a given word. It is a net of relations constructed in the text, whose value is progressively determined during the reading process. Furthermore, reading is not a neutral operation: to read is to determine meaning. A quantum point of view on meaning has deep semiotic implications on language knowledge. Semantics is not deterministic, as the text regulates the meaning of its lexical units. The adoption of quantum formalism seems in line

with cybernetic framework, involving a probabilistic point of view on meaning aimed to critically discuss the human-machine relation. Furthermore, quantum theory implies a phenomenological point of view on the conditions of possibility of meaning.

François Dubois elaborates “On macroscopic intricate states in quantum modelling”. The focus is on one enigmatic aspect of quantum physics, namely, the Einstein-Podolsky-Rosen paradox and entanglement. After a review of the state-of-the-art concerning macroscopic quantum effects and quantum interaction, this contribution proposes a link between embryology and acupuncture in the framework of macroscopic intricate states induced by quantum mechanics. He considers an open question related to a possible link between acupuncture and embryology: can a weak form of intrication be maintained during stem cell division to interpret the acupuncture meridians as an explicit manifestation of a macroscopic intricate system? The macroscopic structure suggested by quantum mechanics could be a beginning of explanation of acupuncture through the embryologic development.

Federico Fiorelli, in his general review “Technological unemployment as frictional unemployment: from luddite to routine-biased technological change”, elaborated on the digital technology in the evolution of the labour market in the knowledge economy. He provides scenarios and elaborates on technological unemployment, routine-biased technological change, luddite fallacy and information and communication technology revolution.

Živa Veingerl Čič, Matjaž Mulej and Simona Šarotar Žižek in the paper “Different intelligences’ role in overcoming the differences in employee value system” elaborate on the differences in employee value system and propose a set of four intelligences to overcome these. The cognitive, emotional, spiritual and physical intelligences are listed as candidates to help satisfy the personal and organizational needs. The understanding, development and use should be regarded as a dynamic circular process, and it should receive a meaningful support from the exercise of social responsibility, which is one’s responsibility for one’s impacts on society, i.e. people and nature. Success of the process depends on “personal requisite holism”. The personal holistic intelligences system is a prerequisite to generate a more socially responsible and sustainable society.

Anja Kreidler and Meike Tilebein in their paper “Driver or Inhibitor for Innovation? Modeling and Simulating Contradictory Forces and Dynamic Aspects of Team Diversity” use simulation modelling to investigate the contradictory and dynamic effects of functional team diversity on innovation. By applying a simulation model to the problem effects of functional diversity on innovation and adding a dynamic component to teamwork, they are opening a new point of view well worth of examination.

Camilo Olaya, Juliana Gomez-Quintero and Andrea Navarrete disclose an actor-based conceptualization of the increasing oscillatory pattern of prison overcrowding in Colombia in the paper “Crime and punishment as a social system: the case of prison overcrowding”. They propose a dynamic hypothesis that explains that unintended behavioural pattern as the result of delayed balance feedback loops is shaped by decision-making processes of actors who intend to control crime and introduce the corresponding system dynamics simulation model. They identify key feedback structures that result from the chains of decisions. Finally, they introduce a simulation model that shows policymakers how to design effective policies intended to tackle prison overcrowding by enhancing their dynamic understanding of the situations development.

Eduardo Franco, Bassiro Só, Hamilton Carvalho, Joaquim Santos and Stefano Armenia present “Nobody deserves this fate: The vicious cycle of low human development in Guinea-Bissau”. They try to understand and explore the causal relationships of elements responsible for the macro vicious cycle of poverty in Guinea-Bissau and discuss policies to

break it. They elaborate that the traditional approaches tend to fail. Breaking the Guinean poverty cycle requires a multifaceted approach involving more resources and the building of several national capabilities. Considering implications, the study models the evolution of Human Development Index in Guinea-Bissau, linking it to the economy and political sectors and allowing the simulation of different scenarios.

Ineza Gagnidze elaborates on “The role of international educational and science programmes for sustainable development (systemic approach)”, with the aim of fostering research on an alternative design pattern for educational system. For this purpose, a new approach to connect clusters and alternative design pattern of education and science system for sustainable development is proposed. First, mutually beneficial effective circular system has been improved by offering an alternative design of the educational system to link it to the international educational and scientific programmes. Second, the visible and invisible sides of the cluster are presented as a tree-shaped system. Third, invisible and visible connection between branch clusters and an alternative design pattern for educational system have been identified and presented as a system.

3. Summary

The concept of this special issue is focussed to present a showcase of variety. Authors address multiple topics: from technology to social systems and ecology; they provide the insights at multiple levels: from the theoretical background development to the method impact analysis; they tackle the issues from diverse research perspectives: from a case analysis to new scientific approach propositions; and they provide various insight points: from the quantum mechanics to Anthropocene.

While lacking the clear production of a red line, or a simple solution, a multi-layered network of silver lines can be identified. In each of the presented papers, a toolset to understand and cope with variety is presented. They address variety at multiple levels by using diverse methods. But what we can learn is that the variety of the research approaches should be wide enough to enable us to cope with the variety around, and inside of, every system we encounter. The next lesson to learn is that the systems are dynamically interconnected on multiple levels. This should reflect on the research methodologies and even the concept of science itself.

The WOSC 2017 three main themes: people, technology and governance for sustainability, democracy, interactions and organization, cyber-systemic thinking, modelling and epistemology are cross-divided into multiple interlinking topics, interestingly enough, not hierarchically, but using multi-layered network of supportive, discursive arguments intended to encourage development and sharing and new, diverse perspectives.

The newly acquired toolset enables us to align the next meta-level of systems thinking. To use this toolset effectively, the concepts of science should not post limitations but provide us with new approaches, and it is on us to reimagine them.

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