Guest editorial

Towards smart model-based governance by systems thinking

Introduction

In our role as Guest Editors, we are very pleased to present this special issue (SI) of Kybernetes, which is devoted to the following topic: "Towards smart model-based governance by Systems Thinking".

The reason underlying this SI is the need to recognize how *complex* our world is and that this outlook entails understanding how to manage our organizations and design proper governance mechanisms accordingly.

Notably, complexity is not a buzzword; rather, it is a definite, strong and widespread feature of any modern system. This is because of a number of underlying factors, which have different natures (economic, social, environmental, political, organizational, etc.); generate short-, medium- and long-term consequences; and witness the interaction of multiple actors having personal (and often different) agendas and goals. A consequence of this situation is that complexity must be addressed and studied by relying on sound and proven tools and methodologies.

In addressing this issue, as clearly mentioned in the SI's call for papers, our idea was to bring together two main streams of research that have been extensively studied, discussed and analysed not only by Kybernetes and all its distinguished contributors but also within the field of management studies: Cybernetics and Systems Thinking.

These two streams of research have a long history, and ample literature testifies to their breadth of application and their potentials in analysing various complex domains. However, although they are concerned with the same ultimate goal of assisting organizations and managers in dealing with complex systems and subsequently informing decision-making, Cybernetics and Systems Thinking have been developing along parallel paths towards their common goal even though they adopt different approaches.

Cybernetics and systems thinking

Cybernetics has its origin in the early 1940s and has been experiencing a long-term success because of the excellent work of scholars such as Norbert Wiener and Stafford Beer. Specifically, Wiener clearly emphasised that the term "cybernetics", at the time, represented a neologism that was invented to identify a new scientific field. As the author explains (Wiener, 1948, p. 14), this term:

> [. . .] combines under one heading the study of what in a human context is sometimes loosely described as thinking and in engineering is known as control and communication. In other words, cybernetics attempts to find the common elements in the functioning of automatic machines and of the human nervous system, and to develop a theory which will cover the entire field of control and communication in machines and in living organisms.

The approach later expanded in breadth and also entailed a definite move towards social systems and softer sciences, and more specifically towards management science and governance issues (Beer, 1966; Jackson, 1987).

The Guest Editors are grateful to the Editor-in-Chief of Kybernetes, Professor Gandolfo Dominici, and to Professor Stefano Armenia for the continuous support and collaboration in creating, managing and publishing this SI. The Guest Editors are also thankful to all of the reviewers that provided valuable comments and insights during the various stages of the reviewing process.

Kybernetes
Vol. 48 No. 1, 2019
pp. 2-6

0368-492X
DOI 10.1108/K-01-2019-548

Derived from a Greek word meaning "the art of steering", Cybernetics relies heavily on two main pillars – the concepts of the feedback loop and self-regulation – which are actually shared with Systems Thinking.

Systems Thinking can be regarded as a field of study that aims to support people in their understanding that the systems in which they are embedded and take action are heavily interconnected and definitely complex; subsequently, they need to learn to use the approach of circular thinking rather than linear thinking. For this purpose, Systems Thinking provides a core set of tools (e.g. causal loop diagrams and systemic archetypes – see Senge, 1990) and focuses on mental models and on an individual's ability to address problematic issues in complex systems (Richmond, 1993). In this regard, Systems Thinking should not be seen as a mere set of tools and methods when it is actually a philosophy that is rooted in the idea that we need a holistic approach to decision-making when living and operating in a complex and interconnected world (Meadows, 2008). Indeed, Systems Thinking advocates that we need to "understand that "you can"t just do one thing' and that everything is connected to everything else" (Sterman, 2000, p. 4).

This said, it is our opinion that the two previously mentioned streams of research share a common goal in supporting decision-makers as they carry out their decisions and take actions. This is absolutely relevant today, when modern organizations face complex issues, are active within multifaceted networks of interrelationships and have an enormous mass of data at their disposal to inform discussion and action.

The building blocks of the special issue

From the previous considerations, it is clear that complexity, availability of data and governance mechanisms are three key concepts that are addressed by both Cybernetics and Systems Thinking and, consequently, have been chosen as the main focus for this SI. In more detail, we sought out contributions that were able to study these three concepts further, adopting a triple perspective.

First of all, the SI looked for an in-depth examination of Cybernetics- and Systems Thinking-based projects, case studies and theoretical analyses in the following areas:

- people, technology and governance for sustainability;
- democracy, interactions and organisation;
- cyber-systemic thinking, modelling and epistemology;
- data-driven decision making vs model-based decision making; and
- modelling and simulation with Big Data and Smart Data.

From different angles and perspectives, this list of topics clearly includes the three concepts mentioned above.

Second, we encouraged authors to look at the list of topics keeping in mind that multiple levels of decision-making and governance may be present in our systems and may be chosen for their analysis or practice-based projects as well. To exemplify, we considered papers spanning from the individual to the global level, going through a number of other intermediate levels and perspectives (i.e. citizen/city, country, region and society).

Third, we were open to expanding the authors' methodological choices for the articles and projects beyond "pure" Cybernetics and/or "pure" Systems Thinking, allowing for the use of methodologies such as system dynamics, agent-based modelling, discrete event modelling and simulation, as well as their "hybridizations" – specifically with the research area on "data-driven" (or Smart-data) decision-making.

Overall, we selected 11 papers which successfully went through a process of double-blind review and are now included in this SI. In particular, the SI is primarily linked to the BSLab-

SYDIC Workshop 2017 (www.bslab-symposium.net/BSLab-Sydic-2017/BSLAB-SYDIC-WS-Rome-2017.htm) which aimed specifically at aggregating various issues within the broad topic of Smart Model-based Governance and its perspective of applications to present and future complex organizations.

As a final note, we emphasise that in launching the call for papers we have sought to involve academics and practitioners. At the end of this process, we believe that the SI effectively and successfully blends academic-based articles, as well as some rigorous practice-based contributions.

More details on the articles that have been selected and included in the SI are provided below.

Structure and content of the special issue

The structure of the SI is organized into two main parts. The first part includes three driving contributions, each representative respectively of the themes to which the SI is devoted: the complexity of world systems, cyber systemic methodology and Systems Thinking methodology. The second part includes eight contributions that develop studies on the topics which are the focus of the SI, the five areas mentioned in the previous paragraph. In this second section, three additional levels of perspectives are recognizable: individual governance of complexities, small/medium aggregations in the governance of complexities (i.e. society, city, country and regions) and global dimension governance of complexities (i.e. climate mitigation actions, 2030 sustainable development goals).

In the first part, the initial contribution is entitled "Governance through political bureaucracy: an agency approach" and represents a cross contribution between SI Area 1 (People, technology and governance for sustainability) and Area 2 (Democracy, interactions, and organization). The author approaches the theme of governance complexities, examining the role of political bureaucracy in policy development and implementation, pointing out that the policing process is not only an attribute of a political administration but also of the nature of its bureaucracy, which is complex and dynamic.

The second contribution, entitled "Governance for intelligent organizations: a cybernetic contribution" introduces a powerful model which has much to offer for organizational governance directed at the viability of organizations: viable system model. The model emanates from the tradition of Cybernetics, the science of communication and control of complex dynamic systems, which here is revisited, approaching the themes from Area 2 together with the Cybernetic methodology as seen in Area 3 (Cyber-systemic thinking, modelling and epistemology).

The third contribution in this first part, entitled "Improving managers' intelligence through systems thinking" reports a general introduction of the Systems Thinking methodology approach, which aims to instruct managers to transform their organization into a learning organization that is able to figure out at least some future consequences of a manager's decisions and actions. This contribution is primarily placed within Area 4 (data-driven decision-making vs model-based decision-making) because Systems Thinking is a model-based approach to decision making, and, in this case, the author proposes this methodology to satisfy governance requirements, as reported in Area 1.

Thus, within the framework of the previous three overview contributions, the Guest Editors are pleased to develop further detail in the second part of the SI, in which further important contributions are organized according to the social dimension of complex systems. This provides a crucial key for reading most of the existing systems of governance: individual governance; the governance of organizations formed by small/medium aggregations of individuals that have primarily a local impact; global dimensions of governance investing in larger communities; and the dynamic of planetary environments. In

each of these three dimensions, the principles and methodologies of Systems Thinking, Cybernetics and data analysis are applied to assist in decision-making.

Governance in an individual dimension is particularly evident in the following three contributions: "Meme propagation in the media sphere: a system dynamic model", "Towards a systems thinking based view for the governance of Smart City ecosystem: a bridge to link technologies and Big Data" and "Smart technology and complex social issues of the Z generation". Each article is aligned within the focussed topics of the SI. Nevertheless, each of them presents an original and a methodologically different approach to solving and satisfying the needs of individual decision-making.

The contribution "Meme propagation in the media sphere: a system dynamic model" is a study of how individuals and organizations can discern whether certain information broadcasted by mass media on the Web is propagated according to a natural interest (viral propagation) or whether the propagation is being forced by an intensive activity of advertising through a media bombardment. The study is based on big data analysis available from internet statistics in combination with System Dynamics methodologies, according to Areas 4 and 5 (Modelling and simulation with Big Data and Smart Data).

In the article "Smart technology and complex social issues of the Z generation", the authors raise the question of how smart technologies are now influencing the self-organization behaviour of the Z generation. Smart technologies, such as mobile devices and the Internet, are furnishing a set of new tools that have changed the ways in which young people are being educated. Now the social system is more dynamic in terms of socialization, but the loss of personal contact with friends and family is seen as the main disadvantage of the improvements resulting from smart technologies. Both themes of governance and technology in Area 1 are highlighted, as well as the decision-making processes of Area 4.

In the third contribution, "Towards a system thinking based view for the governance of Smart City ecosystem: a bridge to link technologies and Big Data", the authors explore the use of big data (Area 4) as applied to Systems Thinking (Area 5) for smart city governance (Area 1). The study points out that individual behaviours and decisions result from multiple influences. Here the relevant role of smart technologies aims to support the alignment among the different elements involved in a system by ensuring a fast reciprocal adaptation over time, together with the key role of Big Data as a pathway for building a strong feedback process that is able to increase the alignment between individual and aggregated behaviours.

Smart Technologies also are revolutionizing the interpretation and organization of aggregated systems. This fact is highlighted in the article, "Analysis of Crowd Stampede Risk Mechanism A Systems Thinking Perspective". Here, the authors report an interesting study on crowd behaviour in the case of sudden alarms or accidents, proposing a new System Dynamics modelling (Area 4) approach to manage, control and govern sudden emergencies (governance, Area 1).

Global water provisioning is also at risk of becoming an emergency because of a rapid increase in climate changes. In "Water used to be infinite: A Brazilian tale of climate change", the authors analyse a case study of water scarcity in Brazil. Here the governance issues (Area 1) are approached mainly through System Dynamics methods (Area 4), presenting an integrative model for evaluating the resilience of a particular water supply system in a region of Brazil. Although there have been previous studies on this subject, the one included in this SI focuses on the role played by the water authority in facing a crisis, highlighting a specific combination of policies used to address an episode of crisis in a system that was unprepared for it. The theme of water scarcity is also treated in the article entitled, "A Systemic Methodology for the Reduction of Water Consumption in Rural Areas", also situated

in a South American country, Colombia, where the effect of water scarcity is most evident. Here, the author also based the study on a System Dynamics approach, satisfying Area 4, by aiming to construct a technological solution (Area 1) in the field that needs the involvement of local communities (people, still Area 1) in the decision-making processes, in the design of the technology and in its construction.

Finally, two contributions focus on the global theme of sustainability. Sustainability represents a process that requires an accurate and complex network of actions to build an effective governance for the equilibrium that regulates human activities in their relationship with ecosystem boundaries. In the study "Sustainable Developments Goals – An analysis of the Outcomes", sustainability is defined through the concepts of synergy, emergence, recursion and self-organization. Then, the authors developed an approach to help determine whether the efforts being made towards the Sustainable Development Goals could be expected to be effective. The results show that further public policies (Area 1 for governance) are needed for Brazil and for any other country that is willing to increase adherence to the SDGs. One of the ways in which it is possible to implement previous policy planning is presented in the contribution, "Integrated Simulation for National Development Planning" that proposes the Millennium Institute's T21 model, (Area 4) a powerful tool to support planning in various countries. Here also the System Dynamics method is found to be a well-suited method for addressing the high level of dynamic complexity and the multidisciplinary nature of the issues.

After the brief overview of the building blocks that this SI concentrates on, the Guest Editors hope you enjoy examining these topics in greater depth.

Federico Barnabé
Department of Business Studies and Law, University of Siena, Siena, Italy, and
Ilaria Perissi
Department of Chemistry, Universita degli Studi di Firenze, Firenze, Italy

References

Beer, S. (1966), *Decision and Control: The Meaning of Operational Research and Management Cybernetics*, Wiley, London.

Jackson, M.C. (1987), "Present positions and future prospects in management science", *Omega*, Vol. 15 No. 6, pp. 455-466.

Meadows, D.H. (2008), *Thinking in Systems: A Primer*, Chelsea Green Publishing, White River Junction.

Richmond, B. (1993), "Systems thinking: critical thinking skills for the 1990s and beyond", *System Dynamics Review*, Vol. 9 No. 2, pp. 113-133.

Senge, P.M. (1990), "The fifth discipline", *The Art and Practice of Learning Organization*, Doubleday Currency, New York, NY.

Sterman, J.D. (2000), *Business Dynamics. Systems Thinking and Modeling for a Complex World*, McGraw-Hill, Boston.

Wiener, N. (1948), "Cybernetics", *Scientific American*, Vol. 179 No. 5, pp. 14-19.

Further reading

Beer, S. (2002), "What is cybernetics?", *Kybernetes*, Vol. 31 No. 2, pp. 209-219.