Shaping collaborative ecosystems for tomorrow

The complexity of interactions and relationships in our world have consistently surpassed our ability to fully comprehend and govern. The presence of intelligent tools, both in the digital and physical realms, is progressively enhancing our capacities to act on personal, organisational, national, and international levels, leading to both intended and unintended consequences. Collectively, these changes are reshaping our primary habitat—the planet Earth—at a speed and scale that necessitate earnest consideration. In the midst of uncertainty, the development and utilisation of these new capabilities would greatly benefit from CyberSystemic approaches and methods of learning. This advancement is crucial for fostering a sustainable understanding and taking action to avert major threats to our civilization.

Book of Abstracts

Conference Chairs -Book editors

Raúl Espejo (UK)

Igor Perko (Slovenia)

Alfonso Reyes (Colombia)

Scientific Board

Bernard Scott (UK)

Sandro Schlindwein (Brazil)

Frank Stowell (UK)

Jerzy Józefczyk (Poland)

Liu Sifeng (China)

Louis Klein (Germany)

Hernan Lopez Garay (Colombia)

Massimiliano Pirani (Italy)

Vasja Roblek (Slovenia)

Vladimir Lepskiy (Russia)

Yingjie Yang (UK)

Sergio Barile (Italy)

Igor Perko (Slovenia)

Alfonso Reyes (Colombia)

Francesco Caputo (Italy)

Milan Zorman (Slovenia)

Vojko Potočan (Slovenia)

Angela Espinosa (UK, Colombia)

Jon Walker (UK)

Marialuisa Saviano (Italy)

Raúl Espejo (UK)

Stuart Umpleby (USA)

Allenna Leonard (Canada)

José Pérez Ríos (Spain)

Markus Schwaninger (Switzerland)

Matjaž Mulej (Slovenia)

Clas-Otto Wene (Sweden)

John Beckford (UK)

Ray Ison (Australia and UK)

Jason Jixuan Hu - Goodman (China, USA)

German Bula Escobar (Colombia)

Peter Ototsky (Russia)

Clive Holtham (UK)

Valarie Lamont (USA)

Lowell Christy (USA)

Matthew Holt (Australia)

William J. Reckmeyer (USA)

Table of Contents

Keynotes

Alfonso Reyes: Exploring New Organizational Forms for WOSC

Presentation Here

Alfonso Reyes Is a physicist and a systems engineer from Los Andes University. He has a MSc in Computer Science (University of Maryland), a PhD in Management Cybernetics (University of Humberside, UK) and postdoctoral studies in Organizational Learning (University of Lincoln, UK). He has worked for the last thirty years in addressing organizational problems in the public sector, especially in the administration of justice and the promotion of local development through the capabilities approach. He has been an international consultant for the Interamerican Development Bank and the Agency for International Development (USA) in applying management cybernetics to the public sector in Colombia, Paraguay and Perú. He has published several papers and being a co-author of four books about self-organization from the point of view of second-order cybernetics. He was the chancellor of the Universidad de Ibagué in Colombia (2009-2016), a Dean of the Engineering School at los Andes University (2016-2020) and since 2020 is again the chancellor of Universidad de Ibagué.

Jason Jixuan Hu: Developing Capabilities of Leaders to Navigate in the Complexities of Our Time

A Large scale Systems & Cybernetics Education Initiative of WOSC Inviting Partners Now

Presentation [Here](#)

Jason Jixuan Hu currently organizes Club-of-Remy on the Internet, considered a successor of the Macy Conferences in 21st century with informal and self-organizing principles aiming to improve the collective wisdom of our time. His career path spans from distance education, system dynamics, teaching, entrepreneurship, project management and corporate training. He is not a pure publish-or-perish academic but focuses on walk-the-talk hands-on learning. That's why he suggested that "system thinking" to be replaced by a new term "system OTAing," OTA stands for Observe-Think-Action. For the WOSC this year he brings in 4 "seeds" for an action plan inviting colleagues to join.

Juliana Mariano Alves: Water Governance for Sustainability: What Do We Need for a Viable Future?

Water governance for sustainability requires complexity-oriented management systems to address multifaceted challenges. River Basin Organizations should play a pivotal role, in enhancing water governance, by fostering coordination and collaboration among stakeholders. Effective water governance relies on adaptive management and prioritizes ecosystem health in and around hydric systems.

Dr. Juliana Mariano Alves Is a professor at Universidade Estadual do Tocantins (UNITINS), Brazil. Tocantins is the youngest state in the Brazilian Federation and is home to the largest hydric system on Brazilian soil, - the Tocantins-Araguaia River Basin. Juliana is recognized for her contributions to rural development, sustainable management, systemic governance, and the design and implementation of key institutions for Water Governance in the state of Tocantins.

She has developed programs to mitigate environmental impacts of hydroelectric plants on the Tocantins River and implemented decentralized environmental policies in northern Brazil, as a consultant for the Brazilian Ministry of Environment (MMA). She is committed to the improvement of water governance and management for ensuring the sustainability of water use. Juliana serves on the board of the American Society for Cybernetics (ASC), and is engaged in international research projects.

Raul Espejo: Distributing discretion and designing structural mechanisms for ecological management

Distributing discretion throughout society, that is, making all citizens active contributors to societal performance, as well as designing structural mechanisms for their collaborative cohesion avoiding hierarchical policymaking and abuses of relational power between customers and suppliers or in other words between organisational actors and environmental agents, is used in this contribution to explore truth, and increase capacity to capture and create value in society. Without sufficient investment and expertise in society's complexity management, the variety of data proliferation can produce costs and generate risks that exceed an organization's capacity to create and capture value from big data. Complexity management scientist have explored data management through a conceptual discussion of chaos, complexity, and order and as such this paper is an introduction to discuss the proliferation of data in situations relevant to shaping collaborative ecosystems for tomorrow.

Raúl Espejo is President of the World Organization of Systems and Cybernetics (WOSC) and Director of Syncho Research, UK. He is academician of the International Academy for Systems and Cybernetic Sciences (IASCYS) and Past Professor of Systems and Cybernetics at the University of Lincoln, UK.

His research is in organisational cybernetics and systems. His most recent book is "Organizational Systems: Managing Complexity with the Viable System Model" (2011 in English and 2016 in Spanish (both with A. Reyes)). Has co-published five books and edited 7 special issues of journals, most recently in 2018, of Futures ("Futures of Society: the interactions revolution"). Has published over a 120 papers in journal and books. Has organised two of WOSC's world congresses in 2014 (Colombia) and in 2017 (Italy) and together with Vladimir Lepskiy of the Russian Academy of Sciences and Igor Perko of Maribor University in Slovenia of the 2021 virtual congress in Moscow. Currently he is organising together with Igor Perko the 2024 WOSC's congress in Oxford.

In June 2024 he was awarded by the American Society of Cybernetics the Norbert Wiener medal. From 1971 to 1973 he was operations director of the CYBERSYN project - the project of the Chilean Government for the management of the industrial economy, under the scientific direction of Professor Stafford Beer.

Sergio Barile: Towards an 'income of recognition'

The contemporary global landscape is witnessing profound transformations driven by rapid technological advancements, which permeate every facet of societal and organizational life. These innovations engender both optimism for their transformative potential and apprehension regarding their ethical, social, and economic implications. A striking consequence is the escalating disparity in wealth distribution, where technological beneficiaries prosper while others face marginalization and impoverishment. This wealth asymmetry fuels social unrest and necessitates critical discourse on equity, justice, and sustainability.

In response to these multifaceted challenges, this study proposes a conceptual model that integrates key dimensions: Technological Innovations, Distribution of Wealth, Social Impacts, and Sustainability. Drawing upon Jürgen Habermas's theoretical constructs of necessity, possibility, and effectiveness, the model seeks to elucidate the evolutionary trajectory of Western capitalism. It examines the shift from traditional proprietary capitalism to the dominance of financial capitalism, characterized by the ascendancy of financial sectors and the digital economy.

Central to the model is the identification of emerging trends potentially leading towards a third paradigm. This prospective paradigm emphasizes knowledge as a primary economic resource, underscores active societal participation in economic processes, and reevaluates income distribution mechanisms. Such a framework aims not only to describe but also to predict and guide policy responses to these transformative dynamics.

Moreover, the model employs a comprehensive approach that integrates both positivist and constructivist perspectives on resource allocation. This dual perspective acknowledges the objective materiality of resources while recognizing their social construction and contextual variability. This nuanced understanding is crucial for decision-makers navigating the complexities of contemporary socio-economic systems.

Sergio Barile is a full professor of business management at Sapienza University of Rome. He has previously served as the head of the Department of Management and coordinated the Doctoral program in Management, Banking, and Commodity Sciences. His research interests span business management, systems theory, decision theory, and complexity theory.

Professor Barile is the founder of the Association for Research on Viable Systems (ASVSA) and is a leading authority on the Viable Systems Approach (VSA). He serves as the editor-in-chief of the Routledge- Giappichelli "Systems Management" Book Series and is a member of the editorial boards of several leading journals in business management and economic sciences.

He has authored numerous books and articles published in national and international journals, including the European Management Journal, Managing Service Quality, Journal of Service Management, Systems Research and Behavioral Science, Service Science (Informs), TQM, Sustainability, and Sustainability Science. In recognition of hiscontributions to research, he was awarded the Evert Gummesson Outstanding Research Award in 2015. He can be reached at sergio.barile@uniroma1.it.

John Beckford: Still in Torment - (Re)Designing Freedom

It is now 30 years since 'World in Torment' explored 'chronic societary triage' (WOSC, Beer 1993) and 50 since 'Designing Freedom' considered the role of 'science in the service of man'. This address will briefly rehearse the key ideas of those works and then consider the current state of the world. Examining the societary, political, economic and planetary challenges we are now facing it will examine those challenges from a cybernetic perspective and show how those ideas can support us in resolving 'The Real Threat to "All We Hold Most Dear"'

Section 1.1 Enabling Active Citizenship

Coordinated by Allenna Leonard and Zoraida Mendiwelso Bendek

Citizenship, as a property of our democracies, emerges from an interactive process of social meanings. It is in a vulnerable condition.

Enabling active citizenship is necessary to make its processes transparent, accessible and feasible. Allowances for referenda and other instruments of direct democracy need to be established and other means, including the pain-pleasure measurements, supplemented by polling by reputable agencies should be available. Jurisdictions for voting, the basic act of citizenship, should be designed so that votes count equally.

Practices that discourage participation including making voting difficult, spreading misinformation and the lack of education about how political processes work ought to be curbed. Finally, it is important that the role of civil society be strengthened. People should have the opportunity to collectively engage in discussions about matters of importance and have a channel to convey their ideas to decision-makers to more widely influence outcomes that affect themselves and build a sustainable future.

F. Varela and Ch. Taylor: cyber systemic and political philosophy keys to identity

Agustin Domingo

Abstract

Purpose – The relations between cybernetics and contemporary philosophy are stimulating, not only in the field of Philosophy of Science, Epistemology or Social Philosophy but also in the field of Moral and Political Philosophy. This research aims to present an exploratory work between cyber-systems thinking and hermeneutic phenomenology that has already been started (Varela 2001). The bridges built between the two traditions refer us to the world of life (Lebenswelt) and explore new horizons for practical reasons. Additionally, we aim to analyse the horizon/processes of identity as a central category of the new practical reason, with its implications for the field of social interaction and motivation in the social sciences. It dives into the field of cybernetics because it involves a critique of substantialist or naturalistic approaches that disregard the consciousness of social agents. In the field of hermeneutic phenomenology because, it is a critique of reductionist approaches that ignore the corporeal, material and factual nature of subjectivity. How can we approach identity from the perspective of the renewal of practical reason? What can the dialogue between systems thinking and hermeneutic phenomenology contribute?

Design/methodology/approach – We focus our research on two important figures for both traditions: F. Varela and Ch. Taylor. They share certain characteristics important for CyberSystemic research: interdisciplinarity, ethical concerns in global research, openness to scientific and technical advances in all areas of knowledge, service to society, strengthening of democratic institutions and broad knowledge of the philosophical tradition. On the subject of identity (of individuals, institutions, and peoples), both researchers are open to transcendence. They are, therefore, concerned with the role of spirituality in the areas of motivation and social interaction, especially in modern, disenchanted and secularised societies. Varela is an important reference in the dialogue of Buddhism and Taylor with Christianity. The two men crossed paths at one of the meetings entitled "Mind and Life" organised in Dharamsala with the Dalai Lama in 1992. It was the fourth of the meetings organised by Varela, which Taylor attended as a special guest.

Findings/Results – Identity is an important concept for systemic research and hermeneutic phenomenology. Although it initially refers us to the identity of the subject or the self as an individual, it is significant that in both traditions it refers us to self-organisation, language and environment. In Varela, we find a novel approach that poses identity in terms of action and executivity. In Taylor, a reconstruction of the self that recovers relational dimensions of identity in which the body, attention, otherness,

historicity and social interaction play a central role. These convergences are not explicitly developed in the Dharamsala meetings but we find them tacitly in Varela's reconstruction of Taylor's interventions. The philosophical reconstruction of both philosophical trajectories shows the productivity of the dialogue between systems thinking and hermeneutic phenomenology. A productivity that is not occasional or accidental because it takes us back to Varela's philosophical training and the productivity of these conversations to enrich social research that requires avoiding essentialist or mechanistic theories of identity.

Originality/value – The dialogue between Varela and Taylor on identity is an opportunity to reconstruct practical reason in the 21st century. The reflections on the relationship between mind and action made by both researchers provide important categories to recover the protagonism of the body, attention, motivation and social interaction in the whole of cyber systemic thinking. Our research does not seek originality in the subjective, personal or motivational dimension of identity for cybernetics; on the contrary, it shows the value of categories central to systems thinking such as the body, intentionality, experience, reflexivity, social communication and autopoiesis. This not only brings about a convergence between Taylorian hermeneutic phenomenology and cybernetics but also a material and communicative revision of hermeneutic phenomenology. It opens up new avenues and opportunities to think together about the productivity of systems thinking with works by Maurice Merleau-Ponty, Michel Henry or Paul Ricoeur.

Research/ Practical/ Social/ Environment implications - This research strengthens the interdisciplinary and practical dimension of hermeneutic phenomenology. The approach to structurally interdisciplinary and specifically scientific research, such as that carried out by Varela in the cognitive sciences, helps to specify and delimit the problem of identity, considering self-organisation, language and environment. This is not a speculative problem but a practical problem because the motivation, action and interaction of subjects are conditioned by self-reflection, self-concept and autopoiesis. The work enables a reconstruction of identity that not only includes social interaction and institutional life but also the whole of nature in ecological terms. There are environmental implications because it systemically enriches phenomenological research by strengthening an ecological dimension of practical reason, even opening the doors for a systemic or integral renewal of moral philosophy. The research shows the fruitfulness of an interdisciplinary dialogue that does not exclude religious or spiritual traditions.

Research limitations - The research is limited by the breadth of Varela's and Taylor's works. Although the former died prematurely, he has considerable work to rethink the relationship between identity, mind and action. Although Taylor's work is much more extensive and wide-ranging, we have limited our reflection to the conversations that took place in Dharmasala. It is a small sample of the fruitfulness we perceive as we unpack the potential of cybernetic thinking to reconstruct practical reason. It is also a small

sample of the possibilities of the hermeneutic transformation of phenomenology produced since the late Husserl. The paper has an exploratory will and is part of a more ambitious research on the role of the body, emotions and communication in the transformations of the ethics of responsibility in the age of science.

Using the Viable System Model to Assist Active Citizenship

Allenna Leonard, Ph.D. Independent Researcher Toronto, Ontario, Canada

Abstract

Purpose – Active citizenship is a privilege and a duty. For some, such as those who work for NGO's, other institutions of civil society or elected officials, it is a full-time job. For the rest of the population, it is an activity that waxes and wanes according to the circumstances and the stages in people's lives. In times of rapid change, it can be difficult to keep up – especially with the complexity of issues and distortions of mis and dis-information.

Stafford Beer's Viable System Model (VSM) is suggested as a template for those who wish to make the most of the time they have to participate as active citizens.

So, what does active citizenship entail? First and foremost, it requires people to be keenly aware of their political, social and economic environments. It requires people who are entitled to vote to do what it takes to register, inform themselves and cast their ballots. And it requires they assess what is most important to them at this time and what civic instruments are available or constructable to address them. This may lead to considering what level of involvement is possible and practical at the local, regional, national or international levels. Using the Viable System Model to map actual and potential personal involvement at these multiple levels engages one's coordinating capabilities, their budgeting of time, money and other resources, their anticipation of the future and their identity and values. It also invites them to think about what their involvement means at the next level.

Design/Methodology/Approach - The proposed presentation is an application of the Viable System Model (VSM) to structuring a citizen's commitment to active citizenship.

Findings/Results - The use of the VSM as a personal planning tool for citizens to get the most out of the time and bandwidth they have to devote to active citizenship can enable them to participate more effectively, see connections and synergies among their different interests and examine their priorities over time. Practice using this tool may also be shared with others to help manage at least the smaller organisations in which they are involved.

Originality/Value - The application of the Viable System Model (VSM) is not often practiced at the individual level and it could be beneficial in helping people to see themselves as part of a number of different whole systems and explore multiple means of engaging with emerging situations.

Research/Practical/Social/Environmental Implications - Using the Viable System Model template can increase the breadth and effectiveness of an individual's engagement in active citizenship.

Research Limitations - If people adopt this strategy, the results will be difficult to see and difficult to measure except in the aggregate and over time.

Key Words: Viable System Model, Citizenship, Time Management

Active Withernsea: a community development project in a hyper-local place with a systems thinking focus

El Wilkinson-Cunningham (East Riding of Yorkshire Council)

Abstract

Purpose – Active Withernsea (AW) is an innovative pilot project run by the East Riding of Yorkshire Council (ERYC) and funded by Sport England, aiming to increase physical activity levels in the small seaside town of Withernsea, East Yorkshire, UK. Since 2019, a community development team has supported residents to become more physically active in the short term, while simultaneously working for wider system changes in order to create a more enabling environment for physical activity in the longer term. As the project comes towards the end of its first five years, the focus is now shifting to how the skills and experiences that AW staff have developed can be transferred to a community network to ensure a sustainable change in the system.

Design/methodology/approach – Throughout the duration of the Active Withernsea pilot, a participative, mixed methods systemic intervention approach has been deployed to develop the skills and capabilities of the AW staff and the community to create sustainable changes. This includes the creation of a Participatory Theory of Change, using rich pictures and open spaces to develop strategic priorities and the use of Critical Systems Heuristics to develop a governance structure to replace a traditional board. In addition, in employing these approaches and consistent with its community ethos, the project has placed an emphasis on formative evaluation and sharing the learning. The evaluation has also been mixed methods in focus embracing both qualitative and quantitative data. The evaluation has included the use of survey work to understand activity levels, social network analysis to understand how the town is becoming more connected and semi structured interviews to capture system changes that support behaviour change.

Findings/Results – Finalised results have not yet been yielded due to the ongoing nature of the pilot. However, interim results from Withernsea-specific Active Lives data highlight notable changes in activity levels in comparison to the 2019 baseline data. When the pilot launched, 44 percent of people in Withernsea were inactive, doing under 30 minutes of exercise a week. In 2024, this has reduced to just 15 percent of residents being inactive.

The percentage of residents who are very active, doing more than 150 minutes of exercise a week, has increased from 44 percent to 62 percent. Happiness and satisfaction with life have improved, and anxiety amongst Withernsea residents has reduced. In line with Sport England's inequalities priority, activity for those with a disability has seen the biggest increase.

In addition to the increase in physical activity, social network analysis using Kumu has highlighted how the town is becoming more connected with shared goals and how the

pilot is expanding the boundaries of the system by bringing new partners into the town or upskilling new voices within the town to take more of a leadership role.

Originality/value – The uniqueness of this pilot lies in the size of Withernsea, with its population of 6000 people making it by far the smallest of the Sport England Place Partners. This is a valuable setting to situate the project's 'bottom-up' systems approach, enabling innovative systems thinking techniques to be engaged with the partners and residents of the town rather than focusing solely on working with strategic leaders of the project. This is key to the project's aim of eliciting positive changes within Withernsea that develop the community network and consequently sustain it beyond the duration of the project.

Research/ Practical/ Social/ Environment implications – This has been key to facilitating the sharing of learning and best practices from Active Withernsea through the wider East Riding of Yorkshire Council and health system systems.

It is hoped that sharing the learning from the Active Withernsea project will help other areas with how to combine community development and systems thinking in small hyper-local communities to create sustainable behaviour change. Additionally, one of the aims of AW was to explore how what might be perceived to be academic Systems Thinking concepts can be made more accessible to community members and residents, to help sustain change and new ways of working.

Research limitations – So far this work has provided positive results in Withernsea but has not yet been tested in other East Riding areas; it remains unknown whether the results of these methods will generalise to other communities across the local authority. The next steps of the pilot will now turn to investigating how this learning can be applied in other areas to create behaviour change.

Keywords: Community Development: Sustainable behaviour change: Physical Activity: Systems Change.

The impact of affective polarisation on political participation: a systematic review

Maruša Lubej, MA, University of Maribor, Faculty of Arts, Department of Sociology

Martin Dolezal, PhD, Paris-Lodron-University of Salzburg, Department of Political Science

Katja Kerman, PhD, University of Maribor, Faculty of Arts, Department of Psychology

Marija Javornik, PhD, University of Maribor, Faculty of Arts, Department of Pedagogy

Monika Lamot, MA, University of Maribor, Faculty of Arts, Department of Sociology

Boris Vezjak, PhD, University of Maribor, Faculty of Arts, Department of Philosophy

Teodor Petrič, PhD, University of Maribor, Faculty of Arts, Department of German Studies

Andrej Kirbiš, PhD, University of Maribor, Faculty of Arts, Department of Sociology

Abstract

Purpose – Affective polarisation, which includes the feelings toward the individuals' preferred political party and the opposing parties, is often seen as harmful to the democratic processes. Yet, recent research has indicated that it may play an important part in political participation. We aim to fill a gap by systematically reviewing how affective polarisation impacts institutional and non-institutional forms of political participation. Moreover, our study offers an overview of how those concepts were measured and of the limitations and future research directions identified in the studies included in our review.

Design/methodology/approach – This paper is a review of 18 empirical studies published between 2000 and 2023 out of the 4981 studies that we found with our initial search. The methodology follows the PRISMA guidelines. It includes a comprehensive search in several databases (Web of Science, JSTOR, ProQuest, Sage Journals, Taylor & Francis Online, and ScienceDirect). We also searched for grey literature to minimise publication bias. Lastly, we conducted a quality assessment using an adjusted Newcastle-Ottawa scale.

Findings/Results – The results reveal that affective polarisation tends to increase political participation, with stronger evidence for the link with institutional forms (e.g., voting) than non-institutional forms of political participation (e.g., protests). There are, however, variations across countries, indicating that the political and cultural context play a role. Additionally, the measurement methods of polarisation and participation concepts vary from study to study, which could also contribute to varying effects of affective polarisation. Authors of the papers included in our review have suggested several areas for future research, including exploring the mechanisms linking affective polarisation with various forms of political participation.

Originality/value – Our research contributes to the field by systematically reviewing current empirical studies on the impact of affective polarisation on political participation, providing a synthesis of findings across different countries. Additionally, it takes a deeper look at how affective polarisation and political participation have been measured, and it synthesises future research directions. In this way, it offers a foundation for future research on the complex relationship between affective polarisation and political participation.

Research/Practical/Social/Environment implications – The findings have implications across various sectors that cover politics, education and research. For policymakers and political strategists, understanding the ways affective polarisation can have a mobilising effect can inform the development of more inclusive and engaging political campaigns and policies. Educators and civic organisations can use these insights to design programs that encourage political participation while addressing the risks associated with deepened societal divisions. Additionally, our research contributes to the broader understanding of how emotional factors in politics influence democratic health and citizen engagement, urging a re-evaluation of political communication strategies.

Research limitations – Most of the studies included in our paper were conducted on samples in high-income Western democracies, which may limit the generalizability of findings. Methodological heterogeneity among the reviewed studies also poses challenges for comparison and synthesis. Lastly, our search methodology, although detailed, might have excluded some relevant studies, potentially affecting our findings' comprehensiveness.

Keywords: affective polarisation, political participation, systematic review, institutional participation, non-institutional participation

Citizen's Panel: 4 innovations

Michèle Friend, Professor, Department of Philosophy, George Washington University, Washington D.C.

Martine Legris CERAPS, Lille University, CNRS

Abstract

Purpose: to share the results of our experiment in adding innovations for Citizen's Panels. We believe they make them more flexible, adapted, less expensive and more effective for democracy.

Design/methodology/approach: We designed a *citizen's panel* dedicated to science – society dialogue, adding our own innovations. This time, we, the researchers, asked the questions to be answered by the citizens, instead of the usual decision makers. We used a particular *systems theory* (the *institutional compass*) to reflect on, and facilitate, discussion. 20 citizens volunteered to be part of this citizen's panel.

Findings/Results - The instigators were given clear recommendations.

The citizens learned a lot about the *problèmatique*. They were able to appreciate the complexity of the issues, which allowed them to better understand why no easy solution has yet been found.

The experts themselves learned a lot during the experiment as they listened to other experts and/or discussed with the citizens (interdisciplinarity)

The three results together means that citizens can be asked to make real recommendations to academics, government and industry. This increases democratic engagement.

Originality/value - The first innovation was to coach the experts to more effectively communicate with the citizens. The second had to do with the instigators of the citizen's panel. They were not politicians. They were scientists. They wanted advice from the citizen's about where to direct their future research efforts. The third was to use a new systems science approach facilitate the discussions and recommendations of the panellists. The fourth was that the number of citizens was low (20). This keeps costs low and logistics simple.

The value of the innovations is that we now know that citizen's panels can be used for many more purposes than political decision making. The organisation of the panel was not very complicated, and the cost of the experiment was low. It brought a higher level of understanding and complicity between scientists and citizens. Industry and local government could use a similar methodology.

Research/ Practical/ Social/ Environment implications: If our innovative method for citizen's panels is adopted and used widely, then academic and industrial research will be more in step with the desires of the people it is meant to serve in the long term.

The gaps between research scientists, industrialists and citizens or "consumers" will be narrowed –producing virtuous feedback loops.

The environmental implications depend on the *problèmatique* and the sensitivities of the citizens.

Systems science and cybernetics will be more widely used, better understood, and become part of the thinking for not only researchers and decision makers but also for citizens and this will lead to solidifying democratic principles.

Research limitations - The method is less limited than the traditional citizen's panel.

The small size of the panel has two implications: one is that the recommendations will not be representative of the wider community, so this is good for more local solutions for researchers, government and industry. In contrast, for a world-wide problem such as climate change, it would be important to make a much more elaborate version, with citizens representing very diverse groups of people.

The organisers of the citizen's panel have to be well connected to a wide pool of experts.

The organisers have to be well versed in facilitation tools and a systems science methodology to facilitate and guide discussion and final recommendations.

There has to be a sincere interest by the instigators to listen to the citizens and not just inform them.

There has to be follow-up after by the organisers and instigators. This is because trust has been established, and this is delicate and easy to break.

Keywords: Citizen's panel, participative democracy, systems approach, institutional compass, complex problem, interdisciplinarity.

Technocracy or Democracy? Educating Citizens in the Era of Automation and Simulation

Piero Dominici

Abstract

Purpose – The purpose of this paper is to reiterate the crucial relationship between education and citizenship, describing the risks of reducing democracy to purely legal norms or delegating education to technology. The tendency of governments is to transform crisis or emergency into perpetual status, either from an inadequate understanding of the unpredictable, emergent properties of social complexity or for the purpose of maximising control over citizens, imposing top-down measures that stifle participation, limit freedom, and creating a mere simulation of the democratic process. We must not allow ignorance of complex systems, nor aspirations to greater political or economic power, to undermine participatory and collaborative citizenship, or to work against an environmentally sustainable democratic system, and it is education which will make the final difference.

The paper proposes two key questions crucial for reflection on the role of citizenship in a global world, urging a new social contract between citizenry and governance:
• How can a systemic approach to complexity in education and research contribute to democracy and citizenship?
• What does it mean today, in the civilisation of autonomation and simulation, to be active and collaborative citizens in a system which principally produces top-down models of participation?

Design/methodology/approach – An epistemological instrument is provided for analysing the amount to which genuine participation in democratic praxes has diminished, in the form of a three-tier pyramidal structure: simulation of participation, the lowest and largest level; hetero-directed participation, an intermediate, substantial level; active participation, the highest level, of much smaller dimensions. list the most important methodologies used or proposed by the paper.

Findings/Results – This paper undertakes to demonstrate that the crucial relationship between education, citizenship and democracy should no longer be considered a hypothesis.
It postulates:
• that there is a progressive, paradoxical lowering of the quality of educational and training institutions and their educators in today's hyper-technological "knowledge society", common to many nations, directly affecting the preliminary conditions for fostering a participatory citizenry;
• that the transnational tendency among educational environments to increasingly delegate responsibility and didactic processes to technology, under the mistaken

impression that teaching know-how and skills, in particular technical and digital skills, is more important than teaching critical thinking and the capacity to ponder "why", leads inevitably to an incapacity for genuine participation in democracy on the part of future citizens.

Originality/value – The paper introduces the need to unite two fundamental aspects of democracies that are generally considered opposing principles: the connection between trust in authority and the ability of authority (thus government) to recognise the self-organising properties of the living social systems they govern, in particular unpredictability and emergence, which invariably stem from the smallest sub-units and impact the entire system. This implicates the recognition that relevant change must be initiated among citizens, not by imposing top-down models and measures. Citizens will not trust a government that does not entrust them with truly active participation, and democracy will not survive if both governance and citizens have not learned to cope with the uncertainty intrinsic to the complex systems they inhabit.

Research/ Practical/ Social/ Environment implications - The methodological pyramid proposed as an epistemological approach provides a tool for social and political analysts to correct the diminishing participation in democratic praxes by recognising its progressive features:
• The use of repression, appeasement, and indoctrination to produce a mere simulation of participation.
• Techniques of fake inclusion, used to induce or hetero-direct participation, by giving citizens the illusion of sharing decision-making, such as media manipulation, communication campaigns, homologation and social censorship, triggering citizenry's compliance in adopting positions and demonstrating in support of instilled value judgments or pre-designed issues or emergencies.
• Active participation will be reached when all citizens have been taught to recognise, cope with, and inhabit the intrinsic uncertainty of complexity, collaborating towards an ecologically sustainable natural environment.

Research limitations - The most serious limit to adopting the methodology and evaluating the findings this paper has proposed rests on the diminished – at this point, almost non-existent - trust in authority and institutions prevalent today among many nations. The approaches herein endorsed may not be possible as long as political and economic leaders, along with scientific experts and academic specialists, continue to impose top-down policies and measures on individuals and communities, without genuine citizen involvement. Therefore, the methods and purposes described will remain pure theory until governance and political deciders re-establish transparency, accountability, and active citizen participation, restoring the trust they have lost due to underestimating, overriding and basically ignoring the value and the importance of grassroots opinions and initiatives.

Community-Based Research and its connections with Systems Thinking and Cybernetics

Zoraida Mendiwelso-Bendek, University of Lincoln

Rebecca Michell Herron, University of Lincoln

Abstract

Purpose – Sustainable futures and democracy are at the centre of our times. The lack of connection between citizens and the political class and institutions is creating uncertainty and reducing hope. Community-Based Research (CBR), as an umbrella term for participatory action research methodologies, has a number of connections with systems thinking and cybernetics approaches and methodologies. CBR is naturally immersed in reflective processes, building up capacity-building processes for social transformation and anticipating futures. This paper, from a fieldwork of coproducing knowledge and practices within community structures and organisations, observes the role of Community-Based Research in building up sustainable communities, transforming democratic institutions and anticipating futures, with the lens of Systems Thinking and Cybernetics.

Design/methodology/approach – CBR as a methodology is rooted within civil society and third sector organisations supporting organisations, groups and communities. CBR is an ongoing reflective process between different parts of civil society and authorities, defining the democratic limits of power. In each context it is building learning lessons from previous promising practices to facilitate civil and civic participation and social transformations. It is basically collective action over communities' social transformations immersed in ongoing reflective processes - reconstructing themselves again and again, (re)framing people's own reality and meaningful content and the structures and processes where active citizens frame power relationships.

Findings/Results – The paper outlines the roots of some of our work in Community-Based Research and learning and how they emerged from Systems Thinking and Cybernetics. It is based on journeys through multiple community projects supported and enhanced by the ideas of double-loop learning and 2nd-order Cybernetics, connecting bottom-up community processes with community organisations and embedding democratic capacity-building processes. From a transdisciplinary perspective, this paper presents the natural relationship between Community-Based Research (CBR) and Cybernetics by connecting CBR principles and values with Cybernetics processes to develop and inform a journey and recent developments in this field.

Originality/value – This work enriches the narrative and understanding of one of the big challenges of HEIs - the university and communities' partnership, the alliances in Community-Based Research and learning to support the communities' capacity-building processes' by engaging in policy development and decision-making. It expands

conceptual models and practical models for problem-solving and offers mechanisms for HEIs to foster healthy, trusty and prosperous relationships.

Research/ Practical/ Social/ Environment implications - This research supports the Third Sector (community organisers, community groups and civil society organisations) in their engagements with each other and local and national government bodies, public sector (state) organisations and other local decision-makers. The methodology supports the capacity of groups and individuals to organise community-based learning opportunities, create their own resources, develop capabilities to learn and articulate community-based research outcomes, strengthen democratic processes and help produce hope and optimism in these processes. The academic impact of this paper will be to help articulate how this activity has been shaped and strengthened by its roots in Cybernetics and Systems Thinking more generally so as to be able to draw on and extend both fields.

Research limitations - comments on the methodology and findings limitations. The uncertainty of community realities creates limits to the speed and sustainability of the processes. This is a sustained engagement (a commitment to co-production) over extended periods of time. Research outcomes and capacity-building may take on many forms appropriate to the communities involved (and may not always conform to academic norms and sector preoccupations). Community interactions and concerns can also be very complex, and it is often not possible to attribute outcomes and impacts in a simplistic fashion. Indeed, these need to be considered holistically and lend themselves also to a Systems Thinking and Cybernetic lens.

Keywords: Community-Based Research, Social Cybernetics, Community Based Research, Participatory Action Research, Experiential Learning

Section 1.2 Enhancing democratic processes

Coordinated by Raul Espejo and José Perez Rios

The abstract of the Congress shows that one of its purposes is offering citizen's stories to enhance society's future development. Our invitation is to build them up in the context of active citizenship in democracy. How is it possible to increase people's participation as citizens in nations, regions, institutions, and communities rather than as subjects or consumers. We are inviting contributors to the congress to offer stories that show examples of people increasingly building up contributions towards organisations through conversations that make apparent respect and mutual trust towards processes of organisational/environmental decision-making that enhance their values towards the collective production of purposes and the construction of shared interests for the benefit of their societies. These stories hopefully will show contrasts between people behaving as subjects and consumers towards people behaving as citizens sharing views and interests for the benefit of societies.

American Cybernetic Experiment in Governance: Shaping the Conversational Ecosystem for Exceptionalism

Lowell F. Christy Jr. The FORUM on democracy

Abstract

Purpose - The design of the American Experiment in Governance was founded on a series of unique and radical distinctions. The most radical ideas were grounded in a profound understanding of the limits of language and the need for systems of feedback, governing policies encouraging discovery and design of a physical and conversational infrastructure. Instead of "Smart" political systems ontologically based on systems of power and powerlessness, the political, social and cultural designs were epistemologically based on the Collective Intelligence processes of a Learning Nation.

Redefining the relationship of the People of a Nation as Co-equal with the power of the State and Keepers of Culture required an Age of Communications more advanced than the bits and bytes of our Information Age. History focuses on the power paradigm and explicit level of a physical war for Independence (1776-1783). The radical second American Revolution was a war of ideas forging unique systems of interaction embodied in the "Declaration of Interdependence" (1786-1791) embodied in the Constitution, Frame of Government and Bill of Rights.

What was the nature of ideas of a Mind of a People, their origin and consequence forming the American Experiment in the organization of individuals into a "more perfect Union?" Democratic Political design rests on finding the antidotes to systems of Power and Powerlessness yet empowers the extraordinary work of a Nation. Language provides the lens through which political systems are based on a power paradigm of "Survival of the Fittest" or the ecologically empowering "Arrival of the Fittest."

If Cybernetics is about control and COMMUNICATIONS in animals and machines, our field is pathologically distorted today in first-order manipulation of "things". Lacking in the deeper Arts of Assembly in communications, formation of information, we need to Re-discover the design of political intelligence beyond second order reflexivity. Political Ecology, Political Alchemy and Health of the Body Politic are explored developing an old/new systems science of health and socio-cultural therapeutics

Design/methodology/approach: Design of Living Institutions requires a Natural History of Consciousness systems methodology. Through distinctions and processes, it illuminates invisible interactive and conversational dynamics of the Democracy Method. A Natural History describes and maps the generative meta patterns (epistemological structuring) of a culture and its consequences. History of Consciousness traces distinctions organized into axes of orientation that processes perceptions. Linguistic anthropology looks towards the patterns embedded in one's very way of speaking.

Findings/Results: This Revolution of Mind countered a Continental Enlightenment still tethered to absolutist epistemological and political designs of Western Civilization and monotheistic religions. The task of the American Experiment was to bridge differences in people. languages and cultures into a greater whole. Conflict/difference was to be integrated at a higher level instead of externally controlled.

The American Experiment consisted of Revolutions of the Mind. Mind is a cybernetic system of repetitive patterns but requires interaction with systems outside itself making it inherently ecological. Mind was immanent in the communication messages and interactive pathways of a living system.

Originality/value: Systemic Change in the design of human systems and governance structures is difficult. The Founding Generations design lens of Political Ecology, Political Alchemy and the embodied Body Politic of 1776 was echoed in the 1976 high water mark of whole Cybernetic thinking but has been lost in the past fifty years. A Democracy Method based on a different model of language and communications is outlined complimenting discreet, analytic, reductive methods of today's Natural Sciences.

Research/Practical/Social/Environment Implications: Invisible dynamics of designing our policy, governance and thinking requires answering the question of "How do we transcend the limits of Language?" The design principles of 1776 and 200 years later in 1976 provides a tool shed of methods countering democracy's winter of discontent.

How does the Ship of State navigate the environment beyond its direct control, design it's institutions and create a union more than a forced union of its parts? Constitutional design of the organization of dependency, independence and interdependence requires new systems sciences informed by the natural experiments of the American Revolution of Mind and lessons from the Cybernetic Moment of the past seventy years.

Research Limitations: Integrative systems research on the design of political systems and how paradigms become embedded in language requires new Natural History tools that this paper only points towards.

Keywords: democracy, tyranny, systemic change, Political Ecology, Political Alchemy, American Revolution of Mind

Double Closed Non-Trivial Machines: from Learning Systems to Nation States and Global Decarbonising

Clas-Otto Wene,

Raul Espejo, President of World Organisation of Systems and Cybernetics; Syncho LTD, UK

Abstract

Purpose – Purpose: Develop a theoretical platform that computes the eigenbehaviour of a non-trivial double closed isentropic machine that follows Onsager relations. The machine is referred to as a NOR-isentropic system. Demonstrate that the eigenbehaviour of the NOR-isentropic system explains the observed learning curves of technology learning systems and the decarbonisation curve of the global economic system. Propose applying the theoretical platform to investigate the behaviour of Westphalian nation states.

Design/methodology/approach - The development of the theoretical platform is based on earlier cybernetic theory for the learning system. The theory understands eigenbehaviour of operationally closed and history-bound systems from analysis of entropy and characteristic eigentime. The unperturbed NOR-isentropic system operates in the linear non-equilibrium regime where the Onsager relations are valid. Analysing the system as a quantum-like object predicts learning rates that agree with empirical observations.

Findings - There is comprehensive empirical evidence for the computed eigenbehaviours of the NOR-isentropic system. Reversely, the findings ground learning curves and the global decarbonisation curve in well-established theory.

Practical/policy implications - The theoretically grounded learning curve reduces the applicability of a key macro-economic theorem and legitimises government's intervention in markets, e.g., in the form of deployment programmes.

Originality - Based on findings in non-equilibrium thermodynamics and quantum theory, the cybernetic theory for operationally closed systems is extended and applied to important social systems where it can be verified by empirical evidence.

Research limitations/implications - The findings raise important research questions for the application to Westphalian nation states, e.g., the measurement of input/output and the design of the Environmental Avatar mediating environmental features, events and processes that have to be managed by the system.

Keywords: eigenbehaviour, learning curve, decarbonisation, non-equilibrium thermodynamics, quantum-like systems, Westphalian dilemma

Colombia 2023: democracy, responsibility, and decentralisation

Germán Bula Escobar, Independent lawyer-Arbiter-Consultant

Abstract

Purpose – The purpose of this article is to address the cybernetic-systemic approach necessary to help resolve the current strong tension between centralisation and decentralisation in Colombia.

Design/methodology/approach – The methodology used in this paper is based on:

A. Observations on i) electoral results ii) survey results iii) statements by political leaders iv) current political context.

B. The cybernetic-systemic approach

Findings/Results – The main conclusions reached by the investigation are:

• That the central government does not have the required variety is a long-standing fact that has promoted legal reforms in Colombia since 1986.

• Simple regulatory changes do not guarantee cultural changes, which must be explicitly promoted.

• In a kind of control dilemma dynamic, Colombian authorities decentralised the State after legal reforms established important rules for decentralisation.

• Despite all this and due to the successive iterations and the arrival of new generations, in 2023-2024 we are facing a qualitative leap: in the eyes of the urban population, it is clear that they cannot have expectations in the central government but in local authorities in relation to sensitive and crucially important issues such as security, mobility, education, etc.

• It is now possible and mandatory to achieve adequate alignment between strategy, structure, and culture.

Originality/value – There are no known approaches to using systemic cybernetics to address the issue of decentralisation in Colombia, specifically on the current situation of cultural qualitative leap.

Research/ Practical/ Social/ Environment implications - The issue of decentralisation and autonomy is high on the agenda in the current Colombian political situation. This research aims to directly impact current debates.

Research limitations - This research is only the beginning of what should be sustained work. The debate has reached its peak in Colombia at this time and has to culminate in a

viable design after having gone through back-and-forth experiences (control dilemma). Besides, it needs a multidisciplinary approach.

School of Democracy with complexity and cyber systemic approach

Rafael Rodríguez, founder and partner of de Cora, Computer Aided Logistics, S.L. (CALS), Member of the Board of Directors of the Sociedad Española de Sistemas Generales (SESGE)

Ricardo Barrera Professor (retired) at the National University of Patagonia San Juan Bosco and the National University of Tierra del Fuego. Member of the SESGE board Member of ISSS; ASC, ELAPDIS (coordinator for Argentina) and CESDES (academic coordinator)

Abstract

Purpose - Democracy is not given to society or that it receives. Democracy is not a party, a religion, or a science. It is a process, a way of life. It is the decision that society makes that affects everything, asking: what are the relationships like in the couple, the family, companies, school, institutions…?

Ibero-America is a place where people of the same backgrounds and origins have diverse expectations. More than five hundred years ago, the above-mentioned expectations crossed America, Europe, and Africa. The independence process started two hundred years ago. Democracy was established in nearly all nations of Ibero-America thirty years ago.

We want Ibero-Americans to know, understand, study, and consider the possibilities of democracy and how to bear upon the future to make a fairer, more tempting, and equal society. This can happen with a School of Democracy.

Why is a School of Democracy needed? The people must defend democracy, and reflections are delayed since there is disappointment among the people. But democracy is defended by showing its benefits, and we must install that in future generations. It is not defended only with legal norms; we must work to improve the quality of democracy.

We aim to see how the complexity and cyber-systemic approach contribute to understanding the issues involved in this matter.

People should come across a learning process with the most suitable tools herein considered to deal with the outlined issue. This process will have two steps. The first one will assimilate the potentials and limitations to apprehend the efficient management of the same.

The second step will develop the transmissible abilities out of the results obtained by the community.

We consider that complexity and cyber-systemic approach give out comprehensive tools for the interactions and connectedness of the different components of a system. Thus, it

can help to create roles that simulate behaviours, to analyse the proposed political consequences.

Design/methodology/approach - As a theoretical framework, the inductive/deductive reasoning method was applied to find links between the basic notions of complexity, cybernetics, and systemic theories. The transductive reasoning method and conceptual pedagogy were used to find the articulations between the concepts and propositions of complexity and the design of the School of Democracy.

Findings/Results - The School of Democracy should be given at different levels. Starting in kindergarten and finishing at the political level. Not necessarily sequentially but in parallel. It can be provided at Universities, Events, Congresses, and other interactions.

Originality/value – Complexity and Systems Thinking are often missing in political governance, organisational and personal mindset and actions. Thus, education for democracy should be applied to invoke democracy as "a process, a way of life".

Research/ Practical/ Social/ Environment implications - We are immersed in growing populism, violence, wars and the lack of democracies around the world. A School of Democracy can have an important positive impact in changing patterns of behaviour in individuals and society, and best practices and good governance in public organisations. The 17 Goals for Sustainable Development could be much better implemented with Systems Thinking and changing the minds with a possible 18 new goals for sustainable minds.

As Humberto Maturana expressed: "The notable thing about democratic coexistence is that it is based on mutual respect, collaboration, equity, and social ethics, not as values in themselves, but as behaviours that constitute a set such that, if one, all the others disappear. They are behaviours that do not require philosophical, scientific, or political justifications. They are not promises, demands, or assumptions, and they are learned in practice in everyday life because they are all spontaneous aspects of our coexistence. And so much so that its violation is always justified with a theory that denies love."

The School of Democracy should contribute to this Coexistence.

Research limitations - The authors did not receive any funding to carry out this research.

Keywords: Democracy, Complexity, Cyber systemic, School of Democracy, Culture, Ibero-America.

Structural design and democracy. The Viable Systems Model in the face of Artificial Intelligence advances.

Jose Perez Rios

Abstract

Purpose - The dizzying development of Artificial Intelligence (AI) poses challenges of hitherto unknown dimensions for humans. Its ability to make decisions without human intervention that may affect humans and their organisations makes it urgent to understand the implications of its extension, diffusion, and use.

Until now, any innovation, including, for example, the ability to use nuclear energy, has always depended on human activation of its use. Still, this ability to choose is called into question by new developments in AI.

The interaction between humans, between humans and non-human entities and the interaction between non-human entities themselves pose enormous challenges.

The implementation of AI in a multiplicity of organisations at various recursion levels poses new challenges to the way that communication and information are handled throughout the organisations' structural and functional components.

The challenges that Artificial Intelligence (AI) presents to decision-makers (and humans in general) trigger the search within the CyberSystemic field to help them face those new challenges.

Design/methodology/approach - The approach used is systemic-cybernetic. Within this field, there are concepts and methodological tools (e.g., Organizational Cybernetics, the Viable System Model, etc.) that may help decision-makers face the new complexities posed by AI's general diffusion and deal with organisational pathologies.

From the CyberSystemics point of view, the question arises as to whether the knowledge contained in our field can be helpful in the face of these new challenges. Concepts such as "variety," "variety engineering," "design of recursive structures," "governance" of such structures, "communication ability between humans and organisations," "understanding of dynamic, structural, and decisional complexities," and many other elements understood and used in the CyberSystemic field may help deal with this new type of complexity.

Findings/Results Given the novelty of the challenges, the paper aims to shed some light on how CyberSystemic knowledge may help us understand what some CyberSystemic approaches could offer to help the new situation. Finally, I will show how to use Perez-Rios´s Taxonomy of Organizational Pathologies (TOP) to facilitate and accelerate communication between decision-makers on complex issues such as those mentioned above. This Taxonomy structures some of the most frequent organisational pathologies in three main groups: 1) *Structural Pathologies*, which identify flaws in how the vertical division of organisations faces the

complexity of the environment; 2) *Functional Pathologies*, which deal with the lack or incomplete design or functioning of the functions that the VSM indicates as necessary and 3) *Information Systems and Communication Channels Pathologies*.

Originality/value The originality is in how CyberSystemic concepts and methodologies may be used to face a new and significant potential problem as AI may represent if its implications are not fully understood.

Research/Practical/social/Environmental implication -The social implications can include a better understanding of AI's potential dangers and awareness of the availability of some knowledge and methodologies to face the challenge.

Research limitations Since AI is still in its initial stages of development and diffusion, this paper's reflections are limited by insufficient knowledge about its practical implications for institutions, organisations, and social groups in general.

In this brief paper, I will limit myself to outlining elements of the complex problem mentioned above and some ways that may contribute to handling them. I will point out which methodological approaches may be helpful for some of the frequent types of complexity. I will indicate how Organizational Cybernetics and extensions of the VSM as Espejo´s Enterprise Complexity Model can be used to help design recursive structures and identify the aspects to be addressed at each recursion level.

Keywords: Artificial Intelligence; Complexity; Viable System Model; Organizational Pathologies.

Citizenship and design of structural mechanisms

Raul Espejo, President of World Organisation of Systems and Cybernetics; Syncho LTD, UK

Abstract

Purpose – Make all citizens in society active contributors to respond to ecological challenges at high levels of performance. This article aims at reducing hierarchies within organisations and increasing balanced relationships between them and environmental agents.

Design/ methodology/ approach - in this research, beyond the more traditional view of organisations as black boxes receiving inputs from and producing outputs to their environments, its emphasis is on citizens' structural mechanisms to achieve collaborative cohesion to deal with ecological challenges. For this purpose, it discusses communication improvements in organisational systems, reducing the extent to which relations of policymakers and workers are dominated by hierarchies. The approach is designing non-hierarchical relationships supported by the law of requisite variety. This article aims at correcting variety imbalances between policymakers and actors and between customers and suppliers, that is, among members of an organisation and between organisational actors and environmental agents. Overall, this contribution wants to clarify abuses of relational power. The argument is that through social and technological transformations, ecological relations become the outcome of organisational interactions, producing degrees of shared trust, creating truth and respect between each other, with a better capacity to capture and create value in society, producing evolving meanings that transform the computation of their relations into evolving desirable identities.

Findings/results - Insufficient investment and limited expertise in complexity management produce costs and generate risks that may exceed an organisation's capacity to create and capture value for environmental and systemic transformations. Complexity management scientists have explored data management through discussions of chaos, complexity, and order and as such, this paper is an introduction to manage the proliferation of big data in situations relevant to shaping collaborative ecosystems for tomorrow.

Originality/value - This contribution offers a non-trivial approach to people's system-environment interactions. Most significantly, its value is shaping in desirable directions people's corrections of variety imbalances at all structural levels, from the most global to the most local, through reflective communications. At all these levels, which are understood as systemic structural recursions, people share the challenge of policy creation, underpinned by regulation and production of changes in their environments. It is central to ecosystemic transformations that global creations are well connected with

successive creation of ideas of social transformations at all levels of society. This is perhaps the most original aspect of this contribution; all participants are contributing from their organisational and environmental perspectives with interrelated changes in their informational and operational domains. Gaps among these domains, where some creations are not connected and supported in their operational implementation, suggest that the structural recursive articulations are not well supported by appropriate relationships and conversations, the outcome of fragmentation and lack of systemic cohesion. The originality of this contribution is that through conversations where chaos, complexity and order are entwined at successive structural levels, people in social systems produce a cohesive reflection of the policy issues of interest.

Research/practical/social/environmental implications - The challenge is producing methodological aids to link the informational and operational domains of the multiple participants in their relevant ecosystemic interactions. This is achieved through relational learning loops that relate structures of people's interactions with their ideas and resources.

Research limitations - It would appear that the elaboration of the conceptual and methodological views of this paper requires research teams in academic centres beyond their particular topics of interest, benefiting from cybernetic and systemic thinking. Through this systemic empirical work in policy issues, social actors may achieve sustainable development goals in issues such as climate change, resource restrictions, educational shortcomings, technology and so forth. Lacking resources to deal with sustainable development goals would offer a limitation to this research.

Keywords: Sustainable development goals, citizens, informational and operational domains, requisite variety, conversations, structural relationships, ecosystemic interactions.

Resilience and Antifragility in the Soviet Political System: Khrushchev, Brezhnev and After

Robert M. Cutler (rmc@alum.mit.edu) Waterloo Institute for Complexity and Innovation, University of Waterloo

Abstract

Purpose – The study offers a comprehensive approach to resilience in the design and maintenance of organizations. In particular, it discovers the targeted need to diminish short-term or medium-term resilience in order to manifest antifragility and so enhance survivability during turbulent change. Specifically, it applies a framework from the science of complex systems to the analysis of the evolution of the Soviet political system (1922–1991). The Khrushchev and Brezhnev regimes in particular are analyzed using the "emergence–autopoiesis–coherence" (EAC) framework.The study extends the EAC framework to validate a related broader-scale complex-systems schema ("evolutionary phenomenology of resilience", EPR). The principles of this framework may be applied to improve the functioning and survivability of diverse organizations, social structures and systems in general.

Design/methodology/approach – The logic employed in the study is both categorical-synthetic and second-order cybernetic. This means that it systematically integrates categories of complex-systems theory to examine feedback and self-regulation processes in the case study to hand. The approach is implicitly underlain by a correspondence theory of truth, whereby there is a constant (even "dialectical") verfication of the analysis against the facts and events that characterize the real phenomenon, thus assuring that the findings align with objective reality. This correspondence theory of truth is united with a coherentism based in the epistemology of complex systems. This means that the method also relies on structured interconnections amongst the categories of the EAC and EPR complex-systems theories (and their applications) to verify and validate the conclusions.

Findings/Results – The three main findings are: (1) the years 1953–1964 and 1964–1976 manifest two consecutive EAC cycles; (2) these two cycles together represent three phases in the overall evolution of the Soviet political system when we understand this political system as a complex system of nine phases from 1922 to 1991; and (3) those nine phases correspond with the nine periods set out in a framework which builds upon the EAC framework, the "evolutionary phenomenology of resilience" (EPR) framework. The USSR constructed itself as a resilient organisation, but the over-learning of past lessons created behavioural syndromes of dysfunction in the face of new challenges, leading to its demise.

Originality/value – An updated reconstruction of K.W. Deutsch's mid-twentieth century work on cybernetic-based learning in political systems is applied to the analysis of the

growth, development and collapse of the Soviet political system. Through this process, Deutsch's original insights are validated, and the robustness of the analytical framework he proposed is demonstrated. The applicability and the analytical value of the EAC cycle is confirmed, along with the EPR framework that builds upon it. This comprehensive approach leads to a new and deeper understanding of the evolution of the Soviet political system. It offers fresh perspectives for contemporary social, political and organizationsl analysis. An Appendix builds further on the EPR framework to speculate on the eventual fate of the Russian state.

Research/ Practical/ Social/ Environment implications - The analytical framework and conclusions derived from this study hold significant value for the practical design and development of resilient organizations. By integrating these insights, organizations can enhance their ability to withstand and adapt to various challenges and disruptions. The study also has broader relevance and usefulness. The conceptual framework's applicabilitye extends beyond organizational contexts to social, political and economic systems and structures of whatever scale. This means that the principles identified and validated in the study can be applied to improve the functioning of diverse systems, whether they are human-created or naturally evolved. The study therefore offers a comprehensive approach to resilience, including the need for antifragility in the long term, even if this implies a salutarily diminished resilience during identified intervals in the short or medium term.

Cybernetics and a critical organisational praxis – notes from India

Sujay Dinnalli, Efion Management Consulting Private Limited

Ushma Desai, Efion Management Consulting Private Limited

Abstract

Purpose – The need for nurturing Indian organisations is evident from the low percentage of organised sector workers in the country's workforce, the dearth of industrial innovation, and other socio-economic indicators. In our own experience as consultants, we have witnessed how socio-cultural factors impinge on organisational success and individual well-being - hampering knowledge creation, growth and innovation, and creating stressful work environments. Social research in Indian organisations reveals much the same, focusing on societal dynamics and the cultural differences between East and West. Critical studies foreground decolonisation imperatives and have called for the uncovering of indigenous management knowledge and organisational epistemologies. However, there is a clear gap between theory and practice in management as Western paradigms operate tacitly, and a methodology to uncover indigenous knowledge is missing. We see a role for systemic thinking and cybernetics to address the issue at organisational and sectoral levels. In this paper we conceive of a 'critical organisational praxis' inspired by Friere's ideas of dialogue and problematisation, and organisational cybernetics. We seek to develop a theory of critically intervening in organisations to improve dialogue, and for ways to enable an interplay between parallel organisational epistemologies (Western and indigenous). Further, we argue that the development of indigenous knowledge is only possible from local knowledge uncovered through practice, and dialogue between systems of knowledge.

Design/methodology/approach – At the outset, the paper is conceptual and attempts to provide a theoretical discussion about the nature of a critical organisational praxis and its constituents. Methods and modalities for the purposes of improving dialogue and introducing systemic thinking are then explored using examples from practice. Some of the techniques described in these examples include structured and semi-structured interviews to uncover individual narratives, Transactional Analysis (Berne) and Cultural Dimension Theory (Hofstede) to frame narratives and bring reflexivity, and the Viable System Model (Beer) for diagnosing structural relationships in organisations.

Findings/Results – Firstly, we have seen through practice that there is a need for indigenous organisational knowledge, in the form of models and metaphors. The gap between Western-oriented and indigenous understandings must be bridged. We have seen the value of Transactional Analysis and Cultural Dimension Theory in providing reflexivity to organisational actors in the negotiation of organisational roles and expectations. Further, the Viable System Model was seen as a powerful paradigm for situating narratives. Its value was evident in the framing of relational challenges and

power asymmetries as issues of structure and design, and not merely as individual shortcomings.

Originality/value – In the Indian context, this contribution is a step in the direction of describing an indigenous approach to management. While there have been increasing calls for research in this direction, methodologies are missing; this paper has the potential to initiate deeper conversations on the topic. At a more general level, the critical organisational praxis described here is about humanising systemic knowledge and describing a pedagogy of co-created systems, especially among stakeholders from varied socio-cultural backgrounds. In this sense, there is a novelty in the use of the VSM in conjunction with sociological and psychological models.

Research/ Practical/ Social/ Environment implications – As Indian stakeholders such as entrepreneurs, consultants, industry bodies or government attempt to enable successful Indian organisations in a globalised world, there is an impending collision of socio-cultural worlds as people from different backgrounds are thrown together at workplaces. Therefore, a critical approach to intervening in organisations is the need of the hour for creating inclusive, democratic and viable organisations. Workplace narratives gathered over time using such an approach can provide rich, qualitative information to support further research on the nature of organisational membership in India, especially with respect to aspects of decolonisation, social dynamics and indigenous knowledge creation in organisations. This could also be of relevance in other geographies where organisations are venues of interplay between people from different backgrounds.

Research limitations – This paper is largely conceptual and describes an approach to study and intervene in organisations that is both critical and systemic. In that sense, it is a call for action in the development of a critical praxis. In terms of methods, techniques such as structured interviews, Transactional Analysis and Cultural Dimension Theory are discussed for their value in enabling dialogue and offering reflexivity. However, the paper is by no means exhaustive on dialogue-building methods, nor does it provide a framework for the same.

Keywords: Organisational Studies, Consulting, Viable System Model, Indian Organisations, Decolonisation, Indigenous Knowledge, Dialogue, Critical Pedagogy

Journey Upstream to the Wellsprings of Democracy and its Revitalization

Valarie C. Lamont, Ph.D. Co-Founder The Forum on democracy

Abstract

Purpose – This is the lesson filled story of a small group of concerned citizens whose intensive four-year journey to find the levers of systemic change to reverse the decline of Democracy processes and counter creeping Authoritarian "Answers."

The evolution of how the initial "Designing Government FORUM" transformed into a viable "FORUM ON DEMOCRACY provides the story behind Margaret Mead's famous quote about "a small group of thoughtful, committed citizens" seeking the systemic levers of change.

The key word in Mead's quote is "CITIZEN." A citizen is central in a democracy, providing the unique perception of the union of parts of the whole that makes for a living, viable system of Governance.

The deficiencies of the current Institutional Landscape and default Newtonian power paradigms became evident as we moved upstream into Problematiques, unsolvable with current methods of developing policy, traditional ideas of government and counterproductive patterns of thinking. The false starts and blind alleys developed the vocabulary and conversational style to cut through the stimulus -response cultural wars of today to develop a road map of the leverage points of change.

Overcoming the speed bumps in our own thinking emerged in conversations between those steeped in attempts to change government and those trained in the original vision of the Cybernetics Revolutions. Our journey reveals all the wrong methods of applying Cybernetics, Systems and Design to the ability to live up to its etymology of navigation, of a rudder in turbulence and to govern. The grand challenge faced by those seeking to apply Cybernetics, Systems and Design to revitalize and rebuild experiments in Democratic forms of Governance is how to not think about the problem but to seek intelligence beyond the Smarts of our dysfunctional socio-cultural-political environment.

Design/methodology/approach – A road map emerges from a modern-day FORUM seeking to become a Meta Network of Citizen Networks catalyzing islands of civic coherence into a National Conservation of Systemic Change.

The Forum is a nonprofit, non-partisan organization whose purpose is to revitalize the American Experiment in democracy. On December 1, 2023, the Forum on democracy partnered with the Policy Studies Organization's Dupont Summit to present "Policy, Thinking and Governance ...AS IF Democracy Matters", a hybrid conference with an

international audience, to present our approach and actionable recommendations, on what is needed to right the American Experiment in democracy.

The story of The Forum's 4-year journey is informative to others grappling with issues of governance and democracy and, more broadly, the need for and the obstacles to systemic change. The lessons learned from our successes and failures may be unique to American society but the process of posing questions to begin our journey may be of universal interest.

Findings/Results - This journey took many twists, turns and bumps in the road, including significant shifts in thinking and emphasis over the course of our conversations. Of note:

• A shift from government to governance
• The central role of the Citizen and organizations of Citizens is to maintain the health of democracy and system of governance
• The inability to change the system directly requires new models and paradigms
• A whole living systems approach for institutions, understanding both the relational nature of the parts and the interactions of the parts, making a greater whole
• Groups of citizens in conversation can change a system, it has never been otherwise

Originality/value – Our discussions, deep research and levels of thinking underscore the need for a new lens/paradigm/model to view the world. The Newtonian science paradigm is inadequate to deal with the complex issues of whole living systems. This presentation may stimulate thinking about the stepping stones leading to systemic change in areas beyond the American example.

As a consequence of our emerging directions, The Forum has partnered with the International Federation of Systems Research (IFSR) to host a one-day event on June 14, 2024, convened around conversation tables to discuss specific ideas on systemic change based on recommendations from The Forum's Dec. 1, 2023 conference. These conversations will then move to the World Organization on Systems and Cybernetics in September 2024 for further discussion and refinement of the next steps.

Research/ Practical/ Social/ Environment implications - How we live together can be decided by a small group of people who see the need for changing the context of illegitimately exercised power or a change in its deep structure.

How do we navigate away from the Law of Rulers to the Rule of Law requires a vastly different way of thinking and methods applied to systems of power that will resist any form of change towards a fully functioning democracy?

Research limitations - System change takes time and development. It requires levels of thinking and intelligence. It requires understanding that the parts of a system are not only related but also interact and the interactions have consequences.

Enhancing active citizenship in self-developing polysubject environments (ontological approach)

Vladimir Lepskiy Institute of Philosophy Russian Academy of Sciences, Moscow, Russia.

International Center for Social Systems Development of the International Research Institute for Advanced Systems (ICSSD IRIAS). (e-mail: VELepskiy@mail.ru)

Abstract

Purpose – Self-developing polysubject environments (SPE) of hybrid reality is the basic object of post-non-classical third-order cybernetics (Lepskiy, 2018). An analysis of the experience of pilot projects of the SPE organisation made it possible to identify fundamental problems, in many cases associated with the opposition of the bureaucratic apparatus and public and political organisations close to it, with a high level of corruption. To solve these problems, it is necessary to create new metacybernetic models (concepts). To organise and support SPE, it is necessary to create a special starting (highly intelligent) mini SPE*. Since in third-order cybernetics, SPE is considered as metasubjects, it is necessary to form a new cybernetic paradigm, "Metasubject ` Metasubject", and a new system of ontologies, philosophical and methodological foundations of fourth-order cybernetics.

Design/methodology/approach – The basic methodological foundations are post-non-classical scientific rationality (V.S. Stepin, 2005) and the methodology of post-non-classical cybernetics of SPE of hybrid reality (third-order cybernetics - V. Lepskiy, 2018). The role and relevance of the ontological approach is substantiated by the example of the analysis of modern models of cybernetics (R. Espejo, V. Lepskiy, 2022), the role of which is increasing in improving the mechanisms of public participation in the processes of control and development of modern social systems. A system of ontologies of post-non-classical cybernetics of the fourth order is proposed.

Findings/Results – The article proposes a system of ontologies for organising the formation (start) of SPE of hybrid reality and ensuring their interaction with other environments. Firstly, the formation of a community of socially responsible leaders focused on the interests of the development of their countries and the world community as a whole. Secondly, special training of socially responsible leaders for their inclusion in specific SPE of hybrid reality (regional, corporate, etc.). Thirdly, identifying and neutralising negative factors for the formation (start) of specific SPE. Fourthly, the formation (start) of a specific SPE. Fifthly, support for the processes of interaction of the created environment with other external environments. The proposed system of ontologies can be the basis for the formation of fourth-order cybernetics. The proposed approach can be applied to improve the mechanisms of public participation in the control and development of various social systems (regional, departmental, corporate, etc.). To test the proposed foundations and system of ontologies of fourth-order cybernetics, an

initiative pilot project was launched in 2024 on the basis of the International Center for Social Systems Development of the International Research Institute for Advanced Systems (ICSSD IRIAS) (part of IFSR).

Originality/value – The formation of fourth-order cybernetics is associated with socio-political obstacles common to various types of social systems and various types of civilisations: the dominance of hierarchical control mechanisms, the lack of adequate opportunities for active citizenship, and corruption. The article proposes ontological foundations for the formation of post-non-classical cybernetics of the fourth order. It is fundamentally important that the creation of a new paradigm of cybernetics satisfies the principle of compliance with N. Bohr and the ideas of T. Kuhn, which will ensure the continuity of the experience of first, second, third and fourth-order cybernetics. The implementation of N. Bohr's principle of correspondence is based on the ascending line of subjectness. First-order cybernetics (N. Wiener) – "Subject-Object" paradigm, second-order cybernetics (F. Förster) – "Subject – Subject" paradigm, third-order cybernetics (V. Lepskiy) – "Subject – Metasubject" paradigm, fourth-order cybernetics – "Metasubject – Metasubject" paradigm.

Research/ Practical/ Social/ Environment implications - The proposed approach can have a significant impact on enhancing active citizenship and improving the mechanisms of public participation in the control and development of social systems. It is focused on stimulating and supporting the activities of socially responsible leaders, the formation of a socially responsible development elite, the formation of a space of trust and the consolidation of the state, society, and entrepreneurs. In the context of the crisis of traditional representative democracy, the proposed approach can help increase the role and possibilities of organising direct democracy in SPE of hybrid reality. This approach will influence the development of qualitatively new foundations for the socio-humanitarian assessment of digital transformations and AI.

Research limitations - The proposed approach will face difficulties in practical implementation in social systems with harsh forms of authoritarian control methods, high levels of corruption, as well as the dominance of racist and nationalist elements of the worldview. The possibilities for implementing SPE will be negatively influenced by impacts aimed at atomising society and reducing the activity of socially responsible leaders (destruction of the institution of family, uncontrolled use of digital transformations and AI, etc.). At the same time, it was the solution to these problems that initiated the development of the proposed approach.

Keywords: active citizenship, third-order cybernetics, fourth-order cybernetics, ontologies, post-non-classical scientific rationality.

Section 2.1 Systemic Governance and Management

Coordinated by Markus Schwaninger, and Sandro Schlindwein

The purpose of this stream of WOSC 2024 is to foster the theory and practice of systemic approaches to organizational governance and management. In the title of our section, we plead for integrating the ecological, social and economic dimensions of organizational governance and management. This would reflect a systemic approach. Currently, the evidence suggests that an integrative take on governance has been announced frequently but realized only sparingly. We invite contributions to a successful systemic organizational governance and management. Both theoretical papers proposing conceptual models and practice-oriented submissions with cases or examples are welcome. Questions to be addressed in this stream:

What constitutes systemic governance as opposed to non-systemic governance? Are there cases which illustrate that distinction?

How can a systemic governance be achieved? How can it be brought to fruition?

Are there Real-world experiences with a systemic governance approach that succeeded or failed?

Are there cases or examples to document these experiences?"

Mapping the Evolution of Systemic Governance and Management: A Bibliometric Analysis

Bojan Žlahtič, Peter Kokol, Grega Žlahtič, Milan Zorman

Abstract

Purpose – In the context of Systemic Governance and Management, this bibliometric paper aims to systematically map the literature, revealing the development and evolution of systemic approaches. It identifies key studies, themes, and trends, highlighting influential works and authors. Through citation analysis, it assesses the impact of research, uncovering under-researched areas and guiding future research directions. This study reveals the integration of ecological, social, and economic dimensions in governance, pinpointing theoretical and empirical gaps. It serves as a bridge between academic research and practical applications, showcasing tested theories and models relevant to practitioners. Additionally, it underscores the importance of interdisciplinary collaboration by mapping contributions across disciplines. This bibliometric analysis provides a foundational understanding of systemic governance and management's current state, historical development, and potential future trajectories, making it a critical resource for researchers, practitioners, and policymakers.

Design/methodology/approach – This study employs a bibliometric analysis using the Bibliometrix tool, an R package designed for comprehensive science mapping analysis. Data for the analysis were collected from the Scopus database, chosen for its extensive coverage of relevant literature in the fields of systemic governance and management. The methodology involves extracting data on publications within a defined timeframe, focusing on keywords, citation patterns, and co-authorship networks to map the scholarly landscape. This approach allows for the quantitative assessment of research trends, thematic clusters, and influential authors, providing a systematic overview of the field's evolution and current state. The Bibliometrix tool facilitates the identification of research gaps and emerging trends, guiding future inquiries.

Findings/Results – The bibliometric analysis revealed a significant growth in publications on systemic governance and management, highlighting a growing academic and practical interest. Key themes identified include sustainability, resilience, and organisational adaptability, with a notable shift towards integrating digital transformation. Influential authors and seminal works were mapped, showcasing the foundational contributions to the field. Research clusters demonstrate interdisciplinary engagement, particularly with environmental science, economics, and sociology. However, gaps in empirical studies and practice-oriented research were identified, suggesting opportunities for future work. The findings underscore the importance of systemic approaches in addressing complex organisational challenges and the evolving nature of governance and management literature.

Originality/value – This bibliometric study stands out by systematically mapping the systemic governance and management literature using the bibliometric tool and Scopus data, offering

a novel, comprehensive overview of the field's evolution, key contributors, and thematic trends. It uniquely identifies interdisciplinary intersections and research gaps, highlighting areas ripe for future exploration. The study's value lies in its provision of a structured foundation for both scholars and practitioners, guiding them through the vast body of literature and underscoring the significance of systemic approaches in organisational governance. It paves the way for innovative research directions, fostering a deeper understanding of systemic governance and management.

Research/ Practical/ Social/ Environment implications – This study illuminates pathways for enriching systemic governance and management practices, directly informing future research, policy-making, and organisational strategy. It fosters a greater understanding of the social and environmental implications of governance practices, encouraging sustainable and inclusive approaches in organisational and societal contexts.

Research limitations – The study's findings are constrained by the scope of the Scopus database and the bibliometric method, which may overlook relevant literature not indexed in Scopus or emerging topics yet to gain substantial scholarly attention.

Keywords: Systemic Governance, Organizational Management, Sustainability, Bibliometric Analysis, Interdisciplinary Collaboration

Appreciating systemic governing of human-biosphere relationships in the Anthropocene: Scotland's River Dee

Houda A. Khayame[a]*, Kevin B. Collins[b], Ray L. Ison[c]

(a), (b), (c): Applied Systems Thinking in Practice (ASTiP) Group, The Open University, Milton Keynes, UK

* Corresponding author: The Open University, Walton Hall, Milton Keynes MK7 6AA. Email: Houda.Khayame@open.ac.uk

Abstract

Purpose – In 2021, National Geographic claimed that "rivers and lakes are the most degraded ecosystems in the world" due to human-made alterations, pollution and climate change. The UK situation is one of contrast and contested agendas within policy and governance debates. Good ecological status was met by only 14% of English rivers in 2022 and by 66% of Scottish surface waters in 2023. Scotland's River Dee is renowned worldwide for salmon fishing and provides habitats for protected species and drinking water for humans. However, like all rivers, its water quality and biodiversity can only be sustained and improved through the effective governing of rivers and associated water bodies in a human created Anthropocene-world. This research aims to understand how, and why, in an Anthropocene context, chosen institutions and practices may be more (or less) systemic in governing ecological, social and economic dimensions of the River Dee.

Design/methodology/approach – Drawing upon the Open University's tradition of Systems Thinking in Practice (STiP), we use a systemic inquiry to explore situations of concern about governing human-biosphere relationships in the Anthropocene. In so doing, the research adopts a framing of "systemic governance" interpreted as "institutional designs and governance praxes enacting feedback processes so that actions can be taken that affect the quality of the relationship between social and biophysical systems". We bring forth the River Dee as a system of interest for case study research informed by first and second-order systems approaches. Narrative and ethnographic methods are used for data collection and diagramming techniques for iterative analyses. Rigour, reliability and validity are addressed through systematic coding, thematic categorisation and data triangulation. Insights from the literature review and primary data analyses are braided to answer three research questions:

- To what extent do practitioners' understandings of the Anthropocene affect their thinking/practices in governing?
- To what extent, why, and how do practitioners of governance use systems thinking in their situated praxes?
- What changes do practitioners of governance see as being desirable, feasible and ethical (or not) in their thinking and practice to institutionalise their situated praxis?

Findings/Results – Empirical evidence and insights from lived experiences illuminate preliminary findings, which can be understood as showing two different but related governance systems with diverging and converging interests in managing the River Dee. These are (a) a system owned by the Dee Fisheries Board and Dee-side landowners to increase salmon populations by 'improving' the biophysical system of the river in order to sustain incomes generated by salmon angling and (b) a system owned by the Dee Catchment Partnership to protect listed species, e.g. fresh water pearl mussels by limiting human interactions with the river in order to support Scotland's international commitment to the Convention on Biological Diversity. Both systems value Earth Systems Sciences' expertise and first-order practices of environmental management. Complex power dynamics appear in negotiating a duality of economic and ecological purposes (salmon fishing and biodiversity conservation), while a systemic dimension of social-ecological well-being seems to be less salient.

Originality/value – Practices of governing human-biosphere relationships traditionally belong to the field of 'environmental management', which can be seen as a set of Earth Systems Science theories and applications of first-order systems approaches to improve 'ecosystem services' and also deliver 'nature-based solutions'. This paper takes the original stance of second-order and critical systems thinking to further explore 'why' practitioners involved in governing humanbiosphere relationships do what they do, 'for what purposes' and according to 'what ethics'. In so doing, the paper explores the possibilities for reframing governance for the Anthropocene.

Research/ Practical/ Social/ Environment implications - In addition to a first-order exploration of the extent to which "the ecological, social and economic dimensions of organisational governance and management" are integrated in the river Dee, the paper offers second-order insights about:

- Implications for governance praxes situated in a broader context of the Anthropocene,
- Framing systemic governance as governing co-evolutionary dynamics between integrated human dimensions (social, economic, ethical) or 'human systems' and biosphere ecologies in which humans are embedded,
- Possible conditions to set praxes of governance on trajectories of systemic governing in the Anthropocene.

Research limitations – Case study research is always contextual and limits replicability of very detailed findings in other settings. However, insights from this case study contribute to our understanding of the relationship between Anthropocene framings and praxes of systemic governance, which is key to improving governance and management in all contexts globally.

Enabling Circular Economy by breaking up system boundaries

Johannes Klinglmayr, Linz Center of Mechatronics GmbH., Austria.

Abstract

Purpose – The rise of global temperature, the reasoning of the International Panel for Climate Change, and the political calls for carbon neutrality urge society and its players to take immediate action. Short-term thinking and its advocation need to be altered. Yet, we see stagnation. The unprecedented complexity and intertwining of effects and a lack of short-term economic benefits impede stakeholders. For the empowerment, drive and effectiveness of stakeholders, an individually designed roadmap that motivates change with feasible action items is needed. While this might seem a too naïve and bold demand, its realisation is doable. Systemic approaches, initiatives and technologies are available. Here, we outline how perspectives and technologies could align for its realisation.

Approach - First, the proper motivation for realisation is economic benefit. With the unbalanced use of planetary resources, shortages occur. Circular economy, by extending resource usage via business cases is a way out. Second, comprehending the capabilities of available services and know-how is key. Realising Self-organizing principles via harnessing AI technologies allows us to create and dynamically update interrelations of system effects. Third, automated services resolve the bottleneck of the scarce availability of human expertise. Digital twins and digital representation of human knowledge are scalable and globally available. Forth, an automated combinability of properly chosen digital twins allows to address individual requests. Digital workflow orchestration deploys a combination of digital twins for specific problem statements. Overall, this technology stack allows us to provide actionable answers to new and paradigmatically different problem statements.

Findings - The first field for application is the ECODESIGN regulation by the European Union. It is currently being crafted. The first ratifications are expected to be in 2027. It will -amongst others- demand for repair, reuse and recycling of products. This will significantly shake certain established business models. With the requirement of considering external processes, the need for companies to consider cross-company business models increases. Companies will have to alter and potentially rethink their products and design processes. Products will have to follow the demand of a consortium of companies. This will be reflected in shared business models, services and product properties. New product and service demands will call for cross-company product design. This is a paradigmatic shift to current in-house designs, laying open the demand for digital workflow orchestration.

Originality - A major showstopper for circular products is the inability to design a product across company barriers. Typically, the needed partners are new, so trust is lacking, the intertwining of product properties is complex, and the fear of risking intellectual property

is high. The proposed approach allows to preserve IPR, identify new ecosystem partners and allows to test and optimise product designs via automated processes. The presented technology stack overcomes these limitations with individual technologies that have already been developed. Finally, a realisation is far from visionary but motivated via business cases for all involved stakeholders.

Implications - To address the challenges of our times, we need to rethink established societal and engineering systems and reassemble economic building blocks for new definitions and dimensions of economic benefits. We need to reorientate as a society by resonating with the consequences of our actions. The proposed harnessing of technologies is providing key feedback loops and empowerment for this paradigmatic shift.

Research limitations - The realisation of a circular economy is a major transformation. The proposed technology and business concept are catalysts for this change process. The process itself may first be used to break up mental, technological and legal barriers.

Keywords: System-of-system, self-organisation, digital services, circular economy, digital twins.

Cultural Challenges in the Adoption of Data-Driven Decision Making

Jonathan Randall, Loughborough University

Tom Jackson, Loughborough University

Peter Kawalek, Loughborough University

John Beckford, Loughborough University

Abstract

Purpose – The UK railway industry takes pride in a history that has increased safety through many innovations in technology and ways of working. Its culture is risk-averse and based on the deep personal experience of those making decisions. There is a focus on actively detecting and correcting issues. There are opportunities to build on this by increasing the focus on anticipation to avoid or prevent issues.

The Seasonally Agnostic Railway Model (SARM) is being developed to provide better insights into anticipation and prevention by using weather forecasting data in an operational model of the UK railway system.

The development of SARM will yield tangible benefits but will need to be enabled by a culture, system, and process which recognises the value of prevention across the various organisations, functions, seniority levels, and regions that comprise the UK railway.

My hypothesis is that an evaluation of an organisation's culture can be usefully integrated with 1) the application of cybernetics, for example, how cultural dimensions would impact the application of the Viable Systems Model; 2) how a new system (processes and IT) is designed and implemented for example how certain cultural values influence certain stages of an IT development lifecycle.

Design/methodology/approach – This research inquiry will need to examine what is meant by culture and its various elements (e.g. organisation cultures, and functional, regional or team subcultures). It will also have to examine how culture interacts with systems implementation approaches and cybernetic ways of understanding organisations.

The research will take a qualitative approach using three methods:

1)   Narrative – analysing the experiences over my career with systems implementations and transformation programmes.

2)   Action Based – working with the SARM team and Network Rail to apply my hypotheses for practical benefit.

3)   Grounded Theory – assessing my hypotheses/proposals with experienced consultants and practitioners.

The aim of 2) and 3) is to test whether the new knowledge contained in my hypotheses (i.e. frameworks to bridge existing gaps) works in practice.

Findings/Results – This PhD is in the literature survey stage, from which there are relevant threads in systems implementations, process transformation, cybernetics, organisational culture and psychology, and cognitive biases. This PhD is part of a trio of PhDs, which include addressing modelling techniques and data quality challenges.

My hypothesis is that frameworks can be developed and tested which integrate organisational culture, systems implementation, and cybernetics. For example:

A culture with a high Uncertainty Avoidance dimension may be more disposed to ensuring that the VSM system 2 operates with a higher level of detail and rules. It is also likely to struggle with the fluid nature of the VSM system 4 meaning that more surrounding structure is required. Such a culture is more likely to require detailed testing of a complete solution rather than an agile/iterative approach.

A highly collective culture may struggle with the candour required for algedonic signals. It is more likely to be comfortable with design and testing being led by a few representatives for the whole group.

Originality/value – The three areas referenced above (organisational culture, systems implementation, and cybernetics) all have a depth of literature and research. However, gaps exist in knowledge of how to combine them. For example, how to incorporate knowledge of, and attempts to change, an organisational culture within a systems implementation methodology.

Research/ Practical/ Social/ Environment implications - The trio of PhDs support the successful use of the Model to help the UK Railway plan and adapt better to changes in our climate. This will help the UK Railway operate more predictably and reliably thus encouraging traveller and freight customer preference towards rail, which will contribute towards Net Zero.

The framework/methodology developed in this research will help improve the success rate of systems implementations more generally. This will mean less human wasted effort on systems implementations and hence less wasted carbon footprint associated with that human effort.

Research limitations - The research will be conducted in a macro-cultural context of the UK and those with experience predominantly in a Western-European/US culture.

The research is not looking to 'redesign' any of the existing systems methodologies but is seeking ways in which to integrate cultural-factors into them.

Impact of rising temperatures on viticultural biomass in Slovenia: A System Dynamics Approach

Maja Borlinič Gačnik, University of Maribor Faculty of Tourism, Cesta prvih borcev 36, 8250 Brežice, Slovenia

Črtomir Rozman, University of Maribor Faculty of Agriculture and Life Sciences, Pivola 10, 2311 Hoče, Slovenia

Andrej Škraba, University of Maribor Faculty of Organizational Sciences, Cybernetics & Decision Support Systems Laboratory, Kidričeva cesta 55a, 4000 Kranj, Slovenia

Abstract

Purpose – This study investigates the impact of rising temperatures on viticulture in Slovenia, focusing on how extreme heat events influence the viticultural biomass system and grape production. It explores potential adaptive vineyard management strategies to mitigate these impacts, particularly as global climate change continues to affect grapevine growth and wine quality.

Design/methodology/approach – The research utilizes a System Dynamics approach to model the effects of temperature on vineyard biomass growth. It collects data from various meteorological stations across key Slovenian wine-growing regions to analyse temperature trends between 2000 and 2010. The study incorporates causal loop diagrams to map the relationships between biomass growth, environmental factors, and vineyard practices, followed by simulations of biomass responses to different temperature scenarios.

Findings/Results – The results show that the frequency of days exceeding 35°C has increased in most wine-growing regions, particularly in Bilje, Nova Gorica, and Novo Mesto. These extreme heat events significantly disrupt vine physiology, particularly photosynthesis, leading to reduced biomass growth. The system dynamics model indicates that temperatures around 25°C are optimal for biomass growth, with both lower and higher temperatures negatively impacting vine productivity. Adaptation strategies, such as optimized vineyard management, can mitigate some of these effects.

Originality/value – This research contributes to the understanding of climate change impacts on viticulture by applying a system dynamics model to the viticultural biomass system. It offers insights into adaptive vineyard management strategies, helping viticulturists develop more resilient practices in the face of rising temperatures, particularly in regions with established wine industries.

Research/ Practical/ Social/ Environment implications - The study highlights the need for climate adaptation strategies in viticulture, including improved vineyard management practices, irrigation, and the cultivation of heat-resistant grape varieties. These

adaptations are crucial for maintaining wine quality and ensuring the sustainability of viticulture in the face of rising global temperatures.

Research limitations - The research primarily focuses on average temperature data, which may not capture microclimatic variations within individual regions. Future studies should include more detailed microclimatic data and explore the influence of other climatic variables, such as precipitation and humidity, on vine biomass growth. Additionally, long-term studies on the effectiveness of various adaptation strategies are needed, alongside an analysis of their economic viability.

Keywords: Viticulture, Climate change, System dynamics, Vineyard management, Sustainable agriculture, Wine quality

Coping with Global Warming: Systemic Design, Scope, and Scale

Markus Schwaninger University of St. Gallen, Switzerland.
markus.schwaninger@unisg.ch

Stefan Ott Eastern Switzerland University of Applied Sciences. stefan.ott@ost.ch

Abstract

Purpose – The mainstream focus of politicians and economic agents regarding global warming is on the reduction of greenhouse gases. This contribution aims to open that perspective towards a wider spectrum of goals and interventions to enhance the repertoire of action in weathering climate change.

Global warming, mostly addressed as "Climate Change", is increasingly considered as the number one challenge facing mankind. We try to develop an organisational strategy for dealing with global warming effectively. In contrast to the dominant one-dimensional approaches, our effort is more differentiated. We rely on the dimensions of scope and scale with their sub-dimensions.

Design/methodology/approach – Scope defines the space of action. It has two sub-dimensions, mitigation M and adaption A, which are considered to manifest themselves in different expressions and intensities:

Scope:(M,A) , $M=(m_1, \ldots , m_p)$, $A=(a_1, \ldots , a_r)$,

m_i, a_i: Intensity of the expressions of the sub-dimensions $\hspace{2cm}$ (1)

The first set of dimensions is the scope or space of action. Currently, many initiatives, actions, programs, etc., are in place, entirely fixated on the reduction or elimination of greenhouse gases, CO2 in particular. The idea is to diminish and eventually stop the growth in temperature of the atmosphere that way. That is the strategy of mitigation M. The other side of the coin is the mostly underrated coping with the effects, i.e., the consequences of global warming. That is the strategy of adaptation A.

The second dimension is scale. It has a set of sub-dimensions, which range from the smallest unit to the largest unit of reference - individual, organisation, municipality, region, etc., to world. The reference units of a given level are embedded in units of the next higher level, and they are composed of units of the lower level:

Scale: $R_1 \subset R_2 \subset \cdots \subset R_n$, $\hspace{3cm}$ (2)

with R_i denoting the reference systems on levels i $(i=1, \ldots, n)$.

Findings/Results – Global warming cannot be coped with on the level of small agents alone, say individuals or families. On the other hand, it cannot be solved on a global level either, even though that is often believed. In fact, activities at any one given level alone

cannot solve the problem. An effective strategy to weather global warming can only be achieved if all recursive levels, from individual to global, for example, local, regional, national, etc., are mobilised to contribute their respective efforts. The attribute of recursiveness denotes the property of the different levels of observation of being isomorphic in one sense: they face and have to deal with the same issue - global warming.

Originality, Value, implications and limitations– We will elaborate on these different dimensions and outline their implications for humanity's quest for viability and sustainability. We leave open if global warming is a problem that mankind can solve at all. In any case, strategies of both mitigation and adaptation should be pursued vigorously, building on the assumption that the problem can at least be attenuated.

Keywords: Global Warming; Climate Change; Systemic Design; Scope; Scale

Analysis of the collaborative innovation effect of China's "dual pilot" policy

Peng Jiang,　Yun Cao

School of business, Guangxi University, Nanning 530000, China.

Abstract

Purpose –Scientific and technological innovation is the primary driving force for development and is increasingly becoming a new driving force for economic growth and social development. China attaches great importance to innovation-driven development, places innovation at the core of the overall national development, and actively promotes high-level scientific and technological self-reliance. Therefore, based on the perspective of policy coordination, this paper empirically studies the impact, mechanism and heterogeneity of the "dual pilot" policy of innovative cities and low-carbon pilot cities on urban innovation levels, in order to provide effective policy recommendations for improving urban innovation capabilities and promoting high-quality urban development.

Design/methodology/approach – Based on the panel data of 293 cities in China, this paper empirically studies the causal relationship between the dual pilot policy and urban innovation development by comprehensively using the multi-period double difference method, fixed effect model, mediation effect model and moderation effect model. In addition, the robustness test is carried out by combining Bacon decomposition, PSM-DID and other methods to enhance the robustness of the model estimation results.

Findings/Results – The empirical results show that: (1) The dual pilot policy of innovative cities and low-carbon pilot cities can effectively improve the level of urban innovation, and the conclusion still holds after a series of robustness tests. (2) The dual pilot policy improves the level of urban innovation by promoting the aggregation of talents and enterprises. (3) Environmental regulation and digital infrastructure play a positive regulatory role in the impact of the dual pilot policy on the level of urban innovation, and the level of financial development plays a negative regulatory role in the impact of the dual pilot policy on the level of urban innovation. (4) The dual pilot policy has a significantly better effect on promoting the level of urban innovation than the single pilot policy, and the policy implementation path of first becoming a low-carbon pilot city and then becoming an innovative city can better improve the level of urban innovation. (5) Due to differences in geographical location, resource endowment and urban characteristics, the policy effect of the dual pilot policy shows obvious heterogeneity.

Originality/value – First, in terms of measuring the city's innovation capability index, the urban innovation index of Kou Zonglai's team is used to measure the city's innovation capability, avoiding the limitation of the single indicator measurement of the number of patents used in most existing literature. Second, it expands the research perspective of policy

synergy. Existing studies mostly explore the policy effects of low-carbon pilot cities and innovative cities in their respective fields in isolation. Few literature explores the impact of the synergy of the "double pilot" policy on urban innovation capabilities. This study enriches the understanding of this field; third, from the perspectives of agglomeration effect, environmental regulation, and digital infrastructure level, the impact of the "double pilot" policy on urban innovation capabilities is analyzed, enriching the mechanism of action of the "double pilot policy". Fourth, it reveals the heterogeneity of the "dual pilot" policy effect and its potential causes, providing empirical evidence and decision-making references for exploring the policy optimization path of urban technological innovation.

Research/ Practical/ Social/ Environment implications - This paper uses a multi-period DID model to deeply explore the impact of the "dual pilot" policy of low-carbon cities and innovative cities on urban innovation levels, in order to provide theoretical basis and policy recommendations for fully releasing the effectiveness of the "dual pilot" policy, accelerating the improvement of regional scientific and technological innovation levels, and building regional scientific and technological innovation highlands.

Research limitations - To realise the full release of policy effectiveness requires the joint efforts of the government, enterprises and universities. To promote the development of new urban productivity, future research should focus on the establishment of an efficient collaborative innovation mechanism to realise the efficient and orderly flow of innovation elements.

Keywords: Low-carbon city; innovation cities; Collaborative innovation effect; Mechanism analysis

A framework for systemic governance of social-ecological systems in the Brazilian Amazon

Roberta R.A. de Castro (Federal University of Pará, Abaetetuba, Brazil)

Aquiles Simoes(Federal University of Pará, Belém, Brazil)

Sandro L. Schlindwein (Federal University of Santa Catarina, Florianópolis, Brazil)

Abstract

Purpose – How to govern the relational dynamics of coupled social-ecological systems (SES) so that they conserve their adaptive capabilities in the unknown world of the Anthropocene, characterised by increasing unpredictability and uncertainty, is a challenging question both from a research and implementation perspective. As an attempt of dealing with this problematique, a framework for systemic governance of SES such as the Agroextractivist Settlement Projects (Projetos de Assentamentos Agroextrativistas - PAEs) located in the Brazilian Amazon is proposed.

Design/methodology/approach – A systemic co-inquiry based research was conducted between November 2019 and March 2023. Building upon a multimethodological research approach, problem structuring methods such as Soft Systems Methodology (SSM) and Strategic Options Development and Analysis (SODA) were combined to facilitate stakeholder engagement in order to distinguish and articulate major issues concerning the systemic governance of SES, such as the PAEs.

Findings/Results – Five dimensions of systemic governing were distinguished, which deal, respectively, with the ecological, represented by the dimension Biosphere, and with the social, that nests other three dimensions represented by Social Capital, Politics and Economy. The fifth dimension relates to the coupling between the social and the ecological and is given by the dimensions of Territoriality and Identity. These dimensions were organised as a framework for systemic governance in the form of a nested, multi-level structure, presenting two main levels of variables: the first level consisting of the five dimensions already mentioned, and the second level represented by a set of variables intrinsic to each one of these dimensions.

Originality/value – Dualistic and disjunctive thinking and systematic control attempts still prevail in governance approaches of coupled socio-ecological systems. Therefore, the distinction of interrelated dimensions of systemic governance, structured in the form of a framework as the one presented in this paper, can help to operationalise a process of governing that is more attuned to the emergent features of the Anthropocene.

Research/Practical/Social/Environment implications – Beyond framing Agroextractivists Settlement Projects in the Brazilian Amazon as social-ecological systems (SES), structuring a dimensions based framework is an attempt of making

objective principles of systemic governance. The framework for systemic governance may help to chart new trajectories of the relationships between humans and the biophysical world, generating innovative forms of SES governance. By facilitating the design of systemic governance practices, the framework can also guide the process of how to increase SES capacity to accommodate unpredictability and uncertainty, enabling humans to continue living and governing in the Anthropocene.

Research limitations – Since part of the research was conducted during the COVID-19 pandemic, some important collective and participatory methodological steps were hampered, hindering critique from the group of participant stakeholders and broader discussions among them. Beyond that, it was not possible to guarantee the desired stakeholder participation throughout the inquiry, and it remains undefined which resources need to be mobilised to effect systemic governance processes.

Keywords: Amazon; Anthropocene; Coupled social-ecological systems; Systemic governance.

Supervision of Organisational Adaptation through Systems Thinking

Véronique Gignoux-Ezratty

Abstract

Purpose – The purpose of this communication is to propose an approach for supervising an organisation's adaptation to its context using systems thinking. This supervision involves developing an understanding of the essential aspects of organisational adaptation to its context and ensuring that these aspects are adequately addressed.

The proposed approach is based on describing aspects deemed significant regarding purpose and involving two interacting systems. The first system is the organisation itself. The second system encompasses all elements involved in the governance of the organisation, whether they relate to organisational culture, management strategies, or organisational structure. This second system is referred to as the extended governance system. The description includes graphical representations, concepts, and explanations.

Design/methodology/approach – The research is based on a progressive construction of knowledge by the author, over 40 years, around human dynamics in organisations of all kinds, particularly through the reflexive observation of concrete systems of action as described by Crozier and Friedberg, in real situations, either as a participant or as an observer. This knowledge has focused, among other things, on the representations that help develop mental models useful for deciding and acting in accordance with a purpose in a context.

To construct the description, the organisation is considered as a system composed of interacting individuals. The system can be viewed holistically with the assistance of the canonical form of Jean-Louis Le Moigne's general system. The evolution of the system depends on the behaviour of individuals within a collective. Indeed, individuals develop mental models, make decisions, and act, thereby modifying the organisation. Cognitive psychology offers perspectives recognised as relevant by a broad community of researchers and practitioners for explaining individual behaviour within a group. These perspectives provide explanations of how individuals construct knowledge and habits for decision-making or action. They have been notably developed by researchers such as Herbert Simon, Daniel Kahneman, Donald Schön, and Chris Argyris. Their relevance is a research hypothesis.

The extended governance system is seen as an iceberg with elements hidden beneath the surface, the identification of which can be either unnecessary or essential depending on the stakes.

Findings/Results – This communication provides graphical representations, concepts, and explanations to help consider the cognitive and sociological processes that facilitate or hinder adaptation to change in the current period. It highlights what strongly impacts

organisations' adaptability and thus should receive specific attention from organisational leadership. It is a guide for building mental models that facilitate an organisation's adaptation to a given context.

The current period is characterised by a perceived need to anticipate the consequences of climate change, awareness of certain indirect effects of key performance indicators, and a rediscovery of human-centred management developed in the 1980s, which is considered more effective in an evolving environment.

These results are particularly intended for individuals aligned with the fundamentals of human-centred management consultancy, especially those who adhere to the concepts of Jean-Christian Fauvet (1927-2010) or Jean-Louis Le Moigne (1931-2022), which are promoted by French associations.

Originality/value – The interest of this research lies in its comprehensive approach, which balances various domains, concepts and approaches and provides a representation of the cognitive and social processes involved in the evolution of an organisation in the current context, whether the evolution is natural or resulting from a change project.

This research relies on a practitioner approach based on 40 years of observation, including an in-depth analysis of the difficulties of adapting the French educational system to its context. It complements other research on governance and project supervision. It aligns with forms of management considered suitable in an evolving environment.

Research/ Practical/ Social/ Environment implications – The research primarily addresses the concerns of individuals in management positions. However, they may interest anyone wishing to influence governance policies towards better adaptability to change. It proposes graphical representations and concepts aimed at accompanying the development of an understanding of the cognitive and social processes activated during an organisation's adaptation to the current context of change. These conceptual tools can be used in academic training. Anticipating the consequences of change allows for considering social outcomes, especially those related to individual well-being, as well as environmental impact.

Research limitations - The cognitive representations of complex objects, which form the basis of this research, are not auditable. This type of approach, regardless of its utility for its audience, cannot be indisputably demonstrated.

Keywords: supervision, organisation, systems thinking, contextual adaptation, control

Better Governance for a Better World in the Anthropocene: A CyberSystemic Perspective

William J. Reckmeyer, PhD Professor | Cybernetics & Systems

School of Cybernetics, College of Engineering, Computing, & Cybernetics , Australian National University Canberra, ACT 2600 AUSTRALIA
William.Reckmeyer@anu.edu.au
https://cybernetics.anu.edu.au/people/william-reckmeyer/ +1 (408) 515-5771 (C)
Professor Emeritus | Leadership-Cybernetics-Systems, San José State University
Visiting Professor | Systems Studies, University of Hull
Kellogg Global Fellow |W. K. Kellogg Foundation
Distinguished Residential Fellow | Salzburg Global Seminar

Abstract

Purpose – My primary goal in this presentation is to help frame a context for improving societal governance in the 21st century, integrating critical scientific insights from the cybernetic-systemic paradigm with key historical insights about the creation of our modern global world. My broader meta-goal is to clarify the most pressing issues we are facing as a species, to support ways that humanity can use its collective cyberneticity more effectively and responsibility to build a more equitable and sustainable future while there is still the time and opportunity to do so.

Approach – This presentation draws on a major research project I have been conducting over the past decade that focuses on this broader goal. That project – currently titled *Homo Cyberneticus: Creating, Understanding, and Shaping the Anthropocene* – uses a CyberSystemic framework to examine the science, history, and impact of humanity's rapidly-evolving cyberneticity, especially over the last 500 years. In particular, it examines how human capabilities and activities have generated an unprecedented combination of interconnected people-centric and planet-centric challenges that are threatening the habitability of Planet Earth for human civilisation as we know it. Although it is the latter (planet-centric issues like climate change and pandemics) that have been attracting the most attention, I'm more worried about the former (people-centric issues like authoritarianism and tribalism) because there is no way to address either type of issues – much less the intersection of both types – if we can't act collectively for the greater good.

Findings – The presentation focuses on the multi-dimensional nature of human agency-autonomy-identity, which are arguably the most significant and anomalous phenomena in the known universe. Humanity's rapidly evolving and increasing cybernetic capabilities and activities have produced exponential improvements in living conditions for people around the world in a comparatively short period of time. Still, they have also precipitated a runaway mix of challenges that are jeopardising the systemic well-being of our species and our world as a whole. Among the most corrosive of those challenges are efforts by

some human agents (ranging from individuals to groups to communities to organisations to geopolitical entities) to maximise their power by limiting the liberty of other agents, which is reversing a centuries-long history of expanding rights and freedoms in many aspects of human affairs.

Implications – Better governance offers the best hope for building a better world. But only if we can develop institutions that are able to focus humanity's attention on systemic priorities, secure agreement among a diverse mix of stakeholders about how to address complicated issues and competing priorities, and collectively utilise humanity's sophisticated cybernetic capabilities to manage increasingly complex messes more effectively and responsibly on a global basis than is currently being done.

Participatory system mapping for emissions reduction of food cold chain

Xinfang Wang[1*], Weize Wu[1], Yingying Feng[1], Bing Xu[2]

[1]University of Birmingham, Edgbaston, Birmingham. UK. B15 2TT
[2]Hariot-Watt University, Edinburgh. UK. EH14 4AS.
*Corresponding author's email: x.wang.10@bham.ac.uk

Abstract

Purpose – To achieve the International Panel for Climate Change's Paris Agreement target of limiting the global temperature rise to well below 1.5°C, all countries need to urgently and radically mitigate greenhouse gas (GHG) emissions. The UK has set a target to achieve net zero emissions across all sectors by 2050. The food and drink sector in the UK is responsible for over a third of its total GHG emissions, with more than 60% of food in the UK is dependent on the cold chain[1]. Furthermore, the food cold chain is complex and lacks integration between sectors. This paper aims to present a participatory systems approach for industry, government and academic stakeholders to contribute to a system mapping of the key drivers and barriers for decarbonising the food cold chain.

Design/methodology/approach – Approximately 20 stakeholders from industry, government and academia from various disciplinary backgrounds joined a participatory workshop, where they contributed their knowledge and experience to a system mapping of the food cold chain in the UK, visualising the complex system and identifying the technical and non-technical barriers and drivers to decarbonise. Participants were divided into three groups, each facilitated and supported by a facilitator and notetaker to enhance small group discussion. Each group produced a system map. Group maps were subsequently converted and integrated using the Vensim software. Participants were encouraged to select a representative food cold chain case, such as the cold chain system of a specific food category (e.g. frozen seafood, dairy products) or a specific region, to stimulate their thinking of the whole systems related, as well as the drivers and barriers to decarbonise.

Findings/Results – Workshop participants identified a variety of drivers and barriers for decarbonising the food cold chain, covering technology, behaviour, finance, policy and environmental aspects. While each group had slightly different focuses, there were overlapping areas indicating their significance in the decarbonisation agenda. The key drivers and barriers to decarbonising the food cold chain systems are identified, which are the ones with the highest number of links attached to them. Causal loops are also drawn from the system map to demonstrate how changing one driver or barrier could have a butterfly effect by directly and indirectly affecting other elements in the whole system. Through the participatory system mapping workshop, the stakeholders attended also

---

[1] Evans, J. and Peters, T. (2021). Towards a net-zero food cold chain. IOR Annual Conference 2021.

benefited through mutual learning from each other during the discussion and improved their understanding of the complex system. The findings can be used by stakeholders to develop integrated, effective and impactful strategies and investment decisions to reduce GHG emissions.

Originality/value – The research provides new information into the food cold chain sector that has not been researched from a whole system approach before. It has significant value in contributing to the decision-making of stakeholders from the industry and government for decarbonising the food cold chain whilst maintaining food supply security and improving resilience for unexpected disruption. The workshop group discussion on emission reduction in food cold chain systems, which integrated the ecological, social and economic dimensions of organisational governance and management, stressed the benefits of systemic governance and provided adequate experience to be learnt.

Research limitations – The participatory system mapping has inherent limitations related to the experts attending the workshop. We have addressed the limitations by involving diverse experts from all sectors, levels of experience and disciplinary backgrounds to ensure all key aspects are covered in the final mapping. The mapping results are also checked against existing literature related to the food cold chain and decarbonisation topics to identify any potential gaps.

Keywords: Food, emissions, systems, mapping, supply chain, net zero

Section 2.2 Exploring the nexus of ecology, society, and economics in organizational governance

Coordinated by Marialuisa Saviano, and Francesco Caputo

This section seeks scholarly contributions elucidating the complexity of integrating ecological, social, and economic dimensions. Soliciting insights, research, and case studies, the call addresses aligning organizational strategies with sustainability, responsibility, and viability. Topics include (but are not limited to) Sustainable Organizational Practices, Socially Responsible Governance, Economic Resilience, and Holistic Governance Models. Encouraging practical implications and lessons, the discourse aims to redefine governance paradigms for a harmonious and resilient global landscape. Contribute to shaping the scholarly dialogue on organizational governance, where ecological, social, and economic considerations converge for enhanced sustainability and resilience.

From Platformization to Community-Centric Resilience: Understanding the Sharing Economy through System Thinking

Anna Roberta Gagliardi University LUM Giuseppe Degennaro, Casamassima, Dept. of Engineering, Italy gagliardi.adr@lum.it

Luca Carrubbo University of Salerno, Italy Dept. of Political and Communication Sciences (Dispc) lcarrubbo@unisa.it

Antonietta Megaro University of Salerno, Italy Dept. of Political and Communication Sciences (Dispc) amegaro@unisa.it

Abstract

Purpose – Uncertainty inherently drives more and more ongoing dynamics of the economic landscape nowadays. Contingences deriving from special events (made by nature or humans), indeed, can affect business models, strategies, partnerships and approaches continuously, and all organisations have to face several unpredictable consequences. In the last decades, novel examples of aggregation, competition and joint ventures evidently show the will to find new solutions for risk-sharing, lean-productions, and district effects. The Sharing Economy (SE) is one of them undoubtedly. The role of platforms, of course, properly sustains all of this due to the facilities, the responsiveness and the networking they are able to allow. The digital era in which we live and operate seems to "need" for such intermediating tools because platforms are easy-to-use with a huge portability, democratic and intuitive modes, and perfectly fitting with today's people's readiness and education. Nevertheless, the progress in technology, even spread and wide, is not always enough for a business's success, both for new activities starting up and well-known proposals to revitalise (counting SE, too). Sometimes, other leverage should be used, and the attention paid today to human aspects is increasing a lot. This paper aims to propose a new SE interpretative model, system thinking based, through which we analyse updated dynamics and equilibrium in order to highlight the wave of Community-Centric Resilience as a key element for success and competition.

Design/methodology/approach – SE phenomena, as recent evidence of not-conventional business model, could be re-read in this way by focusing on the traditional interpretative scheme (based first on the platformization), linking users (assets' seekers), providers (assets' owners) and platforms (matching through-put for recommendation and delivery) and trying to make an original overview, thanks to the System Thinking (ST) lens, and the Viable Systems Approach (VSA) in particular. Using ST as a method theory, we can have a meta-level conceptual system for studying the substantive issue(s) of the domain theory of SE. Due to its special features, ST well matches this, especially concerning the organisation of key phenomenon's dimensions and implications and the explanation of relationships between the studied variables of Community-Centric Resilience.

Findings/Results – The proposed model usefully embraces a number of distinctive elements never included before in SE studies, like actors' engagement, shared intentionality, finality alignment, new kind of resource integration, converging strong beliefs and values, all defined as structural and consonant pre-condition for Community-Centric Resilience and for individuals willing to be part of something bigger to contribute to. These findings are in line with some other works dealing with A2A (Actor-to-Actor) and A4A (Actor-for-Actor) and try to continue the advances in Resilience conceptualisation, no more seen only as resource recovery but 'renewal', no more as comfort zone expression but 'challenge', no more as bouncing back phenomena but 'forward'. This manuscript resumes all of these points inside an unedited and fascinating framework.

Originality/value – A new model can advance in Research.

Practical implications - Lots of suggestions for practitioners are therein.

Research limitations - – It's a conceptual paper. Further empirical research could be conducted accordingly.

Keywords: Sharing Economy, Community-Centric Resilience, System Thinking, interpretative model, VSA

Decoding the World 5.0: A system thinking overview for interconnecting Society 5.0 and Industry 5.0

Claudio Del Regno, *Department of Management & Innovation Systems – University of Salerno (Italy)*

Mirko Perano, *Department of Management & Innovation Systems – University of Salerno (Italy); Department of Management – Reald University College (Albania)*

Francesco Caputo, *Department of Economics, Management, and Institutions – University of Naples "Federico II" (Italy)*

Rosario Bianco, *Pegaso Online University (Italy)*

Abstract

Purpose – This article aims to utilise systems thinking to examine and understand the paradigms of Society 5.0 and Industry 5.0, including their areas of overlap. By establishing systems thinking interpretative framework, the main goal is to identify and describe potential value enablers within both paradigms.

Design/methodology/approach – The paper develops a theoretical framework based on systems thinking to decode the interrelationships between Society 5.0 and Industry 5.0.

Findings/Results – This study provides a pathway to uncover value enablers for Society 5.0 and Industry 5.0, as well as their intersection, through systems thinking approach.

Originality/value – This research is pioneering in its attempt to identify value enablers within the emerging paradigms of Industry 5.0 and Society 5.0.

Research/Practical/Social/Environmental implications – Identifying value enablers within Society 5.0 and Industry 5.0 has significant theoretical, social, and practical implications. Theoretically, this understanding can enhance the connection between managerial, entrepreneurial, systemic, and social theories within these paradigms. Socially, recognising these value enablers will support value (co)creation processes, thereby boosting social and environmental value. From a managerial and entrepreneurial perspective, these value enablers can be leveraged to create greater value within the relational networks of Society 5.0, Industry 5.0 and their overlap.

Research limitations – The limitations of this study pertain to its theoretical nature, which requires empirical testing through single or multiple case studies to explore the societal and industrial phenomena and their overlapping areas.

Keywords: Society 5.0; Industry 5.0; Systems thinking; Theoretical framework; Value Enablers

Cybernetic Strategies: Fashion's Sustainable Supply Chain Evolution with Ship-then-Shop

Francesca Igini, Sapienza University of Rome, Department of Management

Arturo Cafaro, Sapienza University of Rome, Department of Management

Mario Calabrese, Sapienza University of Rome, Department of Management

Abstract

Purpose – This study explores the intersection of cybernetics and systems theory, focusing on the integration of predictive artificial intelligence (AI) and the Ship-then-Shop model within the fashion industry's supply chain, with sustainability as a central theme. By analysing the dynamic interplay between predictive AI and the Ship-then-Shop model, our objective is to elucidate how these advancements can optimise resource allocation, mitigate waste generation, and reduce environmental impact. Additionally, we examine the pivotal role of AI-generated insights in aligning production with consumer demand, thereby fostering the evolution of a supply chain ecosystem characterised by resilience and adaptability. This comprehensive approach engages manufacturers, retailers, and consumers more effectively, contributing to the advancement of a sustainable and efficient supply chain paradigm.

Design/methodology/approach – The study employed a comprehensive literature review, covering established and emerging sources from national and international scientific journals. It aimed to gain a thorough understanding of current knowledge and identify areas for future research. Additionally, the study explored the potential impacts of the ship-then-shop model on different supply chain stages, including consumer preferences, sourcing strategies, warehousing operations, production methods, and distribution processes. It also analyzed the handling and reintegration of returned products, emphasizing the model's influence on reverse logistics and sustainability efforts.

Findings/Results – The burgeoning scholarly interest in sustainability within the fashion industry underscores the imperative of comprehending the supply chain as a multifaceted and interconnected system. Through the analytical frameworks of systems theory and cybernetics, this necessitates a meticulous examination of information flows and actor interactions embedded within this intricate network. Pioneering technologies like Blockchain and Artificial Intelligence (AI) serve as pivotal components in augmenting the transparency and traceability of this network (Elhidaoui et al., 2022), furnishing a comprehensive elucidation of operations and fostering more efficient and conscientious resource management practices. Of note, Predictive Artificial Intelligence emerges as a cybernetic control mechanism endowed with the capability to discern and adapt to fluctuations in data streams (Rahmani,2021), thereby pre-empting consumer demands (Davenport, 2018) and optimising decision-making protocols throughout the supply chain

(Pereira et al., 2022). Moreover, as demonstrated by Caputo et al. (2019), there is a positive relationship between firms' investment in Big Data and revenues. This approach engenders heightened flexibility and adaptability vis-à-vis evolving market dynamics while concurrently mitigating waste and heightening the overall efficacy of the system. Furthermore, the Ship-then-Shop model, when viewed through a cybernetic lens, operates as a feedback loop mechanism, empowering retailers to amass insights into consumer behaviours and preferences (Bughin et al., 2018; Im & Lee, 2023) and subsequently tailor their procurement and inventory management strategies in response. This iterative feedback loop mechanism fortifies the resilience and adaptability of the system, curtailing the risk of inefficiencies and disruptions across the supply chain continuum. In summation, the convergence of cutting-edge technologies, systems theory, and cybernetic methodologies epitomises a seminal stride towards the realisation of a more sustainable and consumer-centric fashion supply chain paradigm. This transformative paradigm not only amplifies operational efficiencies (Dokku et al., 2023) but also engenders heightened consumer confidence in the industry (Tao & Xu, 2018), thereby fostering a corporate ethos characterised by heightened mindfulness of the environmental and societal repercussions of its operations.

Originality/value – The research delves into the intricate dynamics of predictive AI applications within the fashion industry through the lens of cybernetics and systems theory. highlights significant advancements achieved in consumer preference analysis and product recommendation, as evidenced by recent studies (Chen et al., 2023). Emphasis is placed on the intricate web of relationships inherent in business-to-consumer (B2C) interactions, elucidating how AI serves as a catalyst in dissecting and understanding consumers' multifaceted behaviours across various channels (Tiutiu & Dabija, 2023). This analysis, as proposed by Giri et al. (2019), underscores AI's pivotal role in constructing personalised consumer profiles, thereby conferring competitive advantages to fashion retailers. Despite these strides, a notable gap exists within the academic discourse concerning AI's transformative potential within the retail landscape (Guha et al., 2021). In addition, as demonstrated by Barile et al. (2022), enterprise competitiveness is increasingly dependent on AI, which is also redefining the rationale of all stakeholders across all levels (Perko, 2020). Notwithstanding, scant attention has been paid to exploring the integration of predictive AI technologies within the Ship-then-Shop model a framework that holds promise in revolutionising consumer experiences and operational efficiencies while advancing sustainability goals. This research endeavours to bridge this scholarly void by meticulously examining the symbiotic relationship between predictive AI capabilities and the Ship-then-Shop paradigm. By adopting a cybernetic and systemic approach, this study aims to unravel the intricate feedback loops and information flows inherent in AI-driven supply chain management. It seeks to elucidate how predictive AI algorithms, when seamlessly integrated into the Ship-then-Shop model, can optimise resource allocation, minimise waste generation, and ultimately contribute to the realisation of sustainable practices within the fashion

industry. Through this comprehensive analysis, the research endeavours to shed light on the transformative potential of predictive AI in fostering a more adaptive, resilient, and sustainable fashion supply chain ecosystem.

Research/ Practical/ Social/ Environment implications - The adoption of the Ship-then-Shop model manifests implications across three pivotal dimensions when viewed through a cybernetic and systems theory lens. Firstly, it engenders a competitive advantage for companies by proactively addressing the inherent uncertainties associated with fluctuating consumer preferences (Bjørlo et al., 2021; Chen et al., 2022; Kaur et al., 2022). Leveraging predictive AI within this model enables firms to optimise operational efficiencies, effectively navigating diminishing returns (Treiblmaier et al., 2021) and fostering the delivery of personalised offerings tailored to individual consumer preferences (Khrais, 2020; Javaid et al., 2022). Simultaneously, this model enhances the consumer experience by expediting search processes (Guha et al., 2021; Frazier et al., 2022) and providing highly personalised experiences (Zhang et al., 2019). Moreover, the Ship-then-Shop model yields profound sustainability implications (Shirkhani et al., 2023; Li et al., 2022), epitomising a systemic approach to environmental stewardship within the fashion industry. By curbing production waste and extending product life cycles, it minimises resource depletion and environmental degradation. Furthermore, its role in reducing carbon emissions through streamlined logistics and transportation practices underscores its contribution to mitigating climate change impacts. By harmonising product regulations with consumer preferences, this model spearheads a transformative shift towards environmentally conscious (Bolesnikov et al., 2022) and consumer-centric supply chain practices (Zhang et al., 2019; Franke et al. 2010), symbolising a paradigmatic evolution within the fashion industry's sustainability landscape (Gahletia, 2021; Gudiel et al., 2021).

Research limitations – From a systemic perspective, the study engages in a thorough examination of existing literature, drawing upon theoretical frameworks and conceptual models to elucidate the Ship-then-Shop phenomenon. By delving into the intricacies of this model, the study aims to uncover underlying patterns and dynamics that govern its function within the broader context of the fashion industry's supply chain. However, it is important to note that the study primarily offers conceptual insights, lacking empirical validation of its hypotheses and assertions. To deepen our understanding, future research could adopt a more empirical approach, leveraging specific case studies and real-world data from companies that have embraced the Ship-then-Shop model. Through such empirical analysis, researchers can explore how the model operates in practice, assess its actual impact on various aspects such as consumer experience, business performance, and sustainability, and identify any unforeseen challenges or opportunities that may arise. Moreover, considering the interdisciplinary nature of systems theory and cybernetics, future research could also incorporate insights from related fields such as information theory. By examining the flow of information within the Ship-then-Shop model

and its interactions with other components of the supply chain, researchers can gain deeper insights into the mechanisms driving its effectiveness and resilience. Furthermore, while the present study focuses exclusively on the fashion industry, there is potential for broader exploration across different sectors. Comparative studies across industries could shed light on how the Ship-then-Shop model varies in its implementation and impact, offering valuable lessons for adaptation and optimisation in diverse contexts. In summary, by combining theoretical frameworks from systems thinking, cybernetics, and information theory with empirical analysis and cross-sectoral exploration, future research can provide a more comprehensive understanding of the Ship-then-Shop model and its implications for supply chain management, sustainability, and consumer behaviour.

A Circular Economy Business Model to Balance the Pillars of Sustainability

Ineza Gagnidze Doctor of Economics, Associate Professor, Iv. Javakhishvili Tbilisi State University, Georgia. ineza.gagnidze@tsu.ge

Abstract

Purpose - To achieve sustainability objectives, the three subsystems of environmental, social, and economic pillars must attain equifinality. However, in numerous instances, these subsystems fail to strike a balance, resulting in a failure to realise sustainable outcomes. Therefore, transitioning to a circular economy through the adoption of appropriate business models could be a valuable approach for achieving equifinality and balancing the three pillars of sustainability. The link between sustainability and Circular Economy Business Models (CEBMs) resides in their mutual aim of generating value whilst minimising waste and resource depletion. The proposed theoretical framework seeks to analyse the relationship between sustainability and CEBMs, concentrating on the key interrelations among them.

Design/methodology/approach - Three graphical conceptual images have been produced. The first image illustrates the macro- and micro-economic connections between Sustainability and CEBMs (this model will have all characteristics of the system - each element works cooperatively with others to deliver results efficiently). The second image portrays the direction of economic development based on the links between Sustainability and CEBMs development in a three-dimensional plane. The author placed CEBMs on one axis and sustainability pillars - on the other. This underscores the importance of incorporating sustainability principles into economic growth models. The third image concentrates on societal welfare. The model combines the approaches of well-known authors.

Findings/Results - In the first graphical framework, we spotlight connections at the macro level, suggesting that a shift towards more sustainable business practices can yield positive outcomes for both individual companies and the broader economy. Visualising the economy in the second graphical framework, we propose that circular practices can stimulate innovation and economic growth while simultaneously reducing environmental impact. The third graphical conceptual framework highlights the potential for sustainable business practices to create value not only for companies but also for society. The circular economy, which impacts most of SDGs, has become a vital tool for achieving sustainability. The proposed conceptual frameworks aim to elucidate the economic connections between sustainability and CEBMs in a three-dimensional plane, highlighting development trajectories.

Originality/value - This conceptual paper explores the connections between Sustainability and Circular Economy Business Models through a series of theoretical and

graphical presentations. This is one of the first attempts to develop a graphical analysis illustrating the connections within the concept of the circular economy.

Research/ Practical/ Social/ Environment implications - The study provides valuable insights into the connections between Sustainability and CEBMs. By developing hypotheses based on theoretical and graphical representations, this analysis demonstrates the potential benefits of integrating circular sustainable principles into business practices. The graphical images presented in this paper serve to visualise these connections and highlight the importance of considering sustainability in economic decision-making. The models are demonstrating how businesses can contribute to social welfare by integrating sustainability and circular economic principles into economic decision-making. This research sheds light on the potential of circular and sustainable business practices to create value at both the micro- and macro levels of the economy, offering a compelling case for the integration of sustainability into business models.

Research limitations - The aim of this endeavour is to create a conceptual framework without the need for empirical testing.

Keywords: System, Circular Economy Business Models, Sustainability, Welfare.

Sustainable Tourism Governance: a systems thinking Triple Helix approach

Marialuisa Saviano, Pharmanomics Interdepartmental Research Center, Department of Pharmacy, University of Salerno, Italy, msaviano@unisa.it

Majid Heidari, Department of Economic and Statistical Sciences, University of Salerno, Italy, mheidari@unisa.it

Daniele Verderese, Department of Economic and Statistical Sciences, University of Salerno, Italy, dverderese@unisa.it

Abstract

Purpose – Like any economic sector, the tourism industry encounters growing pressures to achieve a viable balance between economic growth, environmental preservation, and societal welfare. Contemporary strategies for tourism governance frequently place a greater emphasis on economic advancement, thereby overlooking the significance of environmental and social considerations. The objective of this study is to investigate how the governance of sustainable tourism can be supported by systems thinking for overcoming an economy-based view. More specifically, by embracing a systems thinking approach, this study studies how the multiple actors involved in tourism systems can effectively interact to co-create value by integrating economic, social, and environmental dimension of sustainability.

Design/Methodology/Approach – The paper introduces a comprehensive framework inspired by the Viable Systems Approach (*vSA*) for addressing the challenges of balancing economic progress with environmental and social well-being in the tourism sector. It adopts a systems thinking approach based on the Triple Helix of Sustainability (THS) to highlight the main challenges for effective governance of sustainable tourism systems.

Findings/Results – While maintaining the conditions of profitability, tourism management is increasingly required to address challenging expectations at both environmental and social levels. The need to address these multiple requirements is further complicated by the involvement of multiple actors characterized by different interests and goals (variety) and by the transitional and seasonal characteristics inherent to the tourism industry (variability). Such a configuration requires for an appropriate governance approach able to ensure an effective reply to the emerging challenges of sustainability. In such a direction, the study highlights the contribution of the THS, a governance framework that integrates the Triple Bottom Line with the Triple Helix of Innovation providing guidance for science, policy, and industry actors for making tourism sustainable.

Originality/Value – Developing long-term strategies for sustainable tourism is challenging because tourist systems are multi-actor and constantly changing. An interplay of multiple different stakeholders, in addition to seasonal changes in visitors'

numbers, changing consumer tastes, and global economic trends, can all make it very hard to converge toward sustainable tourism models. Through the THS, systems thinking could support key actors in better catching and understanding the multidimensionality of sustainability.

Research/Practical/Social/Environmental Implications – Effectively integrating the Tourism and Hospitality Sector (THS) into the tourism industry requires a deep understanding of complex feedback mechanisms and the ability to adapt to dynamic conditions. This adaptation is necessary to ensure that economic growth aligns with environmental and social considerations. The convergence function of systems thinking provides a valuable framework for addressing these challenges effectively and developing comprehensive solutions that foster sustainable progress in tourism. This study offers guidance to the various stakeholders in the tourism sector, particularly policymakers and organisations responsible for overall governance. It also provides insights to academic institutions and scholars who play a crucial role in envisioning new scenarios. These stakeholders are collectively committed to engaging businesses and local communities in a collaborative effort to facilitate the transition toward sustainable tourism.

Limits of the research/future directions – One significant research limitation is the reliance on theoretical literature without empirical studies to supplement it. A potential avenue for future research involves using empirical methods to explore how systems thinking and the Triple Helix of Sustainability can be practically applied in real-world tourism governance contexts. By employing empirical approaches, researchers can investigate the effectiveness of these frameworks in enhancing sustainability outcomes while mitigating adverse impacts. Furthermore, it is essential for next studies to delve into the potential benefits of integrating systems thinking into the tourism development process. This empirical investigation would allow for an assessment of the governance capacity of tourism, with a particular focus on the long-term sustainability of tourism destinations and experiences. Such research efforts would also emphasize the importance of safeguarding natural and cultural resources for the benefit of future generations.

Keywords: Sustainable tourism; Governance; Viable Systems Approach; Triple Helix of Sustainability.

Synergies between digitization and sustainability: systems thinking insights from the Italian recovery and resilience plan for healthcare

Marialuisa Saviano, Pharmanomics Interdepartmental Research Center, Department of Pharmacy, University of Salerno, Italy, msaviano@unisa.it

Anna Di Vernieri, Pharmanomics Interdepartmental Research Center, University of Salerno, Italy, divernieri.anna@gmail.com

Abstract

Purpose – In response to the COVID-19 pandemic, the Italian government has adopted an action plan – the National Recovery and Resilience Plan (NRRP) –, which is part of the Next Generation EU Plan and is developed around three strategic axes: digitization and innovation, ecological transition, and social inclusion. These axes reflect key elements of the global challenge of sustainable development that require integrated approaches: innovation for the economic one, ecological transition for the environmental one, and social inclusion for the social one. Hence, the digital and sustainability transitions characterize the plan and are expected to be synergistic in each plan mission. Assuming the complexity of achieving such synergistic outcome in practice, this study aims to investigate whether and how the NRRP is approaching the integration of the ecological, social, and economic areas of action and how digitization, supports the process focusing the attention on the NRRP's Mission 6 "Health" at national, regional, and local levels.

Design/methodology/approach – This work adopts a 4-phases methodology, moving from an analysis of the NRRP official documentation about Mission 6 "Health" at the national level and at the level of the Campania Region with a focus on the Local Health Authority of the Salerno province to investigate both the big picture behind the policy makers' panned actions and the specific actions to be realized at the local level. Then, by wearing the lens of systems thinking, an exploration of the literature and an on-field case study are realized to identify key elements of a framework of reference for integrated governance of the digital and ecological transitions. Real-case examples of good practices and criticalities of integrated strategic governance approaches are discussed.

Findings/Results – The study is expected to reveal that, at given conditions, the digital transition can be synergistic with the sustainability transition. Specifically, digital care and telehealth, as part of the digitization plan, could be the key to many positive outcomes of Mission 6 at the economic, social, and environmental levels. The findings provide the basis for outlining a general framework of reference for an NRRP governance approach at the local level that integrates the ecological, social, and economic perspectives to explore and exploit opportunities for potential synergies of the twin transitions in progress.

Originality/value – Achieving sustainability is a complex issue. It is especially complex in integrating the needs of ecology, society, and economy. Similarly, the digital transition is expected to be complex in ensuring positive impacts and avoiding negative ones, especially at the social level. This work highlights how envisioning and combining positive can impact the twin transition for ecology, society and economy when implementing policy plans, by adopting an (eco)systems governance approach.

Research/ Practical/ Social/ Environment implications – The study has several implications. From a research point of view, it highlights how adopting the higher perspective offered by (eco)systems thinking can favor the view of nexuses of ecology, society, and economy that are not 'visible' at the very local level of observation. From a practical and social point of view, the study highlights the necessity of adopting a governance framework of reference that integrates the three sustainability perspectives to inform wise policy decision-making on the multiple eco-systems impacts of the planned NRRP actions at the local level.

Research limitations – As an essentially conceptual reflection, although based on official documents' references and real case examples, the interpretative hypotheses developed in the work necessitate empirical studies to be validated and further developed at both theoretical and practical levels.

Keywords: Sustainability, Digitization, National Recovery and Resilience Plan, Healthcare, Governance, Systems thinking.

From experiential learning to eco-systems awareness: a Sustainable Outdoor Training approach

Marialuisa Saviano and Mario Testa University of Salerno, Italy
Rita Klapper IDRAC University, France
Adriana Apuzzo University of Salerno, Italy

Abstract

Purpose –Adult education within corporate training settings has evolved significantly, reflecting broader trends and societal needs. In line with the Viable System Approach (VSA) (Barile et al., 2012), the paper highlights the importance of adopting a holistic perspective for sustainable management. Transformative and experiential learning theories dominate the educational landscape (Grund et al., 2024), emphasising the shift from altering perceptions to changing behaviours. Over time, training paradigms have transitioned from institutional training, focused on HR management skills, to more flexible, inclusive models that integrate experiential and informal learning.

This study aims to develop a training approach to sustainability learning that aligns with emerging corporate training requirements. This model seeks to enhance environmental awareness and foster an eco-centric learning approach, transcending traditional educational frameworks by integrating direct, immersive experiences in natural settings. The goal of the study is to promote an educational approach that significantly contributes to personal and professional transformation, favouring the emergence of systems eco-resonance through experiential learning.

Methodology – The research moves from an overview of the main theoretical references in the stream of experiential learning. Key principles from transformative and experiential learning approaches, such as Kolb's experiential learning cycle and Mezirow's transformative learning theory, are integrated to envision the theoretical foundations of a new conceptual framework for training in the context of education for sustainability. Additionally, the study refers to the Information Variety Model's contribution to emphasise the role of values and emotions in decision-making processes related to sustainability.

Results – The preliminary findings indicate a significant shift in educational paradigms towards more flexible and immersive learning methods. The study envisions a fourth generation of learning paradigms that leads to identifying the foundational elements of a Sustainable Outdoor Training (SOT) model, characterised by direct engagement in (natural) environmental contexts oriented to favour the emergence of eco-systems awareness. Participants in SOT-based sustainability educational programs are expected to exhibit increased ecological awareness and a stronger inclination towards sustainable behaviours.

Originality and Limitations – The originality of this research lies in its innovative approach to integrating outdoor experiential learning with sustainability requirements. The SOT model's use of eco-systems awareness for learning assessment is a novel contribution to the field of

sustainability education. However, the study acknowledges some limitations, including the need for empirical support to corroborate the theoretical and conceptual considerations. Further research is necessary to validate the model's efficacy and explore its applicability in different contexts.

Research implications – This research may be of interest to both educational theory and corporate practice. By bridging the gap between theoretical frameworks and practical applications, the SOT model offers a pathway to more effective sustainability training. It encourages companies to adopt innovative educational strategies that not only enhance employee skills but also promote broader environmental and social responsibility. The introduction of eco-resonance training methodologies provides a measurable way to assess the impact of educational interventions, offering valuable insights for continuous improvement for individuals, businesses and the broader environmental context.

Keywords: Corporate training, Sustainability, Transformative change, Experiential Learning, Outdoor training

Online consumer behaviour: reinterpreting marketplaces through the Viable System Approach

*Paolo Barile, Department of Computer Science (DI), University of Salerno (Italy) - pbarile@unisa.it

Guido Iandiorio, Independent Researcher - guido.iandiorio@connextup.it

Clara Bassano, Department of Pharmacy (DIFARMA), University of Salerno (Italy) - cbassano@unisa.it

Gennaro Maione, Department of Economics and Statistics (DISES), University of Salerno (Italy) - gmaione@unisa.it

Abstract

Purpose –In recent years, the development and spread of online commerce platforms have changed the traditional concept of selling, radically altering the interaction between customer and seller. The figure of the consumer, as a consequence, has witnessed a shift in his behaviour in function of a due readjustment to new paradigms. This paper sets out to analyse such a scenario through the Viable Systems Approach (vSa), exploring the factors influencing consumer behaviour in the era of online marketplaces. The aim of the study is to contextualise the interaction between consumer and marketplace from a systemic perspective, with particular attention to the role of emotions in the decision-making processes characterising the sales cycle. The results emphasise the importance of feelings in the interactions between viable systems, suggesting the possibility of implementing emotional chatbots – or other systems capable of detecting emotions – in modern online shopping platforms, to gain greater awareness of consumers' decision-making schemes.

Design/methodology/approach – While the paper has many practical implications, it remains in the realm of reviews/conceptual papers. At the methodological level, the fundamental postulates of systems thinking will be taken up and applied to modern online marketplaces to demonstrate that – despite the paradigm shift from traditional enterprise to online sales – the concepts of vSa are still applicable. A special focus will be given to consumer needs, interpreted in the systemic view of marketplaces as relevant supersystems. This will enable a more detailed analysis of the decision-making dynamics underlying sales processes and an understanding of the role of emotions, their significance from a systemic perspective, and the possibility of using automated Artificial Intelligence (AI)-based approaches to detect consonance in sales processes.

Findings/Results – The main findings of the paper lead to a new interpretation of the role of emotions in the sales processes of modern online marketplaces. The study shows that a consonance-based approach could significantly improve the effectiveness of interactions, enabling the building of a relationship of trust and understanding that leads to more informed and satisfying purchasing decisions. While remaining on a conceptual

level, the findings suggest the possibility of using emotion detection tools to assess consumer decision-making patterns, paving the way for future research that – through the implementation of emotional chatbots or other such systems – could assess the actual benefits of applying consonance measurement frameworks to current online shopping platforms.

Originality/value – The Viable Systems Approach, in its conceptual vastness, offers an all-encompassing and multidisciplinary view of all aspects that characterise the different areas of knowledge whose central element is the human being. The complexity characterising the nature of our species and interactions with the environment around us is readily described by systems thinking in all its facets. On the other hand, using such a powerful tool could – in many cases – be difficult: correctly framing each element while maintaining the right overview is far from trivial. This paper, in this regard, aimed to enrich the literature on vSa, offering the reader a new original systemic perspective on consumer behaviour, online shopping and the role of emotions in decision-making processes involving both parties.

Research/ Practical/ Social/ Environment implications - This research opens new paths for further studies on human-computer interaction, particularly the role of emotions in purchase decision-making dynamics and how they can be better understood and assimilated by AI systems. From a practical point of view, the adoption of chatbots based on emotional consonance could revolutionise the e-commerce and customer service industry by improving the user experience and fostering a more empathetic interaction. This would lead to an increase in the overall perception of AI-assisted interactions, contributing to greater acceptance of and trust in these technologies. Finally, an improvement in the effectiveness of chatbots – guided by the theoretical concepts of vSa – would lead to the optimization of sales processes and toward a deeper understanding of relational dynamics.

Research limitations – Being this a conceptual paper, one of its main limitations is the lack of empirical data to support the hypotheses formulated. Although an approach based on the study of consonance through emotion recognition has already been used by the authors in other contexts, it has not yet been tested on real interactions between sellers and buyers: the inherent complexity of the human emotional sphere could make it difficult to develop a universal model applicable to all customers. Another obstacle arises from the integration of the proposed approach with existing AI systems. Since there is no real data to support it, it is difficult to estimate at a quantitative level the costs and benefits of such an innovation.

Keywords: Viable Systems Approach, Consonance, Emotion Recognition, Human-Computer Interaction, Vendor Chatbots, Artificial Intelligence.

Enhancing Efficiency and Sustainability through Systemic Thinking in Industrial Symbiosis Networks

Pietro Vito, Gerardo Bosco, Mario Calabrese, Raffaele D'Amore, Francesca Iandolo, Antonio La Sala, Giuliano Maielli, Alessia Sciarrone

Abstract

Purpose – The purpose of this work is twofold: to analyse industrial symbiotic networks using the Viable System Model (VSM) and viable Systems approach (vSa) methodologies and to demonstrate how reference to these methodologies in the design and management of networks can improve their operational efficiency in the direction of sustainability and adaptability to environmental and economic change.

Design/methodology/approach – A mixed-method approach was used in the work, comprising a literature review on VSM and vSa that examines the key contributions within the two methodologies and the historical roots in which they were generated; a theoretical analysis that shows how the principles underpinning industrial symbiosis are implicitly consistent with these methodologies and more generally with systems thinking; and a case study in which the Kwinana eco-industrial park in Australia is interpreted in light of the two methodologies.

Findings – The study finds that the conceptual frameworks of VSM and vSa allow for an in-depth understanding of symbiotic phenomena and that the integration of these models is able to improve strategic planning, resource allocation and coordination between participating enterprises, leading to greater sustainability and operational efficiency. The case study shows that systems thinking facilitates the development of adaptive and resilient industrial ecosystems.

Originality/value – The paper contributes to the literature on industrial symbiosis by introducing a point of view, hitherto present only in an embryonic way, that complements the established methodologies, in this field of study, of system dynamics, agent-based modelling and network analysis by providing a novel perspective on how VSM and vSa shed light on the actors, relationships, distribution of responsibilities, co-competitive dynamics existing in industrial symbiotic networks and how such systemic theories can be harnessed to design and manage sustainable industrial networks.

Research/ Practical/ Social/ Environment implications - The paper suggests a research direction that enables an in-depth understanding of the systemic characteristics of IS and highlights how the interpretation of industrial symbiotic initiatives through the methodological frameworks of VSM and vSa can improve economic, environmental and social sustainability through a more conscious framing of waste and emission management, the consequent reduction in resource use and

increased economic viability of both individual participating firms and the network as a whole through the co-creation of value among stakeholders.

Research limitations - The study acknowledges the limitations of the generalisability of the case study results due to contextual differences. Furthermore, the theoretical analysis may require further empirical validation. Future research could explore the wider application of VSM and vSa in different industry contexts and assess their long-term impacts on IS sustainability.

Analysing Smart Tourism Ecosystems for Sustainable Development: A System Dynamics Approach

Pooyan Sedarati. Faculty of Economics, University of Algarve, Faro, Portugal, Pooyansedarati@gmail.com

Tadeja Jere Jakulin. Faculty of Tourism Studies – TURISTICA, University of Primorska, tadeja.jerejakulin@upr.si

Francisco Manuel Dionísio Serra. School of Management, Hospitality and Tourism University of the Algarve, Faro, Portugal , fserra@ualg.pt

Abstract

Purpose – This study aims to elucidate the dynamics within smart tourism ecosystems using a system dynamics approach to enhance sustainable tourism development. By examining the causal relationships and feedback mechanisms, the paper seeks to provide insights into how these ecosystems can foster economic growth and sustainability, assisting stakeholders in making informed decisions towards smarter tourism practices.

Design/methodology/approach – The methodology involves constructing and analysing causal loop diagrams to identify feedback loops and key variables within smart tourism ecosystems. This is complemented by scenario-based simulations, which allow for the exploration of the impacts of various strategic decisions and policy implementations over time. The use of system dynamics models aids in understanding complex interactions and predicting future trends in tourism development.

Findings/Results – The simulations indicate that integrating smart technologies, such as AI and big data analytics, into tourism practices can significantly enhance the adaptability and sustainability of tourism economies. Key findings suggest that smart ecosystems enable better resource management, improve tourist experiences, and facilitate more effective stakeholder engagement, leading to enhanced economic resilience and sustainable growth.

Originality/value – This paper contributes to the literature by applying a system dynamics approach to the study of smart tourism ecosystems, a relatively underexplored area. It demonstrates how simulations and dynamic modelling can provide practical insights into the complex dynamics of tourism, offering a novel perspective on promoting sustainability through technology integration.

Research/ Practical/ Social/ Environment implications - The research underscores the importance of technology and data analytics in shaping the future of tourism. Practically, it guides policymakers and business leaders in strategic decision-making. Socially, it

promotes inclusivity and participation in tourism planning. Environmentally, it encourages sustainable practices that minimise tourism's ecological footprint.

Research limitations - The limitations of this study stem from the assumptions inherent in the simulation models and the generalizability of the findings. The models rely on available data, which may not fully capture the rapidly evolving nature of smart technologies and their applications in different geographical and cultural contexts. Future research should address these gaps by incorporating more diverse data sets and refining the models accordingly.

The Role of Multidimensional Digital Transformation for Sustainable Business

Samuel Plečko, Barbara Bradač Hojnik, Polona Tominc, University of Maribor Faculty of Economics and Business, samuel.plecko@um.si

Abstract

Purpose – Digital and sustainability transformations are increasingly significant factors in entrepreneurship, fundamentally altering business processes. This presents both opportunities and challenges for companies. Businesses opt for a digital transformation of their business model as new digital technologies enable more efficient operations and serve as sources of innovation. These innovations enable companies to meet customer expectations, enhancing their competitiveness. However, customers increasingly expect companies to operate sustainably, and governments are working towards achieving sustainable development goals that also impact business operations. Therefore, it is worth considering whether digital transformation, characterized by innovation and new business models, can contribute to the sustainability transformation of companies. In this paper, we present the design of a research that will address the research problem presented.

Design/methodology/approach – To form a more holistic understanding of the research problem, a sample of small and medium-sized enterprises in Slovenia will be invoked to provide their perspectives, which will be collected using a mixed-method approach. Semi-structured interviews will be conducted initially to gain insight into how companies perceive and implement digital transformation. This insight will inform the design of a survey for further quantitative research. The collected data will be analysed using structural equation modelling with partial least squares to examine the influences among measured constructs and confirm the posted hypotheses. Subsequently, multilayer perceptron neural networks with backpropagation will be used to gain a more precise understanding of the interactions between variables.

Findings/Results – The expected results will demonstrate that digital transformation has a positive impact on innovativeness and the emergence of new business models. It is also expected that innovation and new business models, driven by digital transformation, will have a positive effect on the economic, social, and environmental aspects of sustainability.

Originality/value – The research conceptualizes digital transformation in a multidimensional manner, emphasizing its complexity, and examines the significance of individual dimensions on innovation and new business models. Past studies have primarily focused on the emergence of digital innovations, leaving the emergence of new business models under the influence of digital transformation poorly researched at a general level. The objective is to expand on the limited research that has explored the

direct effects of digitalization on sustainable business by examining the impact of digital transformation on sustainable business aspects through indirect variables such as innovation and new business models. A new general measurement scale will be used to measure the perceived relative advantages of digital technologies based on collected information from interviews and past measurement scales connected with specific digital technology.

Research/Practical/Social/Environment implications - The research findings will deepen the understanding of the effects of digital transformation, reflected in innovativeness and new business models, on achieving sustainable business practices, thereby aiding decision-making in promoting digital transformation in the context of achieving sustainable development goals. The study will also identify the dimensions of digital transformation, providing an in-depth insight into the factors that constitute digital transformation. Furthermore, the research will delineate the impact of individual dimensions on digital innovativeness and business models, enabling companies to address relevant dimensions in an appropriate range to achieve effective digital transformation of their operations. The proposed combined method of gaining and analysing multiple perspectives will augment the list of CyberSystemic approaches by better explaining the interactions between digital transformation and sustainability orientation in today's business environment.

Research limitations - The main limitation of the study is that it does not investigate the factors of digital transformation; rather, it treats it as exogenously given. Additionally, the limitation of the study is that the measured constructs will primarily be subjective assessments of respondents, likely to be managers or business owners. Consequently, dimensions of digital transformation related to leadership abilities, personal characteristics, and beliefs will be excluded from the research model.

Keywords: digital transformation, innovation, business model, sustainable transformation

Integrating artificial intelligence and machine learning into tourism destination management

Silvia Baiocco, Assistant Professor in *Management*, Department of Management & Law, Tor Vergata University of Rome

Paola M.A. Paniccia, Full Professor in *Management*, Department of Management & Law, Tor Vergata University of Rome

Roberto Basili, Full Professor in *Computer Science*, Department of Enterprise Engineering, Tor Vergata University of Rome

Danilo Croce, Tenure track Professor in *Computer Science* Department of Enterprise Engineering, Tor Vergata University of Rome

Abstract

Purpose – This paper aims to better understand how and if Artificial Intelligence (AI) and Machine Learning can help to successfully manage tourism destinations. To do so, it proposes and applies a novel systemic-co-evolutionary model based on a data-driven approach and the key assumption that tourism destinations can be better understood in the context of complex adaptive ecosystems. In this view, each tourism destination is made by a plurality of reciprocally-functional local sub-systems, each characterised by its socioeconomic and ecological components, where inter- and intra-relationships are of dialectical nature. The interactions and mutual feedback among multi-level actors shape (un)sustainable paths within destinations, thus involving multilevel effective (or not) adaptations within the destinations and with the wider society.

Design/methodology/approach – Following the participatory action research approach, the model was developed from December 2022-March 2024 by the Italian Institute for Tourism Research-ISNART and the Italian Union of Chambers of Commerce-Unioncamere with the support of management and computer science researchers, and a university spin-off delivering AI solutions. Employing the data-driven approach, AI and Machine Learning were used to collect and integrate real-time data on Italian tourism destinations from heterogenous sources, creating extensive location-specific information and knowledge. This enabled the automatic modelling, design, and population of a data lake currently including 45.5 million statistical and dynamic open micro-data covering all Italian municipalities, 4 million reviews, 708,000 scraped Web pages that supported the design of 74 variables on tourism destinations.

Findings – The proposed systemic-co-evolutionary destination model based on a data-driven approach allows to jointly analyse: i) the *integration level of tourism destinations' offering* through indicators on tourism products, tourists, infrastructures, firms, local community, and governance; ii) *tourists' satisfaction level* using Natural Language Processing and Machine Learning for sentiment analysis from travellers posts; iii) *tourism destination appeal* according

to dynamically gathered data from local and national media; and iv) *environmental, social, and economic impacts* of tourism development through quantitative indicators. Such analyses support various actions related to key determinants of effective multilevel co-adaptations within destinations and with the wider society that have been identified in prior sustainable tourism management studies.

Originality/value – This paper provides a novel destination model by integrating research and practice on sustainable tourism management with AI and Machine Learning methods into destination modelling. The proposed model allows for a better and more concrete understanding of how tourism destination co-evolutionary ecosystems can be successfully managed by considering the complex interactions connected to their multi-dimensionality. Moreover, it addresses the need for appropriate methodologies, specific indicators, and associated targets for ongoing verification of achievements. Additionally, it proposes a model that integrates tourism destinations' digital transformation and the relationship between the supply- and the demand-side of tourism destination by applying the sentiment analysis, which is still scarcely used in the tourism sector.

Research/ Practical/ Social/ Environment implications – Preliminary results suggest that the proposed model is considered as a valid tool for decision makers and policymakers to adopt shared adaptation strategies aimed at tourism destination ecosystems that are aligned with their environments, generating a common vision. Online and real-time access to intelligent services provides a wide range of relevant, reliable, comparable, and up-to-date information that allows acting on key identified determinants of effective multilevel co-adaptations between various actors within destinations.

Research limitations – The proposed model has been applied to one Italian tourism destination and is not generalisable. Consequently, future research may consider broadening the field of investigation by applying the model to other destinations and comparing results that emerge from the analysis. Moreover, future research can be supported by interviews with other various multi-level actors of tourism destinations such as tourism firms, institutions, local inhabitants, and tourists. Such research could verify the real perception of the importance of acting upon the determinants of effective multilevel co-adaptations to create shared value in the face of ongoing socioeconomic and environmental challenges.

Keywords: Tourism destination ecosystem; Co-evolution; Artificial Intelligence; Machine Learning; Data-driven model; Sustainability

Climate Governance Action and Corporate ESG Performance: Evidence from China

Tachia Chin. Zhejiang University of Technology, Hangzhou, China

Zhisheng Li

Abstract

Purpose – At present, it is very important to carry out effective climate governance to cope with the increasingly severe climate crisis and the devastating ecological impact.

Design/methodology/approach – Using the climate-resilient city construction initiative in China as an opportunity, this study explores the impact of climate governance action on corporate ESG performance using a DID method based on empirical data from Chinese A-share enterprises between 2012 and 2022.

Findings/Results – The results indicate that climate governance action can significantly enhance corporate ESG performance, green investors and diversified boards of directors generate monitoring and governance effects that can effectively strengthen the positive impact of climate governance action on corporate ESG performance. An exploration of the impact mechanism reveals that climate governance action enhances corporate ESG performance by promoting the increase of TFP of enterprises. Heterogeneity analysis shows that the effect of climate governance action is more pronounced for enterprises in regions with severe weather hazards and higher greenhouse gas emissions, as well as for enterprises with higher pollution levels.

Originality/value – The research highlights the strong link between climate governance action and corporate ESG performance, suggesting an important role for businesses in addressing global climate change.

Research/ Practical/ Social/ Environment implications - These findings not only help companies build more sustainable business models but also provide important evidence to achieve climate change mitigation and sustainable development goals.

Research limitations -As the urgency of global climate change becomes increasing, future research perspectives can focus on how to promote a greater role in climate governance through innovative policy tools and incentives while ensuring the full fulfilment of their environmental responsibilities to achieve the SDGs.

Keywords:

Climate governance action; Corporate ESG performance; Green investors; TFP

Complex Systems Modelling: A Systems Approach in Tourism and Criminal Law

Tadeja Jere Jakulin, University of Primorska, Faculty of Tourism Studies – TURISTICA, Obala 11a, SI-6320 Portorož, tadeja.jerejakulin@upr.si

Vid Jakulin, University of Ljubljana, Faculty of Law, Poljanski nasip 2, 1000 Ljubljana vid.jakulin@pf.uni-lj.si

Abstract

Purpose—The systems methodology upgrades reductionist thinking and analysis. This contribution touches on reductionism and concentrates on contemporary systems thinking methodologies for examining complex systems in tourism and criminal law concerns. Linking and exploring tourism and criminal law provides a comprehensive understanding of the complex interactions between these two areas. This understanding, facilitated by systems methodology, helps identify risks and promote sustainable tourism development and empowers policymakers to improve legal frameworks and enforcement mechanisms, prioritising the safety and well-being of tourists and host communities.

Design/methodology/approach—The research is based on systems thinking and dynamics. These methodologies are appropriate for addressing the complexities and interdependencies within the tourism and criminal law domains, leading to more effective problem-solving and policy formulation. Future research directions are also proposed to explore the effectiveness of the systems methodology further.

Findings – The analysis suggests that reductionist thinking, while useful for simplifying complex phenomena, may overlook critical interconnections and emergent properties inherent in systems. Conversely, systems methodology offers a holistic perspective that acknowledges the interconnectedness and dynamic nature of phenomena in tourism, criminal behaviour, and environmental systems. This holistic perspective can enlighten researchers, policymakers, and practitioners, leading to more effective problem-solving and policy formulation.

Originality/value—This paper stands out by highlighting the need for a nuanced understanding of complex systems and emphasising the importance of adopting systems approaches to address contemporary challenges effectively. By advocating for the adoption of systems methodologies, this paper aims to motivate researchers, policymakers, and practitioners to develop integrated strategies that consider the multifaceted nature of issues in tourism management, criminal justice, and environmental governance.

Research/ Practical/ Social/ Environment implications— To implement the methodology, we used a qualitative-quantitative model built with the Vensim tool and obtained optimal results. This paper's findings significantly affect researchers, policymakers, and practitioners. Advocating to adopt systems methodologies encourages the development of integrated

strategies that consider the multifaceted nature of issues in tourism management, criminal justice, and environmental governance, making it a valuable resource for those in these fields.

Research limitations— Despite the optimality of the systems methodology, it's important to acknowledge that there is always the possibility of reductionist behaviour in individuals or society that can suddenly affect the results of systems solutions. This limitation, namely, society's consciousness, is a crucial factor to consider in the application of these methodologies.

Keywords: Systems theory, system dynamics, cybernetics, modelling, tourism, criminal law,

Multicriteria Model of Shore Excursions Sustainability in the Frame of System Dynamics

Taja Macek, University of Primorska, Faculty of Tourism Studies – TURISTICA;ATLAS EXPRESS Slovenia

Tadeja Jere Jakulin. University of Primorska, Faculty of Tourism Studies – TURISTICA, Obala 11a, SI-6320 Portorož, tadeja.jerejakulin@upr.si

Abstract

Purpose: The purpose of this paper is to build a multicriteria model for the assessment of a cruise ship's shore excursion's sustainability. This model, which incorporates three primary indicators-cultural (such as preservation of local traditions and respect for cultural heritage), socio-economic (such as economic benefits for the local community, job creation), and environmental (such as carbon footprint, waste management), will be used to evaluate the sustainability of shore excursions. By doing so, we aim to provide a solid theoretical background to evaluate shore excursions at a destination or a port of call. This relation has not received much academic interest in the past but is crucial for developing a port of call.

Design/Methodology/Approach: The research employs a systems approach with its modelling. A qualitative multicriteria decision-making model was initially developed through a comprehensive literature review and in-depth, unstructured interviews with tour operators, where the operators were free to express their views and experiences. This model was built with the help of DEX-I, a tool for MCDM. Subsequently, the research findings were integrated into a qualitative system dynamics model (CLD), representing the sphere of influence of a sustainable shore excursion on a destination, considering the dynamic interactions and feedback loops between the various indicators.

Findings: This research illuminates the profound significance of shore excursions to a destination. By uncovering the intricate interplay between the indicators, we can anticipate the destination's excursion sustainability and its points of equilibrium and reinforcement. Grasping the intricate dynamics of a sustainable shore excursion and its influence on a destination from a cultural, socio-economic, and environmental standpoint is pivotal for fostering sustainable tourism practices.

Originality: In a pioneering move, we delve into the characteristics and impacts of a cruise shore excursion on a destination. Our research scrutinises the structure of a shore excursion in the context of a destination, elucidating its significant influence through a sophisticated system dynamics model. This innovative approach provides guidelines for sustainability indicators that bolster the operation of shore excursions, a critical stride in advancing a destination.

Research/Practical/Social/Environmental Implications: The research carries substantial practical implications. It strives to present the intricate system that amalgamates the destination, shore excursions, and further development. With a comprehensive understanding of the issue, we can foresee unsustainable relationships and make well-informed decisions to bolster a destination's strategic development. For instance, tour operators can leverage the findings to craft more sustainable shore excursions, policymakers can devise guidelines for sustainable tourism practices, and destination managers can strategise for the long-term sustainability of their areas.

Research limitations: The information and data are hardly accessible, so we needed to source the expertise from a tour operator. This limitation suggests the need for further research to highlight the influence of the diversity of shore excursions on the destination and the creation of its environment. Additionally, the model's effectiveness could be further tested and validated using more diverse data sources and in different geographical contexts.

Keywords: shore excursions, cruise, sustainability, system dynamics modelling, multicriteria decision-making,

A more Holistic perspective of AI-based inventory forecasting – implications on business user experience

Žan Domanjko, Faculty of Economics and Business, University of Maribor, Slovenia; Novartis Pharmaceutical Manufacturing LLC, Slovenia

Igor Perko, University of Maribor, Faculty of Economics and Business; World Organisation of Systems and Cybernetics

Abstract

Purpose – The purpose of the research is to check how demand forecasting using artificial intelligence algorithms affects the business user experience. The development of modern technologies allows us to use forecasting and optimisation methods based on generative artificial intelligence over mass datasets stored in company or organisational databases. Technological progress in parallel opens up the issue of user experience in accepting and using new methods. During our research, we are planning to build a prototype, which will then be tested by users/employees of various supply chain functions (procurement, sales, logistics, analytics, warehousing and planning) of the test company with sensitive products.

Design/methodology/approach – We will use the case study method and a combination of predictive models. During our research, we are planning to develop multiple stages of a prototype, which will then be tested by users/employees of various supply chain functions (procurement, sales, logistics, analytics, warehousing and planning) of the test company with sensitive products. In each prototype stage, the prediction quality will be examined directly -through measuring accuracy, while the user experience will be measured by observation and partially structured interviews.

Findings/Results – We expect to find correlations between the data quality, the AI algorithms selection and the user interface with an emphasis on the business user experience. Since the examination will be repeated multiple times, we will also observe the level of user experience development through multiple phases of the prototype development.

Originality/value – We will bring together multiple perspectives on the qualitative improvement in the availability and accuracy of predictions, the presentation of the results and the user perspective on the new product, examined not only once but in three occurrences during the process of implementation. This is a significant step forward relating to the usual approach of employing a single observation point in the research.

Research/ Practical/ Social/ Environment implications – Our plan is to improve and simplify work processes for business users by taking into account the improvement of user experience. The management team will gain a prototype that regulates organisational and informational flows inside and outside the company with the

participation of the employees. For researchers, we will present the operation of supply chains, features and factors for inventory forecasting, artificial intelligence and optimisation algorithms. We also contribute to the terminology of the sector by introducing the term business user experience. Our society will get higher quality and on-time supplied finished products. There will also be a direct impact on the environment by reducing the amount of waste material.

Research limitations - While preparing the research, we will limit the final set of finished products and limit the extensiveness of the data inputs. We will focus on the availability of data, not on the creators and methods of data collection. We will only use available software and hardware equipment. For measuring business user experience, we will limit ourselves to test representatives from six functional areas (purchasing, sales, logistics, analytics, warehousing and planning). At the same time, the obtained data will remain anonymous, will be used in accordance with the ethical code and will be deleted after analysis.

Keywords: Inventory planning, Manufacturing optimisation, Sales forecasting, Artificial intelligence, Business user experience

Section 2.3 A Shift in paradigm: how the Viable System Model shapes collaborative, self-governing organisations and networks

Coordinated by Angela Espinosa, and Jon Walker

It becomes progressively more obvious that a new paradigm for sustainable self- governance is a pre-requisite for the creation of a fairer, regenerative, more democratic world. Stafford Beer's VSM has proved itself to be in a class of its own for dealing with these kinds of issues: it is deeply systemic and fundamentally concerned with patterns of relationships rather than isolated decisions restricted to a vast number of silos. All VSM diagnosis focusses on the interactions with the environment and, once the environment defined by the observer extends to include the health of eco-systems and bio-diversity, the VSM offers clear guidelines to organise any institution in a regenerative manner.

Further the combination of levels of recursion and the law of requisite variety make it clear that a centralised, authoritarian governance approach cannot possibly work. The VSM requires autonomy at all levels, and at the lower levels of neighbourhood and family, dramatic devolution of both power and responsibility so that everyone becomes part of the solution. Lastly the VSM views society as a vast array of nested viable systems, where lower levels are braided together for their mutual benefit in a fundamentally collaborative way. In this team we invite academics and practitioners to suggest ways to further clarify and apply the ideas of organisational viability, sustainability and self-governance, to promote collaborative networks rather than competitive, authoritarian organisations; and to develop adaptive capabilities, to more effectively contribute to a more peaceful and resilient society.

From viability supporting competitiveness to sustainable self-governance and collaboration, as the basis for a post-capitalistic society

Angela Espinosa, Metaphorum

Jon Walker, Metaphorum

Abstract

Purpose - The purpose of this paper is to clarify the collaborative dimension of the Viable System Model, and its relevance for shifting the traditional management paradigms towards a new paradigm of sustainable, collaborative, non-authoritarian self-governance, which is fundamental to move businesses and society towards a post-capitalistic era. It argues that only be making this shift, we will have a chance to address the intractable problems organisations and societies are currently facing, i.e., climate change, inequality, and geo-political wars.

Approach - Both in the corporate and the not-for-profit sectors, there has been a growing interest for exploring new governance models, towards more agile, networked, and collaborative organisations, to progress towards a fairer, regenerative, and more democratic society. We present selected examples from the literature of new approaches to governance that suggest shifting organisations towards a neural-network type of organisations, while keeping a strong sustainability ethos and actively engaging with its local socio-economic and environmental niches. Ashby's Law which is at the heart of the VSM argues that only by maximising local autonomy can a system have any hope of matching the massive environmental variety we now all face. The vast majority of governance models still bear traces of Taylorism, which is incompatible with local autonomy.

We then illustrate how the authors 'viability and sustainability' approach (v&s) inspired in the VSM offers a way of encouraging new ways of self-organisation and self-governance. The v&s presents the VSM from a constructivist perspective, observer based, focused on individual and group management of complexity. Its 'Self-Transformation Methodology' supports organisational learning through collaborative workshops, aimed at jointly developing capabilities for sustainable self-governance. It explains how, by improving the interactions with the environment and actively working towards improving the health of eco-systems and local communities, the VSM offers clear guidelines to reorganise any institution in a regenerative manner.

Methodology - There has been recently a rise in organizational and governance research exploring new governance paradigms to address systemic challenges our global socio-economic environment is facing. We explore some innovative proposals embracing collaborative rather than competitive ways of organizing, which can potentially move towards a post-capitalistic society (e.g., holocracy, sociocracy, DAOs, polycentric

governance, Teal approaches). We identify the common threads they share regarding patterns of organization with Beer's VSM.

We then present the author's viability and sustainability approach (v&s) and explain the criteria it offers for developing sustainable and collaborative self-governed organisations and societies. By comparing these criteria with the criteria emerging from the literature we demonstrate that the v&s brings a radical shift in paradigm, which complements these approaches.

We introduce our 'Self Transformation Methodology' to apply the v&s approach to business and societies which offers a systemic and comprehensive framework to analyse existing gaps in capabilities for self-governance, and to improve self-governance towards long term viability and sustainability.

Through stories from published v&s case studies, we demonstrate the way the v&s facilitates a shift from centralized authoritarian governance structures towards devolved autonomy at all levels of recursive organization and the development of adaptive self-governance capabilities. We argue that the most effective way our VSM approach to self-organization and self-governance would work is by developing collaborative rather than competitive strategies as our examples demonstrate.

Key findings - Both the review of literature in the paper's central topic, and the comparative analysis of specific case studies reveal important theoretical and practical findings.

We found that the growing fields of governance and sustainability research are suggesting innovative theories and research approaches, which complement what the VSM has to offer. We highlight key conceptual and methodological aspects of these new approaches which complement the v&s and STM approach. We provide a landscape of possible VSM research routes to continue developing VSM theory and related methodologies to contribute to self-governance research.

We demonstrate through the case study's stories, that rather than 'ignoring power struggles' as some traditional VSM critics have said, the VSM results in a dramatic devolution of both power and responsibility (what we call 'responsible autonomy') by inviting everyone to be part of co-designing their own solutions, developing a shared collective mental model of organization, which cements a collaborative platform for implementation of sustainability strategies.

Originality and Contribution - While recent studies on governance and sustainability are opening up new research paths towards distributed governance and collaborative networks, not all of them offer a systemic view of organisation, or systemic methodologies to apply it and facilitate development of systemic changes.

The v&s approach and the STM coherently offer a view of the VSM which emphasize the design of collaborative and self-governed structures and explains the learning path to put

it into practice combining systemic tools and clarifying VSM theory. It resonates with some governance innovations, like holocracy, sociocracy and polycentric governance, but the v&s provides a more complete criteria for designing collaborative and sustainable self-governed organisations and networks.

The stories we reflect upon through published case studies confirm that our way to applying the v&s through collaborative applied research, offers a robust framework to sow the seeds of collaborative self-governance, which once experimented with positive results, can contribute to shift the paradigm of governance in organisations towards sustainable self-governance.

Research and Practical Implications - Comparing VSM with other fashionable approaches to self-governance helps to clarify the strengths and value of current practice using other systemic perspectives, and also to highlight the power of the VSM and the v&s to integrate and potentiate them, by creatively combining approaches.

In practical terms, we demonstrate the value of adopting a creative mix of methods to continue exploring theoretically robust and practically feasible approaches and methods to facilitate the transition towards a more peaceful and sustainable society.

Specifically, we demonstrate the value of collaboratively mapping complex organisations as a vast array of nested viable systems, where lower levels are braided together for their mutual benefit in a fundamentally collaborative way. And how, by jointly exploring the self-governing capabilities of each of the nodes in such a network, using VSM criteria, contributes to co-designing collaborative networks.

Research Limitations and Future Directions - While there have been several publications detailing the v&s approach and providing multiple examples of application, we are aware that we still need to progress towards more systematic research to compare multiple theoretical approaches and multiple case studies with standardised assessment tools. We summarise what we see as open paths for improving research to explore self-governance in organisations and societies, and our conclusions about future directions to continue exploring theories and methodologies to support applied research in sustainability and self-governance.

Keywords: Viable System Model (VSM), Sustainable Self-Governance, Collaborative Networks, Post-Capitalistic Society, Systemic Change, Responsible Autonomy

A VSM governance tool and agricultural paradigm change for climate and ecology

Angus Jenkinson. Research Fellow, CLEA, Vrije Universiteit Brussel (VUB). Councillor for Regenerative Agricultures and Ecology, Cotswold District Council.

Center Leo Apostel, Vrije Universiteit Brussel (VUB). Bd de la Plaine 2, 1050 Ixelles, Belgium.

Cotswold District Council, Trinity Road, Cirencester, Gloucestershire.

Abstract

Purpose - This session presents a comparison of two models of farming via a VSM System 5 identity management tool that offers scope for VSM's evolution. Farming is an ecological, social, and economic sector vital for climate change, nature, and human life. Its current operating paradigm is internationally agreed to be unsustainable (IPCC et al.). It generates large negative economic and ecosystem effects, including 22% of world climate impact (GHGs), due to failures in meta-level organisational governance. By contrast, a biodynamic English farm stewards patterns of relationships in nature's ecology. The analysis introduces Virtuoso, a whole-system identity management tool (VSM System 5). The paper shows how Virtuoso fits and amplifies the VSM's sustainable self-governance methodology, providing novel functionality and developmental opportunity. Its progressive scientific base in cybernetics and ecology introduces new theory to management. It recursively integrates into all levels of the VSM, supporting its development as a systemic tool for the world.

The twin goals are to support VSM's ongoing development, amplifying its effectiveness, and highlight the necessity for a paradigm change in agriculture, an ecological, social, and economic sector vital for nature and human life. VSM System 5 (S5) establishes the regulatory guides for viable integrity at all recursive levels as an organisation self-organizes (using the notational distinction of organisation and organization to demonstrate their co-creation). The paper introduces Virtuoso as a design innovation to address the absence of a formal S5 design specification with requisite variety. The paper uses the Virtuoso model to compare industrial and biodynamically regenerative farming paradigms. It reflexively uses each subject to demonstrate aspects of the meta-level self-organizing governance of the other. Agriculture's conventional industrial paradigm is scientifically confirmed as unsustainable, generating substantial negative economic and ecosystem effects, including 22% of global GHGs (IPCC analysis). This speaks to VSM's concern for the health of ecosystems and biodiversity.

Design/methodology/approach - The paper draws on two existing bodies of research to illustrate how Virtuoso's closed circular logic of disposition of coherent identity-goal-states would fit VSM and amplify its usefulness.

1. Selecting farming and a particular farm as a model reflects applied research in UK local government and draws on extensive published scientific research. It illustrates the conference theme of paradigm change and the importance of requisite feedback and epitomises VSM diagnostic focus on the interactions with the environment.
2. Virtuoso's unique approach to requisite variety is a minimally sufficient 'Ouroboros' identity logic (MESE), both reflexive and recursive. It was designed and refined in multi-stakeholder action research. Its use is empirical and phenomenological. The theoretical base is cybernetic and consistent with the work of Beer, Maturana, and Varela.

Findings/Results The paper hypothesises Virtuoso as a toolkit embedded in VSM S5 identity regulation to simplify management while amplifying rigour in diagnostics, design, and governance. It further hypothesises that it can support industrial paradigm change at all recursive levels of application.

Extensive scientific research (IPCC et al.) confirms the unsustainable crisis of nature in the industrial model of farming. This indicates decades of systemic failure in meta-level national and organizational governance (learning). The peer reviewed case study of a viable English biodynamic farm presents an alternative century-old paradigm treating a farm as a natural ecosystem, a vast interweaving interdependent array of nested viable living systems in a global context. The reference farm sustainably captures an astonishing ten times more carbon than it generates, most sequestered in the soil.

It is useful to make the distinction that an *organisation* forms its own *organization* of internal structures, processes, situations and so on, which together thereby constitute and conserve it as an *organisation*. S5 is the governance centre for this. This is self-organizing. An organisation is further posited as an autonomous multidimensional descriptive space (MDDS), closed to organization, recursively composed of autonomous agents, each responding to feedback from their MDDS environment, along with mechanisms of production and operation. Coherence requires viable and integral alignment, a key aspect of living identity. Resilient viability requires requisite variety of timely feedback. That demands requisite organization of the VSM S5 principle, currently not specified adequately in VSM but offered through this approach.

Originality/value. Functional identity is treated as a pervasive and primary ecological governance discipline with an integral methodology, respecting Beer's treatment of organisations as social organisms.

1. Using Virtuoso as a paradigm change specification and applying it to the VSM are innovations. It offers a proven specification for S5, a broadly unspecified space. Its flexible protocols and recursive requisite variety are both simple and comprehensive. This can support VSM development as a prime tool for

governance, design, diagnostics, strategy, and decision-making. Benefits can accrue through both praxis and technology development.

2. A major economic, ecological, and social sector of sensitive global priority is treated with a cybernetic VSM characterisation, yielding insights for the cybernetic and VSM communities as well as for agricultural policy and practice interests.

3. Standard treatment of climate change prioritises technological change. This paradigm change reduces technology and discloses mindset and technique as key.

4. It offers the VSM community the opportunity to support managerial needs in any sector to enhance autonomy while conserving viability more precisely.

Research/ Practical/ Social/ Environment implications - The proposal may close a functional gap in the VSM, offering a praxis and potential for integral management and learning. It is easy to implement and fits the VSM frame elegantly.

The global and local turnaround potential of agriculture for climate, ecology, and other ecosystem benefits can hardly be exaggerated. The industrial farming model uses extrinsic inputs as isolated treatments to compensate for a declining core farm matrix. This increases costs, reduces quality, destroys habitats, and leads to a Red Queen vicious cycle of economic mismanagement that ignores negative feedback. A century of failure to learn the unsustainability of conventional farming reflects myopia induced by powerful business and political interests. Such characteristics are found in other management fields.

The comparative approach assists policy formation, management education, and benchmarking. It enables national and local conversation on comparative epistemology, models, and practice. It could be a tool for farm clusters pioneering change.

Research limitations - While the application of Virtuoso to VSM has been discussed by experienced VSM practitioners, it must be applied and its uses refined in practice. How it serves technology systems as they emerge also needs analysis.

Practical application in the field of agricultural policy and practice is only scheduled from autumn 2024.

Keywords: Paradigm change, VSM, identity governance, regenerative farming, climate change, cybernetics.

New Horizons for the Viable System Model

David Cooper, Chair Reading Patient Voice, former Lead Governor, Royal Berkshire NHS Foundation Trust

Abstract

Purpose – The purpose of this paper is to explore the human dimension of the complex interactions identified in VSM. It focuses on personal emotions, power, conversations and relationships, and the tensions between personal identity and organisational identity, particularly in periods of organisational and strategic change.

It draws on psychology and microsociology to provide a complementary perspective on understanding complexity, not simply as a result of the variety of organisational products and services, but the variety of human beings in all their complex manifestations in organisational life. Ashby's law of Requisite Variety applies to people as well as things.

Approach - These human aspects of VSM are often neglected in the mainstream academic literature. This has been recognised by many system practitioners who need to adapt their methods to the wider context including organisational history, culture and local power relations, behaviour, and relationships.

The paper highlights the importance of language and meaning systems i.e. how people make sense of their situations and problems. The mechanistic language of VSM can be off-putting to people without a scientific background- e.g. describing it as ' applying cybernetic logic to human relational conditions'. This is a somewhat extreme reading of VSM, but the underlying issue has been recognised in the VSM community. However, despite some notable innovative books integrating VSM with broader management methods, the model has not been universally acknowledged by management.

A second concern is that VSM has been seen as a purely functional, rather than an interpretive approach. It focuses on roles in a structure rather than on individuals and offers no systematic methods for understanding organisational relationships in which feelings are felt and expressed through conversations-often inadequately described as 'interactions'.

These conversations and observations in an investigation are inevitably subjective and will be shaped by people's assumptions, ambitions, power, experience, and risk aversion. These can have a major influence on sustaining undesirable feedback cycles.

The implications of these concerns are that VSM practitioners need to broaden their practice to include awareness of other disciplines. Practical examples in this paper illustrate these ideas.

Results The paper presents three stories: personal experience in supporting two organisations and a well-documented account of strategic change in a pharmaceutical company involved in a merger. The first experience was in a utility company undergoing a challenging strategic change in its IT systems, where cognitive bias in separate groups in different locations was resolved using a re-framing approach. Despite differences in power, mind-set, and

assumptions, a mutually acceptable solution was identified and implemented. The story raises questions about appropriate methods and tools for getting shared understanding and agreement from remotely separated teams.

The second story describes how a hospital looking for extra space, used a medical model to justify closing a hospital hydrotherapy pool. The model was challenged by an external pressure group and led to the creation of a novel dialogue involving pool users, physiotherapists, and the Lead Hospital Governor. The limits of model-based decisions are discussed.

The third story describes how senior managers in a pharmaceutical company made sense of their situation through challenging strategic conversations where they experienced power differences, feelings of loss of control, threats to identity, and anxiety, but out of which an agreed way forward emerged. This story highlights the need for situational awareness and emotional intelligence in VSM practitioners.

Organisational Value -There have been attempts to simplify VSM language and make it more acceptable to the business world. This paper explains how these initiatives can be built upon, using a richer human-centred vocabulary that resonates with managers both in the private and public sectors and with the proliferating variety of third-sector organisations that have become a growing and important feature in modern societies.

Research and Practice Implications - VSM communities of interest, such as Metaphorum and SCiO, currently provide opportunities to share practitioner insights into alternative approaches to the effective use of VSM in organisational change, especially in their recent training initiatives. This paper aims to offer new insights for this work, by introducing VSM learners and practitioners to a broader, multi-disciplinary set of ideas in the design and implementation of VSM-based projects.

Keywords: Relationships, Conversations, Language, Psychology, Emotional Intelligence

Spaces of dissent and recounting variety in a democratic beverage company.

James Fox, University of Exeter.

Abstract

Purpose – This paper explores the democratic processes within organisations and suggests that cyberneticians have tended to emphasise particular conceptions of democratic organising to the exclusion of others. By reintroducing these unexplored notions of democratic participation, specifically the notion of dissent/dissensus and its contrast to consent/consensus, the paper aims to broaden and complexify conceptions of democratic organising which are accounted for by systems designers. Drawing on research gathered from a democratically governed caffeinated cola-drink company based in Germany, the author argues that Premium Collective's (PK) use of spaces of dissent (SoD) was central to their survival during the Covid pandemic and was instrumental in their rapid adaptation to the challenging circumstances that the pandemic imposed.

Design/methodology/approach – This research drew on a variety of research methodologies, particularly netnography. The author was provided access to PK's digital forum, upon which all major decisions made by the collective are decided by means of consensus. This provided over a decade of rich discussions and tracked the development of PK's unique approach to self-governance. It also provided a real-time look at their response to the pandemic and attempts to adapt to the situation in which they found themselves. Additionally, the researcher conducted interviews with members of the collective, considered online resources, books, podcasts and scholarly work by other researchers and by prominent members of the organisation.

Findings/Results – The paper shows that democratic participation is not merely produced through agreement-establishing processes (eg; through consensus decision-making or voting) but also through the facilitation of SoD, in which participants are provided with a space in which they can propose new ways of organising, suggest changes to governance methods, and hold existing centres of power to account. Additionally, the research found that these spaces are dependent on a culture of equality and trust being maintained within the organisation. Finally, the author re-links their findings to the cybernetic notion of variety engineering, showing that SoD not only enables participants to amplify the organisation's variety but also enables the recounting of variety, an entirely novel contribution to organisational cybernetics.

Originality/value – This paper produces two novel contributions to organisational cybernetics, particularly as it pertains to democratic self-governance. First, it encourages cyberneticians and designers to introduce a more multi-faceted notion of democracy to organisational design, enabling democratic organisations to become more adaptive to

environmental perturbations, as well as to draw on the collective intelligence of its members. Second, the paper makes significant contributions to the cybernetic notion of variety engineering, showing that conventional democratic processes tend to focus on only one side of the variety engineering cycle (processes of agreement, which amount to variety attenuating mechanisms), while also revealing the political nature of counting organisational variety.

Research/ Practical/ Social/ Environment implications - This ambitious research will impact various members of the research and professional community, particularly researchers and practitioners within a democratic and participatory context. Researchers considering the relationship between cybernetics and democracy will be exposed to new notions of democratic organising and new democratic practices (dissensus democracy practised through SoD). These contributions are shown to lead to more adaptive democratic organisations, as well as enabling the ongoing self-emancipation of its members. Furthermore, the paper hopes for these findings to produce impacts on society as a whole by popularising the unique and radical techniques used by PK, which enabled them to survive perhaps the greatest environmental perturbation of a generation.

Research limitations - Future research may build on the findings of this paper by investigating other organisations which facilitate SoD. As this research focused on a single organisation, future studies could explore in more depth the commonalities between different SoD, enabling more generalised conclusions to be drawn from organisations that use similar spaces. One particular opportunity for future research is the use of SoD within physical rather than digital settings. Face-to-face environments which use SoD could not be explored during the project due to the conditions imposed by the pandemic.

Keywords: variety engineering, netnography, self-organisation, participation, democracy, dissent.

Navigating the Waves of Change: Advancing Ocean Literacy through a Recursive, Viable System Model

Peter Tuddenham – College of Exploration, Potomac Falls, VA 20165 USA

Abstract

Purpose - The intricate web of interactions and relationships defining our global ecosystem is a tapestry of complexity that continually challenges our understanding and stewardship, particularly in the realm of oceanic affairs. Ocean Literacy, a concept birthed in 2000, embodies the dual recognition of humanity's impact on the ocean and, reciprocally, the oceans' profound influence on humanity. Encompassing seven core principles and forty-four detailed concepts, this initiative has, over two decades, evolved into a globally acknowledged endeavour instrumental in shaping our interactions with the world's ocean. The urgency to advance this literacy has never been more acute as the anthropogenic footprints on marine ecosystems become increasingly indelible, urging a reimagined approach to governance and interaction within this domain.

Approach/Methodology - This study employs the Viable System Model (VSM) as a methodological framework to enhance Ocean Literacy at multiple levels of organisation, from global to individual scales. By utilising VSM's principles of recursiveness, autonomy, and adaptability, the research investigates how these concepts can be applied to structure Ocean Literacy initiatives. The methodology includes a detailed analysis of existing Ocean Literacy programs, mapping them onto the VSM framework to identify gaps and opportunities for improvement. This is complemented by case studies and pilot projects that implement VSM in various contexts, assessing their impact on fostering sustainable ocean stewardship. Data collection involves a mixed-methods approach, incorporating qualitative interviews, surveys, and quantitative metrics of program effectiveness.

Key findings - This paper proposes the adoption of the Viable System Model (VSM) as a recursive framework to enhance Ocean Literacy, aligning with the conference themes of fostering active citizenship, integrating ecological, social, and economic governance, and merging cybernetic systems with ecological understanding. The VSM, with its emphasis on self-regulation, adaptability, and viability within complex systems, offers a robust scaffold to navigate the multifaceted challenges of ocean stewardship.

Originality and Contribution - By structuring Ocean Literacy initiatives within a VSM framework, we can foster a decentralised, adaptive learning ecosystem that empowers individuals, families, communities, organisations, and nations to internalise and act upon the intricate dynamics of ocean-human interactions. This approach not only aligns with enhancing democratic processes and active citizenship but also embeds the ecological, social, and economic dimensions into the fabric of organisational governance and management. Furthermore, integrating digital and AI-driven tools within this framework

can catalyse a CyberSystemic ontology, bridging the gap between physical and digital realms and enhancing our capacity to understand and respond to the nuanced interplays within marine ecosystems. This digital augmentation is essential in an era marked by uncertainty and rapid environmental changes, providing a dynamic platform for continuous learning and adaptation.

Research and Practical Implications - In conclusion, advancing Ocean Literacy through a recursive, viable system approach embodies a paradigm shift towards sustainable, self-governing networks of ocean stewardship. This paper aims to elucidate the pathways through which the VSM can catalyse a more profound, systemic understanding and action towards preserving our planet's vital marine heritage, ensuring a harmonious coexistence between humanity and the ocean that sustains us.

Research Limitations and Future Directions - One limitation of this study is the initial focus on theoretical frameworks and pilot projects, which may not fully capture the complexities of large-scale implementation across diverse geographic and socio-economic contexts. Future research should aim to scale these pilot projects, assessing their long-term impact and sustainability. Additionally, while integrating digital and AI-driven tools shows promise, there is a need for further exploration into the ethical implications and potential digital divides that may arise. Future directions include expanding the research to include a broader range of stakeholders, particularly underrepresented communities, and exploring the intersection of Ocean Literacy with other critical global issues such as climate change, biodiversity loss, and environmental justice. By addressing these limitations, we can better understand how to create resilient, inclusive, and effective Ocean Literacy programs that adapt to the ever-changing dynamics of our global ecosystem.

Keywords: Ocean Literacy, Viable System Model (VSM), CyberSystemic Ontology, Ecological Governance, Adaptive Learning Ecosystem, Sustainability in Ocean Stewardship

Enhancing Life Beyond Subsistence: Applying Stafford's VSM Model to manage Perception and Active Inference to increase model evidence by reducing surprise

Stephen Brewis

Abstract

Purpose – This paper explores leveraging Stafford Beer's Viable System Model (VSM) as the core of Adaptive Organisational Intelligence, using Agentic Classifiers to align agents with the active VSM model. We demonstrate how VSM can be transformed from a static framework into an active, adaptive organisational solution aimed at enhancing performance and managing complexity. We will demonstrate the evolutionary stages of the model from purely descriptive to prescriptive by using the Surprise as the driving force behind adaptation and perception and active inference as the adaptation. This paper demonstrates how Stafford Beer's Viable System Model (VSM) can address and manage complex organisational challenges. We illustrate the transformation of VSM from a static image into an active agent capable of running a business. This dynamic model aims to enhance organisational performance while mitigating the chaos associated with unmanaged complexity. Our approach is driven by the free energy principle, which emphasises adapting to surprises through creative solutions.

Design/methodology/approach – We tackle organisational complexity using VSM, focusing on control authority and reducing surprises, key elements in achieving organisational maturity. We guide organisations from a state of raw, unmodeled reality $Y=R(x)$ to a state where the organisation is fully informed by an evolving model $Y=f(x)$ with the objective function of $S(surprise) = min(R(x)-F(x))$. The Markov blanket concept is employed to protect functions within VSM's systems from noise, acknowledging that variety and complexity grow as functions evolve. We define adaptation as Surprise increasing model evidence through Active Inference, where we change our environment, or through perception, where the model is improved.

We use Stafford's VSM as an active organising kernel. The model's fascinating irony lies in the tension between rigidity and flexibility. While the structural framework remains invariant, the functions within this structure are highly adaptable. This paradox highlights the model's robustness and flexibility, making it a strong foundational epistemology for understanding, managing, and controlling organisational behaviour.

Institutional capital (IC) is embedded within the functions and channels that create the organisation, representing the causes we use to make decisions about the business and its operation. This IC must be safeguarded as we learn and adapt, ensuring that we are not misled by correlations, a common phenomenon when senior managers leave the business with critical knowledge.

The integrity of this intellectual capital is maintained by Judea Pearl's Markov Blanket, which retains the integrity of the causal model to run the business. We have integrated Stafford's Team Syntegrity with Paul Pangaro's conversation theory and aligned it with our agentic classifiers and the active VSM model to intercept and resolve surprises. We have also included an organisation index called PHI from the work of Giulio Tononi on integrated information theory to assess the level of organisational cohesion.

To illustrate our methodology, we use a case study of BT's Public Payphone Service, where VSM serves as the organisational kernel to monitor and enhance performance. We view surprise as a catalyst for innovation and define organisational intelligence as the rate of this innovation. By integrating Giulio Tononi's concept of phi (organisational cohesion) and Judea Pearl's Markov blanket (filtering low-variety disruptions), we provide a nuanced understanding of organisational intelligence and resilience. Spencer Brown's 'Theory of Forms' heavily influences how the adaptive process is conceptualised as an unsevered space, represented by 'f' and being replaced by a distinction f(fa,fb), increasing degrees of freedom and visualised as an image through a 'model theoretic' semantic for language as described by Antonio Damasio. Karl Friston's free energy principle is fundamental as the adaptive driving mechanism using perception and active inference to increase model evidence.

Findings/Results – Our findings reveal that reconfiguring business logic around VSM effectively delineates complexity, establishing a boundary between classical determinism and quantum indeterminism, between order and chaos, This boundary similar to the concept of consciousness described by Roger Penrose and Stuart Hameroff, aligns with System 5 in VSM as a regulator of innovation and mediated through the Markov blanket. A model-driven approach, which prevents direct managerial intervention and aligns managers with the VSM model, fosters a collaborative white space that enhances communication and overall organisational coherence.

Originality/value – Our work innovatively combines multiple theoretical frameworks to engineer organisational intelligence. By applying Pearl's Markov blanket and Karl Friston's free energy principle, we establish model evidence as a central driver of creativity and intelligence. The integration of Stafford Beer's Syntegrity algorithm with Paul Pangaro's conversation theory further enriches the collective white space, increasing Integrated Information Theory's (IIT) phi.

Research/ Practical/ Social/ Environment implications - This study highlights the value of integrating diverse methods to explore robust, practical approaches for improving organisational control authority. By focusing on surprise-driven adaptation, we offer a framework for continuous innovation and resilience in complex organisations, applicable across industries facing high volatility and complexity.

Research limitations - Our research underscores the effectiveness of Stafford Beer's Irreducible Idea, especially when integrated with other theoretical frameworks to manage

organisational complexity. Future research should explore additional interdisciplinary connections, including advanced machine learning techniques, Agents and apply the enriched VSM framework to a broader range of organisational contexts. Expanding and refining this epistemological foundation will enhance VSM's utility in managing modern organisational complexities.

Ontological Cybernetics Revisited

Stephen Harwood, Department of Space & Climate Physics, UCL, London, UK

Abstract

Purpose – My recent evaluation of Autonomous Weapon Systems (AWS) suggested that their complexity could be conceptually explained by drawing upon the Viable System Model (VSM). This focuses attention upon the nature of the systems and their autonomy but also introduces the need to consider their legal and ethical application. This ethical consideration has implications for how we handle situations characterised by complexity, uncertainty, and turbulence, using such approaches as the VIPLAN Methodology. The aim of this paper is to explore how ethics can be accommodated within the VIPLAN Methodology by envisaging it as the ontological domain that complements its cybernetic and epistemological domains.

Design/methodology/approach – This is a conceptual paper that is grounded in Stafford Beer's Viable System Model (VSM) viewed through a second-order cybernetics lens, as well as draws upon Espejo & Lepskiy's (2020) concept of an 'ontological cybernetics'. It also reflects upon prior works that examine the notion of ontology in relation to cybernetics.

This argument is premised upon an evaluation of Autonomous Weapon Systems. The word that attracts attention is 'weapon'. However, the systemic nature of these 'weapons' invites attention to what constitutes the unfolding of the complexity of these weapon 'systems'. This then raises the question of what it means to be 'autonomous'. This view of autonomous technological systems can be explained using the VSM. However, another dimension is invoked with the word 'weapon' that needs to be explicitly recognised. Irrespective of International Humanitarian Law (IHL), which is open to interpretation, there are fundamental questions about the use of weapons to harm and kill and who is the target/victim. This raises ethical issues and, particularly in the context of AWS, questions about where the human is and human accountability, especially with regard to so called 'collateral damage'. This has implications for any autonomous technological system. As such, the example of the AWS exposes the need to recognise the ontology of a cybernetics approach to handle complexity and, accordingly, what is meant by ontological cybernetics. By drawing upon what is known about ontological cybernetics and the ontology of ethics, the aim is to offer a more developed insight into this important domain.

Findings/Results – The ontological domain focuses attention upon that which is construed as the morals and beliefs that underpin decisions and judgements that relate to modes of learning and inquiry. The ontological domain complements the cybernetic and epistemological domains that characterise the VIPLAN Methodology and which distinguish it from other approaches for dealing with complexity, such as Problem

Structuring Methodologies and Design Thinking. The VIPLAN Methodology comprises six activities that act as a heuristic that point to possibilities for thinking and action at any stage in dealing with the situation. The epistemological domain concerns the learning related to appreciating, making sense of and changing a situation. The cybernetics domain is about the organisation of those involved in this process. Consequently, whilst there is no change to the six activities, attention to the ontological domain makes explicit the underlying values and beliefs of those engaged in the transformative process that underpins the use of the VIPLAN Methodology.

Originality/value – This paper develops and clarifies the notion of ontological cybernetics, which has received limited prior attention. This is built upon the ideas developed by Gunther (1962), Turchin (1993), Galison (1994), Maturana (1988) and Espejo & Lepskiy (2020).

Research/ Practical/ Social/ Environment implications – This paper grounds the notion of ontological cybernetics into a pragmatic approach for handling complexity. It is argued that the three domains, comprising the cybernetic, epistemological and ontological domains, provide a more coherent approach to handling wicked – messy, problematic situations, especially in a multicultural society where Western values need not be shared. It forces attention upon the morals and beliefs that underpin thoughts, decisions and judgements.

Research limitations – As a conceptual paper, its argument requires debate to evaluate its robustness.

Keywords: CyberSystemics, VSM, ontology, methodology, ethics

The final clue of viability and sustainability Is it hidden in Dorian Gray's picture?

Wolfgang Lassl, Qwinnt Management Institute, Vienna, Austria

Jens Martignoni, ZHAW, Switzerland

Abstract

Purpose—The systemic role of the algedonic channel and the Model of the Total Viable System (MTVS) concerning the Metasystem and System 5 has been barely in the focus of the VSM research. Yet Beer identified neither System 5 nor any other system function but the algedonic channel as the "final clue to viability" and, as such, also to sustainability. This paper aims to understand better and in greater detail how Beer conceived this "final clue". Thereby, it aims to stimulate a debate about these overlooked elements of the VSM and to reenergize the theoretical research on the VSM itself. From this, it derives implications regarding the design of the VSM, especially the need for System 5 (and the metasystem in general) to have a critical counterpart offering it a second-order perspective – a critical mirror similar to Dorian Gray's picture.

Design/methodology/approach – Conceptual analysis combined with textual analysis of Beer's writing and empirical evidence at an anecdotal level.

Findings/Results – It is conjectured that the algedonic channel and the MTVS introduce a vital metasystemic, second-order, and thus critical perspective on the metasystem. By stimulating the self-reflection process of System 5 and the overall organization, they keep a system's viability and sustainability orientation alive. As such, they contribute to the auto-correction process of dysfunctional Systems 5 and metasystems in general. If true, their distinctive systemic role, functioning, and agency need to be better reflected in the current design of the VSM. For this reason, the paper proposes establishing the MTVS as a new system function.

Originality/value – Currently, no paper or publication deals in-depth with this part of the VSM.

Research/ Practical/ Social/ Environment implications – for VSM researchers, the paper will open new avenues for research, and for organizational development practitioners, it will offer new ways to diagnose and develop organizations.

Research limitations – The paper is mainly conceptual and needs further corroboration by empirical evidence.

Keywords: Viable System Model, Algedonic Channel, 2nd-Order, Ethics, Controlling, Feedback, Conscience

Section 3.1 AI in the environment of uncertainty

Coordinated by Yingjie Yang and Massimiliano Pirani

Real-world systems are always challenged with various uncertainties, and the application of AI has to deal with the existence of uncertainty. This theme calls for papers on methodology and applications of various data analytics models in AI with consideration of uncertainty. It covers topics on grey systems, fuzzy systems, rough sets, statistics and other related computational models and their applications in management, engineering, environment, healthcare and social economics.

This section is also devoted to some insights into the active and evident effects that AI is bringing to our scientific, technological and social spheres. In particular, AI today goes far beyond the possibilities of an analysis tool for human decision-makers and analysts but participates in the construction of shared reality between humans and machines through two-way interactions. This phenomenon is currently growing out of control in a cybernetic sense. Therefore, this section can complementary deal with what pertains not only to uncertainties (unknown knowns), but also to known unknowns and unknown unknowns, which bring into play systemic methodologies and associated tools against the complexity of wicked AI problems such as explainability, cybersecurity, and sustainability.

Photonic AI for embracing the uncertainty of the environment

Aleksandr Raikov, Jinan Institute of Supercomputing Technology, Shandong, China

aleksandr@jnist.cn

Meng Guo, Jinan Institute of Supercomputing Technology, Shandong, China

guomeng@sdas.org

Abstract

Purpose – to accelerate understanding of the environment's uncertainty and instil trustworthiness in the conclusions of AI systems. For this, the paper suggests a full-analogue Photonic AI (PAI) that can overcome the impasse of digital AI systems. Currently, digital AI systems struggle with the need to convert a continuous signal into a discrete one, the limit of chip size reduction, and the increase in deep learning parameters. The digitalisation of continuous data truncates the processed signal's spectrum, leaving the reflection of external reality incomplete. The computer's element base cannot be smaller than the size of an atom, and the complexity and energy intensity of calculations are dictated by the Kotelnokov-Nyquist-Shannon theorem.

Design/methodology/approach – the design of the PAI system is a collaborative effort, drawing on the theory of the evolution of life on Earth and the role of light in this evolution, the organisation of expert collaborations, the solution of inverse problems in topological spaces, holographic pattern recognition, genetic algorithms, continuous optical Fourier transforms of images, convergent human-machine interacting in hybrid reality, fundamental thermodynamics, synthesis of materials for 3D holographic data storage with the inclusion of protein. This system is built with a laser, optical devices (lenses, deflectors), a digital controller, and rewritable 3D holographic memory. Expert collaborations are being constructed to provide an accelerated interdisciplinary synthesis of innovative solutions for fragments of photonic AI with the support of autoregressive (GPT/LLM) AI.

Findings/Results – a justification is given for the purposefulness of the protein body evolution process based on the author's convergent approach and fundamental thermodynamics to find necessary structure conditions for purposefulness and stable convergence of different processes to the randomly possible goals. The critical steps in the evolution of protein body development to create a living being are described. The project of PAI development has achieved the following results: principle with the basic requirements of the principle, concept with the basic design elements of PAI architecture, and methodology to be used have been proven on paper and numerically. Some components (laser matrix, holographic memory, deflectors) have been implemented and passed standalone methodological and functional validation tests. This is the third technology readiness level (TRL 3).

Originality/value – the PAI allows replacing the traditional multistep and energy-consuming ML training of a multilayer neural network with a single-step simultaneous optical Fourier convolution of a set of training images and recording the result in separate quantum dots (cells) of the 3D holographic matrix, which can store many allowed quantum states in a single cell. The research on Earth's life evolution with GPT/LLM support has helped to find the path to creating photonic material for 3D holographic memory of PAI using different structures, including a protein.

Research/ Practical/ Social/ Environment implications – the paper will provide states power, researchers, professional community, individuals, society and the environment with advanced possibility of AI. PAI will speed up the machine learning of AI systems by several orders of magnitude, significantly increasing the accuracy of understanding the environment's uncertainty while reducing energy consumption.

Research limitations – developing a reliable photonic material for the 3D holographic memory, real-time optical controller (deflectors, calculation), analogue-digital interface, optical signal distortion, miniaturisation, and the lack of interdisciplinary and international research collaboration.

Keywords: full-analogue AI, Fourier convolution, holographic memory, hybrid reality, photonic AI

The influence of standardisation methods on the stability of grey correlation rank

Baohua Yang and Kegang Li, Business school Jiangsu Normal University

Abstract

Purpose – The purpose of this study is to analyse the influence of standardisation methods on the rank of the grey correlation model, such as Deng's grey relational analysis, grey absolute relational analysis, grey relative relational analysis, grey similar relational analysis and grey proximity relational analysis.

Design/methodology/approach – Data standardisation is an important method to avoid the influence of different data metrics on decision ranking results. In this paper, the effects of data standardisation methods on the ranking of five different grey relational models are analysed by numerical calculation. In this method, the decision schemes are generated randomly, and Spearman's rank correlation coefficient is used to measure the consistency of decision ranking of different standardisation methods.

Findings/Results – For the given five grey relational analysis models, Spearman's rank correlation coefficient of the Sum method and the Vectorial normalisation method are always the highest, which indicates that the decision ranking results obtained by the two normalisation methods have the highest similarity. The Max-min method and Sum method have the lowest Spearman's rank correlation coefficient, and the similarity of decision ranking obtained by these two normalisation methods is the lowest. Therefore, the comparison of the rankings obtained by the Max-min method and the Sum method should be avoided when decision-makers choose the scheme. In addition, among the five grey relational analysis models, the difference in ranking obtained by combining Deng's grey relational analysis with different normalisation methods is minimal and can resist the influence of weight to a large extent. Therefore, Deng's grey relational analysis is the most stable among the five grey relational analysis models.

Originality/value – By comparing and analysing the influence of different data standardisation methods on decision-ranking results, this study provides a way to judge the stability of grey correlation analysis decision-making methods. It provides a basis for decision-makers to choose grey correlation analysis models when they are faced with complex decision-making problems.

Keywords: Grey relational analysis, data standardisation, consistency of decision ranking, numerical experiment, Spearman's Rank Correlation Coefficient

Explainable artificial intelligence and Data canyons in the context of cybernetics

Bojan Žlahtič*, Peter Kokol, Grega Žlahtič, Milan Zorman

Institute of Computer Science, Faculty of Electrical Engineering and Computer Sciences, University of Maribor, Slovenia

Abstract

Purpose – Explainable artificial intelligence (XAI) is a new field of study that is rising in popularity because of recent developments in the artificial intelligence (AI) and machine learning domains. Deep learning algorithms, large language models, and the abundance of data present an opportunity to improve and evolve workflows, systems, and even whole domains. However, while the field of AI is advancing at an unprecedented pace, the understanding and presentation of the decisions made by those AI systems are not upholding the development pace of the field. The underlying issue is that integrating advanced AI systems into real-life structures that dictate and drive our daily lives without understanding the decision-making process and without the ability to extract knowledge presents a serious design flaw. The introduction of explainable algorithms like data canyons enables us to enhance trust in those AI algorithms by adding an interpretation and explanation layer to assist in the quest for XAI.

Design/methodology/approach – The feasibility of data canyons as a standalone machine learning algorithm and as an interpretation and explanation layer were tested through comparison with several machine learning algorithms and assessment through human decision-making testing based on the interpretation and explanation layer of data canyons. Several data sources were used during testing; additionally, a comparison was made with current state-of-the-art XAI solutions.

Findings/Results – Through thorough testing, it was shown that data canyons present a viable alternative to other machine learning algorithms since they performed consistently and comparably to the most popular machine learning algorithms. Additionally, human decision-making based on the explanation layer of data canyons proved to be reliable, understandable, and easy to interpret. The visualization layer proved to be a natural and easy concept to evaluate without any expert knowledge and training.

Originality/value – Data canyons present a unique opportunity in XAI compared to most tools that aim to provide explainability and interpretability. Data canyons have a local and a global explanation layer. The global layer consists of the visual representation of the canyon while the local explanation layer is a combination of the global layer and the local representation in the global layer. Most state-of-the-art XAI tools are standalone algorithms that by themselves are not intelligent and, therefore, cannot be used by themselves for learning objectives, while a data canyon is both a machine learning

algorithm with inherent explainability or can serve as an explainability layer for black box machine learning algorithms.

Research/ Practical/ Social/ Environment implications – XAI plays an integral role in the application of AI in several advanced systems and structures where decision-making has a direct impact on our health, environment, safety, status, and overall well-being. The integration of AI systems in all facets of our lives is inevitable. However, the implications and outcome of those integrations are dependent on the maturity of those systems, and XAI represents a measure of maturity.

Research limitations – Data canyons are new and need to be integrated into sophisticated state-of-the-art machine learning systems to be more commonly available and to be applied on a large scale. The basic calculations that take place during the construction of data canyons present an excellent opportunity for integration into supercomputers and distributed systems.

Keywords: XAI, AI, artificial intelligence, explainable artificial intelligence, transparency

Blockchain and the unexpected: taming complexity in sustainable supply chains

Massimiliano Pirani, department of information sciences and technologies, Pegaso University, Naples, Italy; massimiliano.pirani@unipegaso.it

Alessandro Cucchiarelli, department of information engineering, Marche Polytechnic University, Ancona, Italy

Luca Spalazzi, department of information engineering, Marche Polytechnic University, Ancona, Italy

Abstract

Purpose – Hybrid reality (HR) is the place where human beings and artificial entities interact and which is constructed, controlled and modelled by both agencies. The HR model can be applied effectively in complex processes where several actors strive to achieve a shared goal, but are subject to the influence of unforeseen events for which other effective and manageable models are difficult, if not impossible; HR can rely on the cognitive power of humans and AI simultaneously. The Blockchain framework, seen under a new cyber-systemic perspective, provides new opportunities and tools for the purposeful organisation and control of the HR, by a built-in democratic empowerment of the actors involved in the HR system. Ongoing research and experimentation in the real field of sustainable supply chains will confirm this perspective, which is likely to be replicated and scaled up.

Design/methodology/approach – The systemic study of the complex supply chain problem reveals the need for a deeper understanding of the dynamics at play. This study starts with framing the problem in the System Dynamics context of HR. The amenable contribution of artificial intelligence (AI) can be used to consider the possibilities of Blockchain technology, but AI is part of the system at the same time. Blockchain sports new directions like Non-Fungible Tokens, Zero-Knowledge Proofs for immutability, authenticity, responsibility, Layer 2 for scalability, and smart contracts for conformity and Runtime Verification and Enforcement methodologies of control. The Blockchain will be challenged against the Law of Requisite Variety in the HR model and used to ground purposeful interactions of the actors involved as a support for the design for the unexpected, a well-known topic in the industrial context of the last decade.

Findings/Results – The nature of the paper is positional. The design of the approach will be the basis of a general methodology to be instantiated first in a running experiment on a food supply chain in a European Project. Major objective of this work is the proposition of the design of such an experiment that will be conducted in that context, due to the positive findings here achieved.

Originality/value – This methodology is a candidate to offer a valuable breakthrough in the field with respect to Industry 5.0 best practices. It integrates, in a transdisciplinary manner, issues from at least the fields of management cybernetics, systems engineering and computer science.

Research/ Practical/ Social/ Environment implications – The context in which the results of the research will impact primarily is in the Green Deal of the European Union, which makes reference to the UN SDGs (Sustainable Development Goals). The industrial target is the primary one in its multi-dimensional and multi-faced sustainability impacts, but this study will also reveal a potential to other societal areas of intervention.

Research limitations – The limits and the risks of the presented methodology pertain mostly to the existing barriers that the interaction between the artificial and human are concerned with, and related issues on trust and acceptance of the approach proposed here. Complexity raises quickly beyond control when there are implications and connections to well-designed regulatory frameworks and policymaking. A deeper insight into the sustainability of the pervasive digitalisation implied by this proposal has to be promoted with further research.

Keywords: Blockchain; System Dynamics; supply chain; design for the unexpected; systems engineering; hybrid reality.

Mandatory features and differences of intelligences. Waves of indoctrination.

Michail Kozlov. Institute integration and professional adaptation, Netanya, Israel

Abstract

Purpose - For optimal functioning, complex technical systems are trying to be endowed with artificial intelligence (AI), including combining it with a matrix of artificial emotions (MAE). And you need to know what necessary properties an intelligent system should have. Typically, AI is created by simulating the intelligence of living beings. However, for living organisms, the concept of intelligence is of little use for forming the requirements that systems with AI must meet. Purpose of the work: to formulate a mandatory feature of intelligence, which allows us to classify biological and technical systems as intelligent and use it in the construction and evaluation of complex technical systems; analyse the differences between natural intelligences of different levels, options for optimal operation of collective intelligence; assess the risks and dynamics of influencing factors in the form of waves of indoctrination and methods of countering such influence.

Methodology - When analysing the problems under consideration, the following works were used: information theory by K. Shannon and A, A, Kharkevich; memory organisations of Nobel Prize laureate for Economics Professor of Computer Science and Psychology H. Simon and Nobel Prize laureate in Physiology or Medicine, neuroscientist E. Kandel, as well as Professor Y Dudai; the influence of emotions on decision making of Professor A. Damasio and other cognitive psychologists; the one of founders the theory of AI, of cognitive and computer scientist M. Minsky, who argued that AI is not possible without emotions; Philosophical-Methodological Basis for the Formation of high-order cybernetics based on self-developing reflexive-active environments of Professor V.E. Lepskiy. And used the author's works: "Computer-Brain Model Memory and Decision-Making"; "Artificial emotions in collective artificial intelligence systems" and "Socio-Economic Cybernetics Transformation Trends".

Results and findings - The knowledge obtained by biological systems and AI with MAE is subject-oriented (SOK). Therefore, for incoming signals, based on the negentropy principle of information, taking into account the dynamically changing apperception of the subject, a subject-oriented estimate Ist+1 of information extracted a posteriori in relation to the a priori SOK was developed in the form of a functional

$$Ist+1 = AKEt+1 * MOt+1 - AKEt * MOt, \quad Ist+1 \in \{1, \ldots, 0\},$$

Where: AKEt*MOt is a subjective assessment of the reliability of the SOK at time t about the object of study, which is a functional for processing the model of the observation object MOt by the AKEt operator. The AKEt operator includes the functions of apperception, matrix of emotions and SOK about the object, AKEt*MOt $\in \{0, \ldots, 1\}$; AKEt+1*MOt+1 is a subjective assessment of the reliability of accumulated SOKs about the object of study at time t+1, AKEt+1*MOt+1 $\in \{0, \ldots, 1\}$.

With the accumulation of SOKs, the value of Ist+1 decreases to a certain threshold, below which the reaction to signals of the same type will be in the form of stereotypes of thinking (ST), which make it possible to reduce the reaction time and save the individual's energy resources. But ST in non-standard situations can lead to errors and simplifies the

procedure for mass indoctrination. On the other hand, a creative subject, accumulating SOKs, can revise the model of the object of observation, and the value of Ist+1 will increase for some time with a subsequent decrease. This is how the Man-Creator gains new knowledge.

Originality and value - The use of assessing information extracted from signals received by subjects provides the necessary basis to judge whether biological or technical systems have intelligence and its dynamic properties. When the assessment is reduced to a certain level, intelligent agents (IAs) can develop a mechanism of artificial skills, allowing them to react more rationally.

Periodic cycles of strengthening the managerial hierarchy and increasing waves of indoctrination lead to disruptions in the activity of collective intelligence, based on the creative thinking of many individuals. And it leads to stagnation. After a wave of indoctrination leads to a decline in Creators density, attractor structures of heterarchy arise that counteract indoctrination and stimulate mass creative thinking.

To optimise the functioning of attractors of collective intelligence, it is proposed to consider the transition from a hierarchical management structure to a kind of triarchic system operating according to the rules of heterarchical homeostasis. At the same time, due to the natural competition of Creators, small waves of indoctrination are possible.

Research implications - According to the author, the work may be useful to developers of complex technical systems, including IAs with MAE, researchers in the areas of analysis of the work of socio-economic processes and the work of complex social self-organising reflexive-active systems. The use of the materials discussed in it will improve the socio-economic climate and will contribute to social development.

Taking into account the prospects for the development of AI, the creative characteristics of each individual can be ensured by the symbiosis of the Human Creator and his Alter Ego - Strong AI. A person in new conditions strengthens his role as a Creator, who often acts irrationally and intuitively, and Strong AI becomes his purely individual, effective, rational assistant.

Research limitations - The author considers general approaches that, with further analysis, can be supplemented and adjusted.

Keywords: negentropy, apperception, subject-oriented knowledge, stereotypical thinking.

EU.EFFICIENT - Shaping a Community of AI Expert Facilitators in EU

Milan Zorman, Institute of Computer Science, Faculty of Electrical Engineering and Computer Sciences, University of Maribor, 2000 Maribor, Slovenia

Aldo Offenheimer, i2m Consulting, Hangweg 27, 8052 Graz, Austria

Bert Pluymers, Katholieke Universiteit Leuven, Celestijnenlaan 300, 3001 Leuven, Belgium, and Flanders Make@KU Leuven, Gaston Geenslaan 8, 3001 Leuven, Belgium

Juan Pérez Rodríguez, Fundació Centre d'Innovació i Tecnologia de la UPC, Carrer Jordi Girona, 1-3, 08034 Barcelona, Spain

Dionysios Panagiotopoulos, Katholieke Universiteit Leuven, Celestijnenlaan 300, 3001 Leuven, Belgium, and Flanders Make@KU Leuven, Gaston Geenslaan 8, 3001 Leuven, Belgium

Bojan Žlahtič, Institute of Computer Science, Faculty of Electrical Engineering and Computer Sciences, University of Maribor, 2000 Maribor, Slovenia

Tanja Botić, Institute of Computer Science, Faculty of Electrical Engineering and Computer Sciences, University of Maribor, 2000 Maribor, Slovenia

Aleš Holobar, Institute of Computer Science, Faculty of Electrical Engineering and Computer Sciences, University of Maribor, 2000 Maribor, Slovenia

Abstract

Purpose – The field of AI is demanding due to its interdisciplinary nature, requiring expertise in mathematics, statistics, computer science, and domain-specific knowledge. The field evolves rapidly, with new algorithms and techniques constantly emerging and demanding continuous learning. Challenges include ethical considerations, bias mitigation, and transparency in decision-making processes. AI's broad applications across industries demand diverse skill sets and adaptability. Moreover, the quest for AI's holy grail—general intelligence—remains elusive, driving researchers to push boundaries and overcome complex theoretical and practical hurdles, making AI a demanding and dynamic field.

Expert facilitators (EFs) play a crucial role in helping the EU effectively apply AI across various sectors. They offer guidance in navigating the complex landscape of AI technologies, ensuring alignment with EU regulations, ethical standards, and societal values. EFs help identify opportunities to implement AI, matching them with specific needs and challenges within the EU, fostering innovation and economic growth. Moreover, they facilitate collaboration among various stakeholders, including government, industry, academia, and civil society, promoting knowledge exchange, collaboration and co-creation. They also support capacity-building initiatives and train professionals and policymakers to leverage AI responsibly and ethically.

Design/methodology/approach – In Horizon Europe project EU.FFICIENT we started with shaping four Communities of Expert Facilitators (CEF): Advanced Manufacturing, HealthTech, Mobility and AI/Digital. CEF AI slightly differs from the other communities, as AI represents key enabling technology in all the fields mentioned above. They all aim to detect existing gaps between beginners and advanced EFs to support co-creation processes, train other EFs on specific co-creation-related topics, exchange knowledge among the EFs, help match supply and demand for innovation, and analyse the impact of new trends/technologies in co-creation processes.

The other core element of the EU·FFICIENT concept is its online platform. As much as possible, we will ensure the platform development is cost-effective. The platform will integrate the processes and tools stemming from the EU·FFICIENT methodology. It will support the piloting of the four CEFs, including the training of the EFs, the matchmaking and networking functionalities, and the library of co-creation resources and learning materials, as well as the challenge release.

Findings/Results – Through the EU·FFICIENT platform, EFs will access up-to-date and practical resources and learning material that will help them enhance their skills and knowledge. They will also benefit from synergies between members of the four thematic communities, which can lead to new co-created projects and partnerships. By providing a centralised platform for co-creation, we will facilitate greater collaboration between academia and industry and generate a more significant impact on society.

Originality/value – The concept proposed by EU·FFICIENT combines these two building blocks: (i.) The methodology for the building of four CEFs, and (ii.) The innovative online platform that facilitates the implementation of the methodology.

Research/ Practical/ Social/ Environment implications - By serving as trusted advisors and catalysts for AI deployment, expert facilitators contribute to the EU's efforts in harnessing the potential of AI to address societal challenges, drive digital transformation, and enhance competitiveness on a global scale.

Research limitations - Despite AI being a global phenomenon, we will mainly focus on the inclusion of AI experts within the EU. Regulatory and policy frameworks within the EU, such as data protection regulations and ethical guidelines for AI development and deployment, represent limitations not necessarily addressed outside the EU.

Keywords: AI, CEF, communities of expert facilitators, EU.EFFICIENT

A novel seasonal grey prediction model with external impacts and its application

Mingli Hu, *College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing, China*

Mengqi Wu, *College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing, China*

Wenjie Liu *College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing, China*

Abstract

Purpose – When the data series of seasonal fluctuations are simultaneously affected by external shocks, it becomes difficult to identify seasonal changes, and the prediction accuracy of prediction models decreases. In order to identify the seasonal changes in China's natural gas production under the impact of the COVID-19 epidemic and predict future natural gas production more accurately, a novel seasonal grey prediction model with the external impacts Grey model (GM(1,1,λ,r)) is proposed in this paper.

Design/methodology/approach – Firstly, based on the seasonal fluctuations of the raw data, the raw data is divided into four seasonal groups. Secondly, the classic average weakening buffer operator is applied to weaken the influences of external disturbance on the system. Then, the new information accumulation generation operator and the fractional order accumulation generation operator are combined to form a new weighted fractional order accumulation operator. Finally, the particle swarm optimisation algorithm(PSO) is used to optimise the new information accumulation parameter and fractional order parameter r.

Findings/Results – The experimental results show that the new grey prediction model (GM(1,1,λ,r)) performs better than other models in predicting quarterly natural gas production in China. This model is more suitable for solving the prediction problem of seasonal fluctuation systems with external disturbances.

Originality/value – Simultaneously considering seasonal changes and external shock disturbances, the data grouping approach is used to identify seasonal changes and an average weakening buffer operator is used to correct the impact of external shocks on the original data sequence. This paper proposes a new weighted fractional order accumulation operator that combines the new information accumulation operator and the fractional order accumulation operator. A novel seasonal grey prediction model with external impacts (GM(1,1,λ,r)) is proposed to improve the predictive performance of the system. The particle swarm optimisation algorithm (PSO)is used to solve the parameter optimisation problem of the model.

Research/ Practical/ Social/ Environment implications - The seasonal grey model proposed in this paper is suitable for predicting data sequences with seasonal changes while considering the impact of external shocks. The model in this paper is applied to the prediction of natural gas production under the impact of COVID-19 epidemic. Accurately predicting natural gas production is of great significance in providing a decision-making basis for the Chinese government to formulate energy policies, plan energy layouts, and adjust industrial structures.

Research limitations - The prediction model proposed in this paper is a univariate data-driven grey prediction, which makes predictions based on the historical and current trends of the system. The underlying assumption is that there is no significant difference between future influencing factors and historical circumstances. Seasonal fluctuation data sequences, in reality, are influenced by various factors; for example, natural gas production is influenced by GDP, market factors, industry policies, etc. The grey prediction model driven by multivariate data is worth further research.

Keywords: Grey prediction; Seasonal fluctuation; Weakening buffer operator; Particle swarm optimisation; Natural gas production

Understanding of grey information and grey system modelling

Naiming Xie College of Economics and Management, Nanjing University of Aeronautics and Astronautics

Abstract:

Purpose – This manuscript aims to express an understanding of grey information and the mechanism of grey system modelling. Grey information is the basic element of the grey system. It is very important to understand grey information and explain the mechanism of grey system models.

Design/methodology/approach –This paper divides grey system models into two classes: grey forecasting models with limited data and grey number-based models. It employs integral matching to elucidate the mechanism of generation accumulation within the modelling process. It utilises increments and growth rates to explicate the overarching modelling process and mechanisms of grey forecasting modelling. Also, it comprehensively classifies grey forecasting models based on their differential equation structures. Moreover, it conducts an in-depth analysis of the generation, computation, and application of grey numbers within grey system modelling. Grey number-based models adopt grey scheduling as an example to show how to collect, calculate and apply grey numbers in real applications.

Findings/Results – The findings of this paper are: (1) It establishes clear definitions of grey system theory and grey information, highlights the differences between grey forecasting models with other forecasting models, particularly emphasising the accumulation generation operation as pivotal in handling limited data and extracting system development patterns. (2) It gives out feasible solution of grey number operations and grey numbers in scheduling topics.

Originality/value – This paper explains why the accumulating operation is effective in the modelling process and why the grey forecasting model is suitable for limited data. It is effective to adopt grey numbers to measure flexible time quotas and make scheduling in production and service management.

Research/ Practical/ Social/ Environment implications – The proposed forecasting models effectively characterise the development trends in different systems, such as the growth of Gross Domestic Product, population, etc. Additionally, the application of grey numbers offers novel insights into managing uncertain job processing times, presenting potential solutions for scheduling operations in industrial settings under the industrial Internet platform.

Research limitations – Grey forecasting models lack consideration of model selection. The operations of grey numbers fail to overcome the problem of increasing greyness.

Keywords: Grey system theory, grey number, grey forecasting, grey scheduling

AI: irrevocable shift from problem solving-making to problem complexity analysing.

Nikolai Razin Research and Forecasting Department, Bank of Russia

Abstract

Purpose - The goal of this paper is to analyse and discuss with the scientific community the phenomenon of a paradigm shift in the approach to solving applied problems: the democratisation of AI and its widespread application already enable a meta-systemic transition from manual task solving to goal setting and complexity management of a specific phenomenon and reducing the power of uncertainty. The correct systemic synergy between humans and AI is possible when developing a systemic approach to analysing the complexity of the applied method and the phenomenon under study, and this work is dedicated to the necessity of a discussion on ensuring effective and fair human-machine interaction for the systemic improvement of human labour productivity through the use of AI methods.

Design/methodology/approach -This paper synthesises existing academic research in the field of artificial intelligence and explores aspects of AI's practical application by corporations worldwide. Special attention is given to the notion of complexity and, in particular, Kolmogorov complexity, with considerations for the constraints typically associated with the time limits for solving tasks and the fuzzy criteria for evaluating solution quality. Current issues related to the practical use of AI are examined at both the technical and managerial levels, including MLOps and ModelOps technologies, as well as questions of trust and ethics that arise when interpreting the results of machine learning models. The conclusion summarises the analysis of existing works related to the subject under discussion.

Findings/Results - The most significant conclusion of this paper is that by employing AI methods, humans undergo a meta-systemic transition from task-solving to managing and analysing the complexity of phenomena. Now, individuals can and should focus less on manually formulating each step of an algorithm and more on effectively analysing the complexity and uncertainty of a task and delegating its solution to a specific AI architecture. AI serves as a new information filter for humans, significantly more efficient and consistent than a human subordinate. Fully embracing the level of effective human-machine interaction will allow for a systemic approach to developing the necessary human skills, building the required repository of AI models, and determining approaches to analysing the complexity of phenomena.

Originality/value - The novelty of this paper lies in discussing the properties of AI that manifest systemically at the intersection of modern technologies and society - serving as an amplifier for humans. For successful and efficient utilisation of AI, individuals must focus on defining the concept of complexity and managing the complexity and

uncertainty of the analysed phenomenon. The multimodality and social nature of humans, combined with the speed and memory of AI, must be applied correctly and effectively to achieve optimal labour productivity.

Research/ Practical/ Social/ Environment - This paper will help initiate the beginning of exploring the transition of humans to a level of understanding of the world in which AI is adeptly and effectively used by people as an assistant. The ultimate goal is to establish best practices for human-machine interaction that comply with legal and ethical constraints while also ensuring higher labour productivity than before.

Research limitations - Within this paper, the authors aim to initiate a dialogue on establishing principles for effective human-machine interaction, ensuring an increase in the complexity and efficiency of tasks solved by humans while adhering to ethical and legal norms. This work does not question the complexity of defining the concept of "complexity" but rather calls for a discussion on possible refinements of this concept considering applied tasks whose complexity is limited by the human's perception. In this sense, we propose to all interested readers a rather ambitious goal - to progress together towards a practical definition of complexity and develop principles based on this for organising effective human-machine interaction.

GAX-based time series hierarchical clustering algorithm

Peixin Li, College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing 211106, China

Yaoguo Dang College of Economics and Management, Nanjing University of Aeronautics and Astronautics, Nanjing 211106, China

Abstract

Purpose –For large-scale air pollution monitoring data, proposed an effective interval grey number approximation aggregation method for time series, and designed hierarchical clustering algorithms to help develop air pollution control strategies.

Findings –By introducing the Kernel Density Estimation (KDE) method to obtain the distribution of values of the raw time series. Multi-Swap k-Means++ clustering is used for the optimal segmentation of the time series. Representing the raw time series by interval grey number sequences. Constructing a hierarchical clustering algorithm for GAX-based time series.

Originality/value – The method proposed in this paper implements effective compression and simplified representation of time series data, which improves the accuracy and efficiency of large-scale time series clustering analyses and provides solid technical support for the monitoring and management of air pollutants.

Research/ Practical/ Social/ Environment implications - Through in-depth analysis of air pollution monitoring data, the methodology of this paper helps to discover the existence mode and potential structure of pollutants, scientifically formulate effective pollution control strategies, which helps to improve air quality and protect public health.

Research limitations - The algorithm in this paper has performed well at present for cluster analysis of static time series, while it is less suitable for dynamic time series and incremental time series.

Keywords: time series, grey number, approximation aggregation, hierarchical cluster.

Multiple Uncertainty Data Fusion and Reliability Growth Model for Complex Equipment

Sifeng Liu[1,2] Wei Tang[1,2] Lianyi Liu[2,3] Yingjie Yang[3,2]

[1].Center for Grey Systems Studies, Northwestern Polytechnical University, Xi'an Shaanxi,710129, P.R.China

[2].Institute for Grey Systems Studies, Nanjing University of Aeronautics and Astronautics, Nanjing Jiangsu, 210016, P.R.China

[3].School of Computer Science and Informatics, De Montfort University, Leicester LE1 9BH, UK

Abstract

Purpose – In the era of big data, people's understanding of the complex and uncertain characteristics of reliability growth data is deepening. In addition to the well-known fact that fault data is a random variable that follows a specific probability distribution, expert judgments expressed in language are fuzzy data. The allowable values of important parameters are usually limited to a certain range, which belongs to typical grey data. However, knowledge about specific components, materials, and processes is often rough data. How to effectively utilise reliability growth data with multiple uncertain features such as randomness, fuzziness, grey, and roughness is the key to solving the modelling problem of reliability growth for high-end intelligent equipment. This paper proposes a novel model and its associated new concepts in uncertainty representation and management to fill this gap.

Design/methodology/approach – The core idea of big data is to fully utilise all available data, not limited to random sampling. The second is to eliminate confounding factors and gain insight into the general direction. The third is to attach importance to relevant relationships rather than pursuing causality. Based on the idea of "fully utilising all data", this paper will start with the collection, identification, and analysis of reliability growth data. Then, the definition of standard uncertainty number(SUN) will be proposed through an in-depth analysis of the characteristics and commonalities of complex uncertainty data with various uncertainty connotations such as random, fuzzy, grey, and rough. The characterisation of SUNs and the rules for converting various types of uncertainty data into SUNs will be studied, and the operation system of SUNs will be built. The analysis and mining models based on SUNs will be established, the key factors for the reliability growth of high-end intelligent equipment will be explored in multiple dimensions, stages, and levels, and a reliability growth evaluation index system will be established. To break through the bottleneck of reliability growth modelling for high-end intelligent equipment, the holographic reliability growth evaluation and prediction models will be constructed by comprehensively utilising big data technology, complex uncertainty data analysis and modelling methods, as well as sequence operators, spectrum analysis, change point analysis, and intelligent algorithms.

Findings/Results –The proposed novel concepts and framework in this paper show that it is feasible to integrate various uncertainties together to realise high reliability for complex equipment.

Originality/value – Although many uncertainty models have been proposed, there has rarely been an effective fusion model to integrate these models. The definition and operation system of SUNs, various data mining models based on SUNs, and holographic reliability growth evaluation and prediction models are the first proposed by the authors.

Research/ Practical/ Social/ Environment implications – Manufacturers use reliability growth tests to iteratively improve equipment reliability and performance to predetermined levels through cycles such as "exposing defects—analysing causes—improving designs, processes, or operations.". However, when the data does not meet the modelling conditions of traditional reliability growth models, people often adopt some "flexible" approach, such as using simulated data or borrowing relevant data from similar equipment to "piece together" data, which may bury hidden dangers in equipment reliability. Obviously, the traditional reliability growth model constrained by random samples is no longer suitable for the practical needs of complex equipment development, and there is an urgent need to explore new models and methods. The novel concepts and models proposed in this paper have the potential to significantly improve the quality and reliability of complex products in smart manufacturing.

Research limitations – The limitation of this research is its coverage of various uncertainties. It is not possible to cover fully all uncertainties due to their unknown status, and the proposed model provides only a method rather than a completed solution to the challenge.

Keywords: Multiple uncertainty data, standard uncertainty number, complex equipment, reliability growth model

An interval grey number risk decision model for venture capital project selection

Tingting He,

Yaoguo Dang

College of Economics & Management, **Nanjing University of Aeronautics and Astronautics,** No 29 Jiangjun Avenue, Jiangning District, Nanjing, Jiangsu Province, CHINA

Abstract

Purpose – The purpose of this paper is to propose a decision-making model based on Cumulative Prospect Theory (CPT) and TODIM method for a risky multi-attribute decision-making problem where the attribute values are interval grey numbers and the attribute weights are unknown and to apply it to the selection of venture capital projects.

Design/methodology/approach – First, considering the correlation between attributes in the selection of investment projects, the linguistic scale for decision makers to select attribute ratings is transformed into interval grey numbers, and attribute weights are determined by using the grey decision test method and the evaluation laboratory method; Then, the CPT is utilised to capture the characteristics of individual risk attitudes and preferences, and the value function of each alternative is determined based on the reference points in multiple states. Furthermore, the extended TODIM method based on CPT and interval grey information is introduced into the venture capital project prioritisation decision model. Finally, the applicability and rationality of the model are verified through the application cases of venture capital project selection.

Findings/Results – – An application case of venture capital project selection is used to illustrate the proposed method. The results show that the proposed method is helpful in aggregating decision information from decision-makers in different states to select the most valuable venture capital project.

Originality/value – The method uses interval grey numbers to represent attribute values, which can reflect decision-making information in a more detailed and comprehensive way. Considering the correlation between attributes, attribute weights are determined by the grey DEMATEL method to avoid information bias. Compared with the traditional TODIM method, the TODIM decision-making method proposed on the basis of cumulative prospect theory incorporates the risk preferences of decision-makers in the face of gains and losses into the decision-making model, which results in a more comprehensive and reasonable ranking of the alternatives, and the decision-making process is closer to the reality. This method is an important supplement to the grey risk decision-making theory.

Research/ Practical/ Social/ Environment implications - The method constructed in this paper can be used to solve uncertain decision problems where the decision information cannot be collected to a precise value but the interval value set can be defined, while taking into account the different risk attitudes of the decision maker towards gain and loss, and it is clear that it can be utilised in other risky multi-attribute decision problems.

Research limitations - This paper only studies the interval grey number risk-based multi-attribute decision-making method. When there is a decision-making group, the decision will become complicated. Therefore, in the future, we will study the multi-attribute group decision-making method of interval grey number based on consensus reaching.

Keywords: Multiple attribute decision making; Risk Decision Making; Interval grey numbers; Project selection

Variable neighbourhood search embedded perturbation mechanism for multi-depot vehicle routing problem with simultaneous delivery & pickup and time limit

Wenjie Liu, College of Economics and Management Nanjing University of Aeronautics and Astronautics Nanjing 211106, China

Abstract

Purpose – Given its complex combinatorial features, the multi-depot vehicle routing problem with simultaneous delivery & pickup and time limits (MDVRPSDPTL) is a well-known and challenging real-world problem faced by manufacturing enterprises. A mixed-integer linear programming (MILP) model and an improved variable neighbourhood search algorithm are proposed to solve the MDVRPSDPTL in this paper.

Design/methodology/approach –. A variable neighbourhood search (VNS) algorithm embedded with a novel perturbation mechanism (including a route-selection strategy and a retention strategy for the current best solution) was proposed to solve the model efficiently. The perturbation mechanism helps the algorithm quickly escape local optima to improve computational precision and reduce computation time.

Findings/Results – The numerical results indicate that the proposed algorithm outperforms existing state-of-the-art algorithms in terms of solution quality and computation time for well-known MDVRPSDPTL benchmark instance.

Originality/value – Limited research has investigated the MDVRPSDPTL; previous studies are unsatisfactory in terms of solution quality and CPU time. To fill the gaps, a MILP model with the objective of minimising total delivery cost was developed, and a VNS algorithm embedded with a perturbation mechanism was designed. MDVRPSDPTL, one of the most challenging problems in academics and business, was solved efficiently.

Research/ Practical/ Social/ Environment implications - The MILP model and VNS algorithm embedded with the perturbation mechanism in this paper are suitable for determining a group of vehicle routes for the MDVRPSDPTL. Our research can be applied to the simultaneous pickup and delivery path optimisation problem for electromechanical products, such as automotive parts, machine tools, office equipment, construction machinery, etc.

Research limitations - This study mainly focuses on the MDVRPSDPTL, where each customer is a static known client, and each customer is visited once by a vehicle. However, the MDVRPSDPTL with dynamic customers and the MDVRPSDPTL with split loads (namely, the customers can be serviced two or more times) are two research topics of interest in academia and business. They are worth further research.

Study on the Influencing Factors of Carbon Intensity in Chinese Regional Manufacturing Industry Based on Grey BO-XGBoost

Yifan Zhang,
Wenping Wang
School of Economics and Management, Southeast University, Nanjing, 211189, China
Corresponding author: Wenping Wang (wpwangJG306@hotmail.com)

Abstract

Purpose – The study aims to explore the key factors of Chinese regional manufacturing carbon intensity (CI) under the background of dual control shift (DCS), and the interaction, regional and stage characteristics among them. It also provides an important reference for the formulation of carbon reduction measures for targeted manufacturing industries.

Design/methodology/approach – A three-stage data mining technology framework based on grey associative clustering attribute approximation, Bayesian optimization (BO) for hyperparameters, and SHAP feature interpretation is constructed. A grey BO-XGBoost algorithm integrating grey system theory and machine learning is proposed. It is also based on China's provincial panel data from 2010-2022 to explain the drivers of manufacturing CI evolution under sub-time windows and type regions.

Findings/Results – Energy consumption and energy intensity are key factors in the CI of manufacturing, and are more pronounced in H_c-H_e and H_c-L_e type regions. Energy structure, industrial quality, and technological progress are positively synergized in each regional interaction type before and after the DCS. The superiority of the BO-XGBoost algorithm in model fitting and feature interpretation is also verified.

Originality/value – On the basis of grey association clustering attribute approximation, the grey BO-XGBoost algorithm with Bayesian optimization is constructed. And it is applied to explain the CI drivers of the Chinese manufacturing industry for the first time.

Research/Practical/Social/Environment implications – The study contributes to the exploration of strategies for implementing the DCS in the regional manufacturing and the formulation of strategies for achieving the "dual carbon" goal.

Research limitations - Data collection is from provinces only, and samples can be detailed to municipalities to mine more accurate feature interactions.

Keywords: Manufacturing industry, Grey BO-XGBoost, Carbon intensity, Dual control shift, Influencing factor

A new grey multivariable dummy variable model for predicting marine disaster losses

Yun Cao[a], Lele Guo[b], Ning Cao[c], Peng Jiang[a]

[a]. School of business, Guangxi University, Nanning 530000, China.

[b]. Home Building Materials Decoration Association, Shaoguan 512000, China.

[c]. School of Economics and Management, Ningxia University, Yinchuan 750000, China

Abstract

Purpose –Marine disasters are the most destructive natural disasters faced by coastal countries around the world and have a serious impact on economic and social development and the safety of people's lives and property. However, due to the "mutability, poor information, and small sample " of marine disaster losses, traditional modelling technology cannot fully effectively support the prediction of marine disaster losses. Therefore, this article aims to explore new perspectives, construct a grey multivariable prediction model of virtual variables, and solve the practical problems of marine disaster loss assessment and scientific prediction in practice.

Design/methodology/approach –Since the marine disaster system is highly uncertain and highly susceptible to mutation, marine disaster loss may exhibit catastrophic characteristics of rapid fluctuations in the short term. This paper uses mutation factors as dummy variables into the $GM(1,N)$ model in additive form and multiplicative form, respectively, to build accurate prediction models $IDVGM(1,N)$ and $SDVGM(1,N)$ of marine disaster losses that can handle the impact of special events. $ISDVGM(1,N)$ is based on $IDVGM(1,N)$ and $SDVGM(1,N)$, and further considers the two methods to examine the changes in slope and intercept. By combining intelligent optimisation algorithms to explore optimisation methods for new prediction models, the trend of marine disaster losses under the impact of special events can be obtained.

Findings/Results – Compared with $GM(1,1)$ model, $GM(1,N)$ model, ARIMA prediction model, neural network prediction model, $IDVGM(1,N)$, $SDVGM(1,N)$ and $ISDVGM(1,N)$ models have higher fitting in the fitting and prediction stages. Accuracy and prediction accuracy. The average error of the new model is within 5%, which is an outstanding performance. The new model was used to predict direct economic losses from marine disasters from 2024 to 2030, and it was found that future marine disaster losses will still show large fluctuations and have typical irregular characteristics. Still, the maximum loss generally occurs in summer. Therefore, future work on disaster prevention and reduction of marine disasters still needs to be strengthened.

Originality/value – Compared with physical models, scenario simulation models, and machine learning models, grey prediction models have more advantages in solving the prediction problem of marine disaster losses characterised by "poor information and small samples".

However, there are currently few studies that use the mutation factors in the marine disaster loss system as dummy variables and dummy variable models rarely consider different impact modes comprehensively. This paper comprehensively considers the impact of the intercept term and slope to construct a grey multivariable dummy variable model. Compared with the traditional model, the new model can predict the direct economic losses of marine disasters with mutation factors and provide theoretical support for the prevention and reduction of marine disasters.

Research/ Practical/ Social/ Environment implications - In view of the sudden change in characteristics of marine disaster losses, a new grey model is proposed to predict marine disaster losses. On the one hand, it can enrich and improve the relevant methods of grey systems and expand its application fields in marine disaster loss prediction. On the other hand, marine disaster losses can be monitored in a timely manner to achieve "scientific prediction and early warning", providing a reference for effectively preventing marine disasters. The research has important practical significance for reducing marine disaster losses, scientifically and rationally planning production layout, realising the construction of maritime power, maintaining social and economic stability, and ensuring the safety of people's lives and property.

Research limitations - The original grey model has certain room for expansion in terms of parameter optimisation and empirical validity. On the one hand, due to the defects of the original grey model, there are also some problems in its application in marine disaster prediction. On the other hand, existing models have difficulties in solving the prediction of marine disaster losses with multiple dynamic characteristics. Existing models are difficult to predict marine disaster losses with multiple dynamic characteristics. It is necessary to improve the existing grey prediction models and expand their application fields. Future research can propose a new grey prediction model group based on the multiple dynamic characteristics of disaster losses, such as seasonality, lag, nonlinearity, and interactivity, to predict marine disaster losses.

Keywords: Marine disaster losses；Mutation；Grey prediction model；Dummy variables

Forecasting the marine "3E" systems based on new grey multivariable prediction model

ZiSheng Wang School of business, Guangxi University, Nanning 530000, China
Yun Cao ,QiuHui Dai School of business, Guangxi University, Nanning 530000, China

Abstract

Purpose –The aim of this study is to propose the IBMGM(1,m), which incorporates a regularization coefficient and optimizes background values in the traditional grey models, for forecasting the future trends of the marine economy-ecological environment-emerging industry system(3E). This model aims to provide theoretical support and recommendations for the government in formulating strategies for marine development and policies regarding marine environmental protection.

Design/methodology/approach – Taking into account the interactive effects among the marine economy, ecological environment, and emerging industries, as well as the characteristics of "small sample, poor information," this study extends the original MGM(1,m) model to IBMGM(1,m) by introducing regularization coefficient, utilizing the geometric interpretation of the original model for background value enhancement, and employing machine learning techniques to intelligently optimize model parameters. This model enhances prediction accuracy and expands the application scope of the original model.

Findings/Results – Compared with traditional forecasting models such as the GM(1,1) model, MGM(1,m) model, BMGM（1,m） model, which only involves background value improvement ,the new IBMGM(1,m) model demonstrates higher accuracy in both fitting and prediction stages.

Originality/value – This paper investigates the interactions among the marine economy, marine ecological environment, and emerging marine industries from the perspective of systems theory. By comprehensively employing both data-driven and feature-driven approaches, a novel grey forecasting model is proposed to effectively address the uncertainties and dynamic changes within the marine economic system. The introduction of this model not only enhances the accuracy of grey forecasting models but also broadens the application scope of grey theory. It provides significant theoretical and methodological support for a deeper understanding of the complex relationships between the development of the marine economy and the evolution of the ecological environment.

Research/ Practical/ Social/ Environment implications –This study employed an innovative grey forecasting model to conduct in-depth predictive analysis of the complex system involving the marine economy, ecological environment, and emerging industries. By comprehensively considering the interrelationships among various factors, we were able to provide accurate predictions for relevant departments regarding the future development of the marine economy, the status of the ecological environment, and the technological

innovation capabilities of emerging industries. Furthermore, the outcomes of this research have provided robust support for advancing high-quality development in the marine economy and promoting technological innovation, which also contributed positively to the decision-making of marine ecological environment protection and the achievement of economic prosperity and ecological balance.

Research limitations –The system of high-quality development in the marine economy is complex, characterized by limited information and small sample sizes. Traditional forecasting models may be constrained in this regard, whereas grey system theory approaches demonstrate notable performance. However, there remains room for improvement in existing grey forecasting models. Future research should focus on problem-oriented optimization and enhancement of grey theoretical models.

Keywords: Marine "3E" system; Grey prediction model; Machine learning; Marine environment protection .

Section 3.2 CyberSystemic examination of Interactions, relationships, and agents of change

Coordinated by Igor Perko and Jerzy Josefczyk

Examining interactions proves challenging, leading us to scrutinize structures, system properties and relations beyond actual interactions themselves. To address this, we invite the Congress participants to discuss the general concept of interactions as a catalyst for interdisciplinary communication, which apply to all systems: social, organisational, biological, chemical quantum, mathematical, to name a few. Thereby, a challenge to systems thinkers and cyberneticians is to enhance methods to, conceptualize interactions and relations with implications for research. If done right, we may help co-designing a new transdisciplinary bridge allowing for a better understanding of the world we live in.

On The Cybernetics of Humour: Can Humour Predict Individual Personality Dimensions?

Faisal L. Kadri independent researcher, artificialpsychology.com

Abstract

Purpose – To demonstrate a new approach to predicting the values of Big Five (B5) personality dimensions of individuals from Age Trend Classification (ATC) funniness scores using parameters obtained from a 2022 cybernetics study.

In a recent analysis, Big Five (B5) personality dimensions were correlated with the funniness scores of arbitrarily selected jokes. The funniness scores were classified a posteriori according to the averages of their Age Trend Classification (ATC). The analysis was not the traditional correlation of two sets of data, it implemented three stages of computed correlation coefficients and entropy; a measure of information often cited in Cybernetics circles.

Design/methodology/approach – In a recent investigation, participants from the Google Magnetic Turk online questionnaire filled out 5-point Likert-type scales. The analysis computed the correlation coefficients and entropy between B5 personality and ATC humour in three stages.

This investigation uses the numerical values from the analysis to demonstrate how individual estimates of B5 dimensions can be computed in three cumulative stages. The first stage computes the prediction values of B5 dimensions of individuals from the average of funniness scores by linear extrapolation. The second augments the values of three B5 dimensions using scaled, keyed and aggregated scores. The third stage adjusts the predictions for age and gender, all by simple linear extrapolation.

Findings/Results – It is possible to estimate individual B5 dimensions from funniness ATC scores. It is also possible to compute humour-gender and humour-age from humour scores; both can be different from the reported individual data.

Each individual has a computed humour age, which reflects their humour preference, and a computed gender preference, both of which may be quite different from recorded age and gender. Predicting personality dimensions will depend on a combination of computed and recorded age and gender, a wide area for further investigation.

Originality/value – Many mainstream humour research analyse humour and personality through traditional statistical procedures, which include humour self-appraisals, a priori classifications of types of humour and compliance criteria with low discrimination.

This study depends on a posteriori classification of humour with four complex dimensions, effectively eight dimensions. It uses the higher discrimination Kullbeck-

Leibler diversion criterion for measures of loss of entropy. It is also unique in containing a non-intrusive and objective measure of humour.

Research/ Practical/ Social/ Environment implications - Implications: The higher dimensionality of ATC humour classification and its dependence on age implies that ATC measures contain more information than B5 personality dimensions. A validated classification of humour makes it possible to construct an artificial personality that either reflects or complements the personality of an automation user, a matching that could facilitate man-machine interaction and improve learning.

Research limitations – The basis of this investigation is an online English language questionnaire which attracted 800 participants, this number may not be sufficient to generalise the numerical values of the parameters. However, the purpose here is to demonstrate the procedure of predicting personality from humour scores and as such, it is sufficient for demonstrating the methodology.

Linear extrapolation is an elementary technique for computing prediction values, its use is a limitation, more elaborate methods could well produce better predictions.

Eigenform and brand value cocreation

Gandolfo Dominici Professor of Busyness Systems and Marketing, University of Palermo, Palermo, Italy, IT

Abstract

Purpose – This study embarks on a theoretical journey to re-conceptualise brand value co-creation through the lens of eigenform, a concept borrowed from second-order cybernetics. The focal point of this conceptual framework is to dissect and illuminate the intricacies of brand value co-creation, showcasing how it can act as an eigenform of the co-creation process within network cohesion. This approach provides a novel perspective on how brand image and value can be dynamically constructed or deconstructed through ongoing interactions.

Design/methodology/approach – To unravel the complexities of brand value co-creation, this study espouses a theoretical construct that combines the principles of consumer behaviour with second-order cybernetics. It meticulously outlines how brands materialise from the sequential actions embedded within a process, serving as pivotal symbols or signals that echo the underlying "behaviours" and dynamics of the process. This framework is predicated on a nuanced understanding of the interplay between brand creation and reciprocal actions and perceptions that fuel its evolution.

Findings/Results – The exploration reveals a paradigm shift from the traditional marketing viewpoint, which traditionally perceives brands as static entities "out there" crafted by producers for a defined target. Instead, it sheds light on the brand creation process as a cyclical and recursive phenomenon scrutinised through the prism of second-order cybernetics. The research delineates how brand co-creation transpires in the market sphere, stemming from a web of interactions that lead to the social construction of the brand as a "symbol of value" and is not a separate entity in the marketplace. This implies that brands are eigenforms emerging through eigenbehaviors characterised by distinct directions and intensities, as denoted by eigenvalues.

Originality/value – This is one of the first theoretical attempts to link brand value co-creation with the second-order cybernetics concept of eigenform. This exploration stands out as a pioneering theoretical effort to meld the principles of brand value co-creation with the second-order cybernetics concept of eigenform. It carves a niche in the academic and practical realms by offering a groundbreaking perspective that challenges and extends the conventional narratives surrounding brand co-creation.

Research/ Practical/ Social/ Environment implications - This study provides valuable insights for both researchers and marketing practitioners to better understand the process of brand value co-creation. The findings and perspectives presented in this study are of paramount importance to both academic researchers and marketing practitioners. They offer insights into the dynamism of brand value co-creation, fostering a deeper

understanding of the mechanisms and nuances involved. By adopting this framework, professionals can cultivate more resilient and adaptable brand strategies that resonate with the fluid nature of market interactions and consumer perceptions.

Research limitations – While this theoretical exploration paves new avenues for understanding brand co-creation, it acknowledges its limitation of not being empirically tested. This conceptual framework serves as a springboard for future investigations that can delve into the empirical realm. Subsequent research could aim to operationalise, propose, and validate hypotheses and test them in various practical scenarios.

Keywords: brand value; value co-creation; eigenform; second-order cybernetics

A New Methodology in Support of Critical Systems Thinking: Critical Systems Intervention (CSI)

Petter Øgland, Department of Informatics, University of Oslo, Norway

Gary Evans, Department of Sport & Event Management, Bournemouth University, UK

Abstract

Purpose – Total Systems Intervention (TSI) was designed as a methodology supporting Critical Systems Thinking (CST), a philosophy trying to unite systems thinking with radical politics. However, TSI has been critiqued on different accounts, which resulted in revisions like Local Systemic Intervention (LSI) and Critical Systems Practice (CSP). We believe that the revisions did not pay sufficient attention to the criticism, so we are presenting a new revision of TSI called Critical Systems Intervention (CSI).

Design/methodology/approach – Four criticisms of TSI are identified and used as input for the design of CSI. The CSI design is illustrated by revisiting a TSI case study of questionable merit to show how the revised approach cleans it up. An important part of the cleaning up consists of showing how the case study's use of the Viable Systems Model (VSM) should be executed by focusing more explicitly on CST themes like collaboration, self-governance and workplace democracy.

Findings – CSI is sounder, simpler and more aligned with CST philosophy than TSI.

Originality/value – CSI is based on ideals and ideas from classic CST literature that were identified at the time but not sufficiently explored and thus abandoned too quickly.

Research/ Practical/ Social/ Environment implications - CSI should make it easier for CST interventionists to align with CST's commitments to critical awareness, emancipation and multimethodology.

Research limitations – CSI has so far only been used for revisiting old TSI narratives and needs to be tested further through action research.

Keywords: Critical Systems Thinking, Total Systems Intervention, Viable Systems Model, Critical Systems Intervention

Interactions – CyberSystemic perspectives on organising a scientific meeting

Igor Perko, University of Maribor, Faculty of Economics and Business, WOSC,

Jerzy Józefczyk Wroclaw University of Science and Technology Department of Computer Science and Systems Engineering, Wroclaw, Poland

Abstract

Purpose – Interactions are the dynamic part of every system, which is elaborated in nearly every domain of human exploration. However, a general formulation of interactions is not adequately provided and will be thus proposed in this paper. We will elaborate on the boundaries, the properties, the prerequisites, and the implications of interactions. Additionally, we will examine cyclical dependency between interactions and structures.

Design/methodology/approach – We start with the literature analysis on interactions from multiple research domains, synthesised with CyberSystemic concepts. The research will be advanced by developing a conceptual general interactions model, which will be cross-validated by a mathematical model. The interaction analysis will be performed at the WOSC 2024 Congress scientific meeting.

Findings/Results We are proposing a cross-validated general interactions model, testing it's overall capacity to generally explain the interaction phenomena in organising a scientific meeting. Three hypotheses anchor this evaluation: H1 posits that an interaction invokes two related actions, the originating and the effect one. H2: interactions are cyclically connected with structures (relations), whereas interactions provide an incentive to develop structures, while structures act as catalysts for desired or inhibitors for undesired interactions. H3: for a successful scientific meeting, a comprehensive interaction analysis provides requisitely holistic perspectives.

Originality/value Interactions were defined in several domains, such as in statistics or chemistry, but a general CyberSystemic examination and definition of interaction is still missing. A general interactions model will provide the framework to observe, measure, predict and plan interactions and consciously develop requisite sustainability-focused structures.

Research/ Practical/ Social/ Environment implications The importance of a general interaction definition is crucial since it illuminates an important taxonomy term in the common epistemology and thus enables comparison of otherwise unrelated phenomena. It can act as a catalyst in cross-domain research communication.

Research limitations – At the congress, we are proposing a conceptual model for the discussion. Before the publication, it shall be cross-examined on several layers: by the congress participants and by the attempts to apply it in several research disciplines.

Realising the humanising organisation

Louis Klein European School of Governance, Berlin, and,

International Federation for Systems Research, Vienna

Abstract

Purpose - A humanising organisation recognises and realises itself in its entire being and becoming a humanising social ecosystem in itself and for itself. It recognises itself in a process of inquiry, learning, and understanding embedded in epistemic humility. Recognising a humanising organisation realises a shared understanding that grows from co-reflected lived experiences. It is a shared understanding that grows continuously and dialectically in the mirror of its partners. It is an evolving understanding that is as growing and impermanent as a single organism in the constantly growing biosphere.

Research organisational self-awareness over 30 years leads from the learning organisation via the reflecting and understanding organisation to the humanising organisation, not only realising the ontoepistemology of organisations but also the implicit axiological propensity. Sharing the learning journey of organisational systems research over the last 30 years.

Design/methodology/approach – Critical Systems Research, systemic inquiry, hermeneutic phenomenology.

Findings/Results – A humanising organisation is emerging and dissolving, and, in this dissolving, it becomes its humus, nurturing the emergence of an autotelic and dialectic process. A humanising organisation recognises and realises itself in the process of a growing shared understanding of the organisation in itself and for itself. A humanising organisation is trusting our human potential, trusting our humanity, and realising the essentiality and existentiality of love.

Critical Systems Research grows in the light of recognising and realising the axiological propensity of the humanising organisation beyond the morality of the critical school. It resonates strongly with the diverse spiritual wisdom traditions.

Originality/value – In addition to the above mentioned, the article transcends the prevalent debates on systems philosophy and third-order cybernetics.

Research/ Practical/ Social/ Environment implications – The recognition and realisation of humanising social ecosystems lies at the very heart of the current metamorphic transformation of the Moroccan education system as part of a societal metamorphosis recognising and realising a humanising society.

Research limitations – The current paradigms of proper science exclude the recognition of axiological propensity and claim a pseudo-objectivity and neutrality.

Natural evolution of Open systems – self-organisation of reciprocal control and communication among complementary entities

Seshadri Ramaswamy. Research affiliate, Simon center for social brain, MIT, s_ram@MIT.edu

Abstract

Purpose - This paper describes the process underlying the natural evolution of open systems - a cybernetic/synergetic architecture with an implementation scheme of "think globally, act locally" with the corollary "sense locally, cognise globally". The open system concept is derived from a detailed study of the human brain architecture. A mathematical model is proposed, with the golden ratio as a plausible single scaling parameter, an idea that was motivated by the observed ratio between the brain rhythm frequencies and the Fibonacci series in plant biology.

Approach - In the evolutionary process, especially relating to living beings, the boundary and initial conditions are not known, mass and momentum/energy are not necessarily conserved, and there is not necessarily an equilibrium at all times. Thus, the natural evolutionary process underlies the formation of unbounded open systems. It is proposed here that this architecture can be formulated as a parallel, repetitive, self-organized, reciprocal interaction between complementary parts of the whole. This proposal encompasses various well-known concepts like cybernetics (self-organised reciprocal control and communication - Wiener, Ashby), synergetics (upward local to global emergence and downward global to local determination - Haken, Buzsaki), natural selection process enabled by complementary structural mutation and functional adaptation (Darwin). There are numerous examples of complementarity in living systems, like matter/energy, structure/function, body/mind, neuronal soma/synapse, body-awareness/mental-attention, sensation/action, cognition/thought, experience/memory, learning/recall, noun/verb words.

Findings - There is no supervisor or agent governing self-organisation - a model-free, mechanism-independent process. The key aspect of this process is the embedded configuration of relations - always circular or reciprocal actions of cooperation and competition between different types of forces arising from distinct energy sources and constituents. The "think globally, act locally" self-organisation process involves two simultaneous activities - "fast, discrete, long-range, selective application of control" and "slow, continuous, local, broad communication" - between complementary elements of an open system. This same simple process is repeated over multiple spatial and time scales. Since the system grows in size by the repetition of the same process, complexity does not scale with size. Therefore, there is no catastrophic interference in the structure or function during the evolution of open systems. While the parts do cause the behaviour of the whole, the behaviour of the whole also constrains the behaviour of its parts according to a majority rule, akin to democracy.

The implementation of this process, unifying all the complementary elements interacting at various spatio-temporal scales into a seamless open system, requires "self-organising links/network" between the elements. These links establish the many-to-many static mappings between the elements (permanent memory, connected hardware). In addition, the network learns both the Bayesian probability of occurrences of each map under different contexts and also the corresponding value proposition to the system's various needs (transient activity–gating, neuro-modulatory action in the brain), i.e., the network provides attractor dynamics capability. For example, the sensations and actions become mutual attractors to each other in a reciprocal manner, evoking a reflex (sensation/action pairing) or a memorised procedural behaviour of living beings. The reader probably can readily envision the GPS used in navigation as a good analogy to understand this process. GPS stores static maps linking many complementary pairs of origins and destinations and is also "capable" of identifying at every finite step of the entire journey, the context relevant (like travel conditions, mode of transportation) and high value-providing (time, toll, places of interest) route. Thus, the GPS emulates how the peripheral and central nervous systems, with the brain as their central organ, learn and execute the control and communication process that guides human behaviour.

Originality - The unification of two fundamental concepts into an open system process - a self-organising controller and the mapping of interaction between complementary entities, is novel. It is consistent with Ashby's (cybernetics) law of Requisite Variety, which says that a regulator's capacity as a regulator cannot exceed its capacity as a channel of communication. For example, bottom-up communication of sensation and top-down control of action are reciprocal processes, and the weighted dynamic mapping of many such pairs (dynamic memory) is essential for the effective governance of human behaviour.

Implications - The human "Self" can be defined functionally as -"I consciously experience and think" and structurally as - "at this instant, I am body and mind guided by the brain, in this world". The first and last phrases characterising the structure define observation time intervals and the deduced continuous space. The main clause defines the body and mind as complementary entities, with the brain as the cybernetic link enabling the behaviour. At the functional level, the brain activity can be modelled as two complementary networks – a mentalising network (Barrett, 2014; Kahneman; Damasio) enables cognition/thinking and generates motor action sequence commands, while another body network processes the communication from/to the sensory/motor organs. The thalamus (static connectivity) and hypothalamus (neuromodulatory attractor dynamics) are potential main interface regions. The hippocampus and prefrontal cortex sequence activity patterns at different times and neuronal population scales.

Statistical model - The activity at various nodes of the brain network is defined as: "*fast, discrete, long-range, selective release of control*" and "s*low, continuous, local, broad communication*".   Mathematically, then this process can be described by a mixed model

Markov chain; i.e., the probability of an event at a node depends only on the current discrete input and the state attained by the node since the previous event. The dynamic state Y follows an exponential change $Y=EXP(1/\lambda)$ within a neuron, and the discrete spatial input X into the dendrites from other neurons depends on the dynamic state variable of those neurons, i.e., X |Y. Then, X is not only a Poisson distribution of Y (Perrenoud, 2023) but also becomes a geometric distribution $X=GEOM(1 / (1+\lambda))$ at a critical threshold. The golden ratio Φ is a scaling parameter solution for λ that fits this model. This particular solution is validated by the experimental data on the ratio between brain rhythms "$\gamma, \beta, \theta, \delta$ frequencies" (i.e., inter-regional activity time intervals scale by $\Phi^2=2.618$, also $\sim=$ "e", Roopun, Kramer, 2008).

Summary - This paper provides a comprehensive framework rooted in cybernetics for understanding the evolution and functioning of open systems, with implications for diverse fields including neuroscience and systems theory.

Keywords: Open systems, Complementary processes, Cybernetics, Sensation/action pairing, Cerebral reflexes, Brain evolution, Brain rhythms

At the Crossroad of Information Security and Inverse Cybernetics: The complexity of interactions/relationships between Cyberneticians versus Cybersecurity Experts

Tenured Professor Teodora Ivanuša, PhD, PhD University of Maribor, SLOVENIA

Professor Emeritus Matjaž Mulej, PhD, PhD, *Founding President of IASCYS, Norbert Wiener Memorial Gold Medal recipient, 2019,* University of Maribor, SLOVENIA

Assoc. Professor Blaž Markelj, PhD University of Maribor, SLOVENIA

Abstract

Purpose – The integration of natural and social sciences, considering the existing systems theories of Božičnik & Mulej, (2009; 2011) and Ivanuša (2016), is crucial for the development of models to ensure data security in information and communication technology. The impact of the Industrial Revolution 4.0 (IR4.0) can be observed worldwide as it has forced various industries to rethink their strategies to remain competitive. Speed, efficiency and the widespread use of information and communication technologies (ICT) are becoming key elements of modern human communication. The integration of people and smart systems (what we call Industry 5.0) is intensifying. ICT is now widely used regardless of distance or time, with the concept of the *cyber-age* being defined as *everything being connected* (Roswati et al, 2020), which means that the amount of data *produced* and used is constantly increasing, making the provision of information security particularly delicate and important.

Design/methodology/approach: The theory review method is an important tool in the research process. It involves a thorough review and critical appraisal of various literature sources such as books, scientific articles, reports, etc. It aims to identify key concepts, trends and potential knowledge gaps, and to gain a deeper understanding of the development of a particular theory or field. In our paper, we focused on the descriptive method of system theories and cybernetics review, which allowed us to systematically analyse the existing literature and clearly present the key findings and concepts.

Findings: In this congress article, the authors shed light on the growing need to ensure data security while presenting different but outlined system theories and cybernetics that could be useful and helpful in this regard.

Originality/value: The daily increasing demands for data security require a thorough knowledge of systems and the systems theories and cybernetics that have been studied at the systems level in the past, if we are to successfully develop and maintain effective security systems in the future and avoid/alleviate the possibility of *Inverse* Cybernetics occurrence/existence.

Research/Practical/Social/Environment implications: The paper will link the discipline of information security with inverse cybernetics occurrences, which is something innovative for the field.

Research limitations: Since the research proposal is theoretical (even philosophical) in its nature, the projection may not display a fully holistic perspective and can/should be complemented with additional research results.

Keywords: Information Security / Cyber-Security, *Inverse* Cybernetics

"Cognition", "Consciousness" and "Cognitive Consciousness"

Author: Thirachai chiraphacharaCharoenkun, independent researcher (Thailand) zhouYang1969@gmail.com

Abstract

Purpose – Through the cognitive exploration of "the underlying narrative of the universe is the logic gate of consciousness", we can reconstruct the possible blueprint of future civilisation.

1. Cognitive science should dialogue with molecular biology

2. Consciousness, cognition and cognitive consciousness

3. The existence form and state of consciousness

4. From consciousness radiation to information interaction

5. Cognitive interpretation of the mass-energy equation

6. The underlying narrative and macroscopic significance of quantum mechanical phenomena

Using cognitive theory to understand consciousness, we can conclude that the manifestation of the logic of the state of affairs is material consciousness, and the so-called "cognition" is the logical set of consciousness of the object at the assumed time point.

A rational pursuit of the logic gate of "consciousness", from biological consciousness to virus consciousness, until all matter has consciousness.

Interpret the mass-energy equation in a cognitive way: the universe is a collection of various forms of energy, and the forms and properties of material existence are different manifestations of various forms of energy. Manifestation is consciousness, which is a natural radiation phenomenon of energy existence. The intersection of manifestation and manifestation is the intersection of consciousness, which is also the theoretical information interaction.

Electrons, ions, quanta, and photons are all carriers of consciousness. The existence of matter waves is the energy radiation of material consciousness, which is applicable to both living and non-living things.

Therefore, the deconstruction of quantum mechanics is the underlying narrative of macroscopic significance: change is the energy radiation of pure expression, and drastic change is the result of changes in the expression environment.

Design/methodology/approach – The "one-man Messi Conference" method to collect materials from the cutting-edge achievements of various disciplines and develop a comprehensive narrative. The dialogue and cooperation among various disciplines of the Messi Conference is the spiritual pillar of cognitive consciousness. Strive to transcend the unity of science and establish philosophy as a "philosophical centralism" for scientific orientation, error correction, and deviation correction.

The Messi Conference, which took place in the middle of the last century, was a dialogue and cooperation among scholars from various disciplines in the cutting-edge thought world, calling for "scientific unity", which led to the birth of cybernetics and artificial intelligence.

Since this is a "Messi Conference for one person", naturally searching, thinking, discovering, and verifying are all done independently. Starting from "cognitive consciousness", Santiago's cognitive theory is the most primitive technical support.

Findings/Results – "Cognitive consciousness" obtains a rational tool such as "cognition comes from consciousness", so that the logical gates where consciousness may occur can be corrected from animals with central nervous systems to single-cell organisms;

The reason why I call for cognitive science to have a dialogue with molecular biology is that through the phenomenal results of molecular biology, it can be demonstrated that substances between non-living things and living things, such as viruses, also have "consciousness".

The reason why I call for cognitive science to have a dialogue with molecular biology is that through the phenomena of molecular biology, it can be demonstrated that substances between non-living things and living things, such as viruses, also have "consciousness".

From molecular biology to molecular physics and atomic physics, there are a series of phenomena that can not only correct the logical gates where "consciousness" may occur downward to "all substances", but also prove the state and form of "consciousness".

Therefore, "cognitive consciousness" is the centre of the whole article, and "all substances have consciousness" can explain that the universe is a collection of energy in the form of matter, and consciousness is only.

Originality/value – Consciousness is the expression of material energy radiation, which can verify the universal law of the mass-energy equation and make the true nature of the existence of the universe clearer.

Research/ Practical/ Social/ Environment implications - The revision of the consciousness logic gate will inevitably lead to ideological oscillation. The structural

adjustment and content reorganisation of related knowledge will be another engineering reconstruction in the humanities.

Research limitations - Will the stability of carbon be the cause of the birth of time?

Observing the "variability" consciousness currently expressed by non-living things and the "stability in change" consciousness expressed by living things, it is indeed a question that can be raised.

Looking forward to further research on carbon-based molecular biology, but currently, due to the lack of concrete evidence, it can only be a mystery!

Keywords: material consciousness, information interaction, energy radiation, consciousness logic gate, underlying narrative, philosophical centrism

The emergence of new capabilities for learning and understanding the work with cobots in healthcare

Vasja Roblek WOSC Member of research board, Ljubljana, Slovenia vasja.roblek@gmx.com

Vlado Dimovski School of Economics and Business, University of Ljubljana, Ljubljana, Slovenia vlado.dimovski@ef.uni-lj.si

Judita Peterlin School of Economics and Business, University of Ljubljana, Ljubljana, Slovenia judita.peterlin@ef.uni-lj.si

Abstract

Purpose – The study aims to provide a comprehensive understanding, using systems thinking and organisational learning theory, of how medical professionals and students can adapt and develop enhanced capabilities in agile processes involving collaboration with cobots. We are analysing the issue of acquiring additional knowledge for existing employees and the need to implement study modules for medical and health science students that focus on gaining practical experience working with cobots and other intelligent technologies. Education and acquiring new skills are prerequisites for innovation and understanding issues related to the implementation of cobots and are among the objectives of a learning organisation. Our research emphasises a systemic collaboration between educational and healthcare institutions to align and advance education, medical treatment or medicine development processes.

Design/methodology/approach – Systems thinking and organisational learning theories were used with a historical review of innovation and organisational change in healthcare systems to explore the complex phenomena that occur in implementing and using new capabilities in cobot collaboration in healthcare.

Findings/Results – The study highlights the relationships, opportunities, and challenges that may arise between healthcare professionals and cobots, as well as the essential new personal and organisational skills. Cobots improve patient care and surgical precision and impact the healthcare system's overall efficiency by transferring medical staff's administrative duties to cobots.

Originality/value – The research identified the capabilities of cobots that decision-makers and policymakers need to include in future educational programmes, demonstrating the shortcomings and the benefits of cobots working with healthcare professionals using practical examples. At the same time, it is necessary to ensure that healthcare professionals continue to learn how to operate cobots, which significantly improves the quality of medical processes and increases patient safety.

Research/ Practical/ Social/ Environment implications - It is essential to emphasise the need to adopt systems thinking and organisational learning approaches to healthcare robotics. This will ensure that the many challenges that are or will be encountered in the context of robotic medical practices are understood and addressed. Systems thinking enables us to explore the interrelated nature of the different elements in the healthcare system, providing a holistic view of the challenges involved.

Research limitations - The reliance on previously published primary sources is a significant limitation of this study. However, this study provides the basis for future primary research to explore the challenges faced by healthcare professionals (e.g. fear, anxiety, non-acceptance and technological failure) and healthcare organisations (e.g. agile processes and new business models) in implementing and working with cobots.

Keywords: agility, cobots, human capabilities, organisational capabilities, healthcare system

Organisational interactions – From Industry 4.0 to Industry 7.0 and beyond

Vojko Potočan. University of Maribor, Faculty of Economics and business

Abstract

Purpose – The main purpose of this article is to research how industry development – from Industry 4.0 to Industry 7.0, changes organisational interactions, which, importantly, forms their relations and determines needed social interactions for achieving holistic development of society framed by the idea of Society 5.0.

Design/methodology/approach – Drawing from organisations, technological and systems theories, we analyse the shift from traditional to new organisational interactions characterised by the collaboration of humans, robots and artificial intelligence (AI). In terms, we focus on two different but complementary aspects of the treatment of selected interactions. First, we will examine how humans change their understanding of relations to technology and how this affects the change in the social framework of organisations. Then, we will analyse "the achieved level of sociality of technology", which is increasingly changing from a hard to soft production factor of organisations. Based on the transdisciplinary approach and application of soft systems theory, we will then place the knowledge of the treatment of both aspects in social systems of modern organisations for supporting Society 5.0

Originality/value – Interactions between human and technological solutions researchers are mainly considered mono-disciplinary when their holistic and trans-disciplinary studies of the emerging new social structures of organisations operating in the frame of newer concepts of industrial development are less developed.

Research/ Practical/ Social/ Environment implications – The study contributes to a new understanding of relations between humans and new technologies and emerging new social interactions and relations between them. It also reveals new possibilities for understanding the social role of technology in organisations, the changing of the social role of AI, and the transformation of IA from only technological to more social factors of organisations.

Research limitations – We will limit our research to the interdisciplinary analysis of selected organisational interactions. To deal with human-technology interactions, we will use soft systems theory for the creation of more holistic social interactions needed for transition in Society 5.0.

Keywords: Organisational interactions, Technological development, Social development, Industry, Society 5.0.

Section 4.1 Cybernetic and Systems Education: Past, Present and Future

Coordinated by Matthew Holt, William Reckmeyer, and Alfonso Reyes

This section aims to explore the past, present and future of cybernetic and systems education. The track will provide a platform for educators, researchers, and practitioners to share experiences, exchange ideas, and collaboratively envision the future of cybernetic and systems education. In particular, we seek papers that present case studies from either undergraduate, graduate and non-award education; experiments and innovations with those programs, and position papers on future trends in pedagogy and content. We aim to create and promote a transnational network to further cybernetic and systems education.

The past - The origins and historical milestones in cybernetic and systems education: Case studies highlighting key contributors, institutions and organisations, educational approaches, and paradigm shifts.

The present - Analysis of the current state of cybernetic and systems education worldwide. Examination of case studies of contemporary programs including courseware and curriculum development, transdisciplinary approaches, new technologies, new learner audiences. This may include showcase of innovative teaching methods and real-world applications, successful strategies for student/learner engagement. Industry engagement: Examples of successful collaborations between academia and industry to enhance cybernetic and systems education.

The future - Exploration of learning technologies shaping the future of cybernetic and systems education; How emerging fields such as artificial intelligence can be steered by cybernetics and systems thinking as embodied in curriculum development. Transnational and First Nations perspectives Strategies for promoting inclusivity, diversity, intergenerational presence, and access within the field.

Systems Thinking in the Professional Context: Short Exposure for Long-Term Impact

Amanda Gregory, Centre for Systems Studies, University of Hull, Hull, UK

Abstract

Purpose – This paper will provide a case-study of a short course delivered for a professional audience which employed a systems approach in its design and aimed to give participants an introduction to systems thinking.

Active Withernsea is a Sport England-funded pilot project which is run by the East Riding of Yorkshire Council (ERYC), UK, in partnership with Active Humber. Since 2019, a community development team has supported residents in the town of Withernsea, UK, to become more physically active while simultaneously using systems approaches to achieve wider system changes. Consistent with its community ethos, the project has placed an emphasis on sharing the learning and, with this in mind, a bite-sized professional learning short course was created for a group of professionals employed by Active Withernsea, ERYC and Active Humber to help upskill their practice.

Design/methodology/approach – A case-study approach will be adopted that will focus on the design and delivery of the short course.

The course was delivered over a period of 3 months. The delivery commenced with a 2 hour face-to-face workshop followed by five one-hour synchronous online workshops, with participants being provided with a session synopsis to help them prepare for each workshop. Workshops were designed to enable the exchange of ideas about how to use systems ideas in practice and systems pedagogy and also to create an effective systems learning community.

Findings/Results – As this is a single case, the focus will be more conceptual in nature but it will include comments and feedback from participants in the short course. Critical points of learning about how things could have been done differently will be suggested.

Originality/value – The originality of this paper lies in its provision of a case of the use of systems thinking to inform the design and delivery of a professional short programme. Such programmes are important as they provide great opportunities for embedding systems thinking in organisations and learning by systems academics about what works where and why.

Research/ Practical/ Social/ Environment implications – One of the aims of the Active Withernsea pilot is to explore how what might be perceived to be academic Systems Thinking concepts can be made more accessible to project and wider public sector professionals to help sustain change and new ways of working. For the most part, systems thinking is being used to inform the delivery of the project in general whereas this case

study reports on the most explicit attempt to deliver systems content. Critical reflection on this case should provide practical learning about how to make systems courses doubly systemic and how to pitch systems thinking to a professional audience.

Research limitations – This short course has been delivered once and the longer-term impacts and use of systems thinking by those engaging in the short programme has yet to be determined. Next steps of the pilot will now turn to investigating how this learning can be applied in other areas to create behaviour change.

Keywords: Systems Education; Systems Thinking and Practice; Systems Pedagogy; Systems Change.

Reshaping 21st-century higher education to underpin cybernetic and systems thinking

Clive Holtham, Bayes Business School (formerly Cass), City St George's, University of London

Abstract

Purpose Though there are multiple and increasing critiques of the relevance of traditional educational practices in higher education, this paper focuses on how and why the pace of innovation in educational practice falls short of what is needed to address either global sustainability or the types of capabilities needed personally and institutionally when concepts of knowledge and expertise are under challenge, not least through the rapid evolution of generative AI. There are, of course, honourable exceptions, such as the thinking behind the creation of open universities in many countries or the specific case study of the University of St Gallen (Schwaninger, 2019).

Design/methodology/approach The paper is an autoethnographic study of a two-decade-long initiative (Learning Laboratory) set up to develop and promote unconventional pedagogic methods.

In 2003, a leading business school created a Learning Laboratory as a mechanism to seek out and prototype more innovative educational methods. The context for this was the 2000-2001 dotcom-based financial crash and a sudden shift in employer expectations. Though the Lab addressed a variety of technology-based approaches, the main driver was to promote the critical, reflective and systemic thinking that had been increasingly lacking and where this lack contributed to ineffective leadership globally, nationally and institutionally.

Findings/Results A review of barriers to educational innovation highlighted the problem of a dominant mindset, certainly in most Western higher education, in that academic disciplines are assumed to be the primary and most effective way to organise both research and teaching and learning. This paper challenges that by highlighting the importance of taking a transdisciplinary approach, ultimately potentially "indisciplinary" (Nicolescu, 2008).

The Learning Laboratory was created on the principle that there were three types of educational "spaces" available – physical, virtual and imaginative, but that higher educational practice had heavily focussed on traditional physical and, latterly, virtual spaces. As well as exploring less conventional deployment of physical and virtual spaces, the Lab has had a particular emphasis on experimenting with and deploying imaginative spaces. Specific themes addressed include:

(a) Arts-based methods
(b) A heavy emphasis on developing personal reflective practices

(c) A university-wide and highly innovative initiative in educating innovative, creative leaders

Originality/value There are few examples of explicit creation of a unit within a business school explicitly charged with conscious (and risky) educational innovation, both analogue and digital, and both in-school and genuinely transdisciplinary (or even indisciplinary).

Research/ Practical/ Social/ Environment implications Two decades of innovation inevitably include experiences of barriers and resistance to change (Owens, 2012), which are both inevitable and which need to be addressed explicitly if cybernetic and systems thinking are to underpin pedagogy. It is not enough to experiment operationally, it is essential to achieve shifts in strategic educational mindsets that are a current barrier to necessary innovation.

There are numerous theories on how and why to challenge the dominant mindset. This paper is a case study of over two decades of educational innovation in management and leadership education, which, though not centred on education in cybernetics and systems thinking, has been shaped by these perspectives, as well as by an appetite to seek out less conventional and often neglected approaches which run counter to the conventional knowledge transfer model underpinning discipline-dominated higher education.

Research limitations This is based on autoethnography, whose limitations are widely understood, including lack of impartiality and non-disclosure of problematic experiences. It is also based on a single institution, where special factors may not apply more widely.

The case study is not offered as a role model but rather to provide data to underpin one type of necessary challenge to the dominant mindset in higher education.

Keywords: Transdisciplinarity, Pedagogic Innovation, Art-based methods, Critical Thinking

References

Nicolescu, B. (2008). *The reform of thought, transdisciplinarity, and reform of the university*. In B. Nicolescu (Ed.), *Transdisciplinarity: Theory and practice*. Hampton Press

Owens, D. A. (2011). *Creative People Must Be Stopped: 6 Ways We Kill Innovation* Jossey-Bass.

Schwaninger, M. (2019) *Cybersystemic education: enabling society for a better future,* Kybernetes, 48(7), pp. 1376–1397.

The Role of "Art" in the (Re)Education of Systems Thinkers

Hernán López-Garay, Director of the Special Projects Unit (UPE) University of Ibague, Colombia. Researcher, MYSCO (Modelling and Simulation of Complex Social Systems), University of Ibague, Colombia. hernan.lopez@unibague.edu.co.

Abstract

Purpose –Over the past two decades, voices within the systems movement have emerged, questioning a dominant way of carrying out systemic interventions that rely heavily on "propositional" ways of knowing (expressed in rational conceptual models, mathematical models, and theories). Often systems practitioners are educated not to expend much time on getting attuned with the living situation where the focus of intervention is taking place, and rather jump to propositional ways of describing the living situation they are both involved in and dealing with. In this regard, we present two different art-based approaches to deal with this "jump". Some important educational reflections will be derived from these approaches to re-educate systems thinkers/practitioners able to reclaim a more holistic practice.

Design/methodology/approach – This paper is based on action research and reflective research methods used by the author over the last twenty years. As an educator of systems thinkers, the author has experimented with and observed (in different educational environments) how art can play an important role in developing richer, more holistic thinking and practice. Such endeavours are in tune with new developments in systems thinking, being one of the most relevant, the increasing "collaboration" between systems thinking and art. As we will see, such "collaboration" is giving rise to a fusion we are only beginning to understand.

Findings/Results –A central point of the research has been to realize that most systems practice weakens its very holistic essence by often jumping from the 'encounter' with the primary distinction (originally made in "a given living situation" (the focus of a given reflection/intervention) to making 'propositional' descriptions, thus privileging 'propositional´ over 'experiential', 'presentational', and 'practical' knowing. Paradoxically, in this jump, systems practice undergoes a sort of reduction that greatly impoverishes its most precious purpose: thinking-acting amidst the greatest possible holistic richness in relation to whatever is the case [in each living situation].

To help "correct" the holistic reduction previously mentioned two approaches will be introduced, both based on the idea that art (great art) can illustrate and shed light about making holistic sense. In one of these approaches is glimpsed the emergence of a postmetaphysical holistic thinking-acting, as an Essential Constitutive Recursive Relation Systems Thinking<<<>>>Art.

To illustrate these approaches, two examples, based on two case studies, will be given.

Originality/value –Given the need to correct "holistic reductionism", the present paper is a contribution to such endeavour, both theoretically, as well as educational.

Research/ Practical/ Social/ Environment implications - The research is also a contribution to needed reflections on the subject of (re) educating systems thinkers, considering the emergence of new systems thinking to correct holistic reductionism. As for environment implications, we are in dire need to gain a deeper understanding of our current civilizational crisis. The (re) education of systems thinkers will contribute to a better understanding of the crisis, and to orient actions which could find both, ways out of, and ways into, the crisis. The latter in tune with Dona Haraway's strategy of "staying with the trouble", to be able to acknowledge our interconnectedness and facing ecological challenge. That is to say: It is within the entrails of the crisis that we will find a light to envision more liveable futures. Equivalently to Heidegger's advice about dealing with technology and its great danger: Neither to run away from it, nor to   demonizing it, but to learn "to correspond" with it. Because where the danger is, the saving power also grows.

Research limitations - comments on the methodology and findings limitations.

In this research, a myriad of qualitative methodologies have been applied (such as Action Research Participant Observer, Design Thinking, Reflective research, etc.). However, what has become clearer is that conducting this type of investigation has less to do with applying research methodologies and more to do with letting the situation be heard, and less with interventions and more with conversations. Regarding limitations, one can argue, from a positivist perspective, that this research generates knowledge that cannot be generalised since it only involves two institutions. However, this is not the place to rehearse once more the well-known arguments to defend the type of qualitative research presented in this paper (see The Sage Handbook of Qualitative Research, Denzin and Lincoln (2011), editors).

Keywords: Art,   holistic reductionism, postmetaphysical holistic thinking-acting, experiential knowing.

Cybernetic Education for the 21st Century: The School of Cybernetics at the Australian National University

Matthew Holt, Associate Professor and Deputy Director, School of Cybernetics, College of Engineering, Computing and Cybernetics, The Australian National University, Canberra, ACT 2600, Australia

matthew.holt@anu.edu.au

Abstract

Purpose – I will be presenting on the education programs offered by the Australian National University's School of Cybernetics. The School is an intentionally innovative and experimental non-traditional organisation within the University context. Its mission is to establish cybernetics as an important tool for navigating major societal transformations through capability building, policy development and safe, sustainable, and responsible approaches to new systems. First, I will provide a brief history of the School and an outline of its application of cybernetics. Then, I will focus on how that application is embodied in the design and delivery of both our award and non-award offerings: our Graduate program (Master of Applied Cybernetics), PhD program, and our non-award Learning Experiences. I conclude with a vision of STEM/ STEAM education driven by cybernetics for the 21st century and a call for transnational collaboration.

Design/methodology/approach – The approach will be part documentary (outlining what the School has done in the education space) and part speculative (imagining the program at scale, transnationally).

Findings – I intend to show that the School's experiments in applied cybernetics can be scaled and adopted by others.

Originality/value – The value of the presentation will be shared with the cybernetics and systems community, the design principles, and student outcomes of our original program in cybernetic education.

Research/ Practical/ Social/ Environment implications – the intended impact is to initiate a transnational community of practice in cybernetics and systems education.

Research limitations – I will focus only on the School of Cybernetics at the Australian National University.

Keywords: School of Cybernetics Australian National University, Cybernetics, Systems Thinking, Education

The Effects of Gamified Self-Regulation with Virtual Rewards for Self-Learning Performance

Qiuhui Dai

Guangxi University, No.100,East Daxue Road,Xixiangtang District,Nanning, Guangxi,China

Abstract

Purpose – People suffer from phone addiction pervasively with mobile technology embedded in work, studies, and trifles in daily routines in the era of information technology. In response to this phenomenon, there are mobile apps developed to help people stay away from unnecessary phone use and focus on productivity. Specifically, these mobile apps introduce game elements (e.g., rewards, levels, badges, et al) to promote self-learning enjoyment, which is conducive to self-learning performance. The current study aims to investigate the effectiveness of gamified self-regulation. Specifically, we focus on promoting self-regulation and improving self-learning performance through virtual rewards for limiting smartphone usage.

Design/methodology/approach – We conducted a cross-sectional survey by distributing a questionnaire via multiple channels. All measurements are either adjusted based on extant research or developed following scientific procedures. Then we use SPSS Amos to verify the structural equation model based on the data from the questionnaire.

Findings/Results – First, we find that engagement-contingent reward is detrimental to both enjoyment of the game elements and enjoyment of the self-learning events. In contrast, performance-contingent rewards increase both enjoyment of the game elements and enjoyment of the self-learning events. Second, we found that the effect of gamification is moderated by an individual's perceived self-learning efficacy. In other words, when an individual perceives low self-regulation efficacy, enjoyment of the game elements becomes external regulation to the self-learning events, which ends up with an increase in task-irrelevant activities and a decrease in self-learning performance. On the contrary, enjoyment of the self-regulation system turns into intrinsic motivation for self-learning events when an individual perceives high self-regulation efficacy, which further improves self-learning performance.

Originality/value – Existing research about gamification has contradicting findings regarding the use of gamification. Successful gamification should be able to achieve both instrumental and experiential outcomes. This study opens the Blackbox of gamification effectiveness by differentiating two types of virtual rewards and distinguishing enjoyment of the game elements versus enjoyment of the core events. In this vein, we provide a new instance of how gamification works in the education domain.

Research/ Practical/ Social/ Environment implications – By pointing out that virtual rewards could impose both positive and negative effects on the main event (i.e., self-regulation events in the current study), we clarify that gamification deserves careful consideration. Besides, we found that enjoyment of a gamified system (experiential outcome) could be external to the main self-regulation events and thus decrease self-regulation performance. This is new to Self-Determination Theory research, which claims enjoyment is considered an intrinsic motivation that contributes to long-term self-regulation performance. Moreover, this study has practical implications in a way that it highlights that self-learning App developers should pay attention to individuals' perceived efficacy when introducing virtual rewards.

Research limitations – Although the mixed-method approach greatly improves the scientific rigour of the current study, there are many confounding factors hard to manipulate in the field experiment. This makes it difficult to isolate alternative explanations. Hopefully, our mixed-method approach can resolve this issue.

A Holistic foundation for teaching-learning games

Ramsés Fuenmayor, retired senior Professor from University of Los Andes in Mérida (Venezuela), and Visiting Professor at Universidad de Ibagué, Colombia

Alfonso Reyes. Professor and Vice-Chancellor at Universidad de Ibague, Colombia

Abstract

Purpose – This paper shows a theoretical framework for teaching-learning games, along with examples designed and implemented by the authors in school and university settings.

Every game, like chess and football, operates within a predetermined set of rules. As the game goes on, players incorporate these rules in such a way that they deploy them as needed without a previous and conscious reflection.

Design/methodology/approach – The design and practice of teaching-learning games are founded in an epistemology based on systemic principles, drawing from the Interpretive Systemology and Humberto Maturana's Ontology of Observing. These principles point to a particular understanding of language and of being human. This paper explains these principles and understandings. In addition, some examples of tested games in elementary education designed for Paideia and in a university environment at Universidad de Los Andes in Bogota are provided.

From an observer's perspective, the players play the game according to the rules, but from the point of view of an experienced player, s/he does not have to bring back the rules in order to play. Instead, his/her body just moves on as expected by the other players.

Findings/Results – Generally, players engage in the game in a focused and enthusiastic way. Their moves intertwine with the moves of other players, creating a social practice. In this way, the game comes to social "life". Throughout the regular practice of the game, new implicit rules may emerge. At the same time, some explicit rules may be transformed, and new ones could be created. Teaching-learning games engage teachers and students to deploy ludic activities that have been designed to foster learning for each of them. The institutionalisation of teaching-learning games aims to establish teaching-learning contexts constituted by a network of ever-changing games that are systematically practised.

Teaching-learning contexts both create and are created by a particular microculture that is concerned with problem-solving, the quest for knowledge and the cultivation of the arts. One of the authors created and managed for ten years a pilot school project called "Paideia" that became an instance of a successful teaching-learning context.

Originality/value – The reflective observation of the game's mechanics encourages a deeper understanding of how educational environments can transform through the ludic interaction of teaching and learning. This approach, weaving together theoretical insights with practical examples, positions the text as a creative endeavour in the field of educational discourse, akin

to introducing a new game that invites players to engage with familiar rules in novel and enriching ways.

Past meets future: AI in transformational education - lessons from German children tv

Rita Klapper, IDRAC University, France

Abstract

Purpose – In its quest to create a human-centred approach to AI in education the UNESCO published in 2021 a report on 'Artificial Intelligence and Education: Guidance for Policy-makers', which is aimed at practitioners and professionals in the policy-making and education communities. One of its key missions is to create a shared understanding of the many opportunities and challenges AI can present in education. In line with the UNESCO agenda, this paper proposes principles for AI-supported entrepreneurship education based on the proposition that the Head, Hands and Heart (HHH) framework developed by Sipos et al. (2008) is an appropriate organising framework to create such education. To this end, this research takes the children's TV series Robbi, Tobbi and the Fliewatüüt

(https://www.youtube.com/watch?v=h9laL0ZmiJY&list=PLfHqNgLZPxQqPiO540fh2G_Wn72m3NNA&index=1) and Robbi and Tobbi's adventures as a case of where AI/robotics and humans interact at the interface of transformational learning in entrepreneurship education. The research addresses the following research questions:

a) 	What role for AI/robotics in transformational learning in entrepreneurship education?

b) 	What is the relationship between AI/robotics and transformative learning in entrepreneurship education?

Design/methodology/approach – This research takes the children's TV series Robbi, Tobbi and the Fliewatüüt and their adventures as a case of where AI/robotics and humans interact at the interface of transformational learning in entrepreneurship education. Tobias Findteisen (nicknamed Tobbi) accompanied the robot ROB 344– 66/IIIa (nicknamed Robbi) to help with the latter's exam at the robot school. The team travels in an all-in-one vehicle, Fliewatüüt, designed by Tobbi and built by Robbi, to find answers to three exam riddles all over the world. There are 24 episodes of about 10 minutes duration in   the   series   (see https://www.youtube.com/watch?v=h9laL0ZmiJY&list=PLfHqNgLZPxQqPiO540fh2G_Wn72m3NNA&index=1). Tobbi calls their vehicle, which runs on juice from red raspberries, later substituted by cod liver oil, "Flie-wa-tüüt" because: it can fly (in German: fliegen), it can travel on water (in German Wasser) and it can be used as a car (and as such has a klaxon making the sound "tüüt").

The study employs a multimodal interaction analysis, which is an analytic approach developed in linguistics to address the growing availability of video footage. Its origins are

found in conversation analysis which analyses verbal and nonverbal communication. It comprises not only words and sentences people use to communicate but also additional channels such as intonations, facial expressions, gestures, gazes, body postures, and physical aspects of the environment. We will use Sipos et al.'s (2008) Head, Hands and Heart organising framework to structure the analysis and coding of the various streams of communications; the focus is here on the verbal exchanges.

Findings/Results – We only comment briefly on three themes that emerged from the data analysis:

a) Harmonious human-A/robot collaboration: The collaboration between Tobbi and Robbi provides an intriguing example of a harmonious relationship between humans and robots/AI. The observed harmony and friendship lead us to propose that AI-supported education should focus on creating symbiotic relationships where AI technologies complement, yet not replace the role of educators. Emotional support and identifying unexpected joint resources are e.g. tangible outcomes of such harmony. AI-supported education can seamlessly integrate technology into classrooms, offering interactive learning materials, AI-driven tutoring, and other technological resources to enhance the educational process.

b) No dominance and subservience in the learner/AI transformational learning relationship

The adventures of Robbi, Tobbi and the Fliewatüüt also point out the difficulties of being non-human. For instance, its physical appearance and its stiff joints make it difficult for the robot to climb, the need for oil but not 'fried potatoes and eggs' as food. Climbing the staircase and the associated problems are limitations the robot experiences similar to those experienced by a human. In this sense, both are equal, and there is no dominance and subservience of either.

c) AI/robot-Learner character development

In terms of character development, both Tobbi and Robbi undergo significant growth throughout the story. Tobbi's journey reflects his transition from a curious and adventurous young boy to a more mature and responsible individual. Robbi, on the other hand, evolves beyond his robotic nature, showcasing emotions and a sense of loyalty that surpasses his mechanical origins.

Originality/value – This study, which is still a work in progress, has provided insight into a possible vision for the AI-human relationship in transformational education with a focus on entrepreneurship, innovation and creativity. The vision opposes the notion of dominance by AI-based learning tools. Instead, it suggests a collaborative learning progress of AI and humans as partners in a journey of exploration and adventure. The paper makes practical suggestions for researchers, educators and policy-makers of how the relationship between AI/robotics and humans could look like, and suggests a

response to the strong polarisation of the spectrum from fear to over-enthusiasm dominated approach to AI.

Research/ Practical/ Social/ Environment implications - Research limitations - The case study is grounded in the context of German children's TV where it has impacted millions of young people since its launch in the late 1970s. Hence it has strong cultural connotations, which may be seen as a limitation, and it may be difficult to transfer the findings to other cultural contexts. Clearly, the children's TV series provides a childlike, innocent, all-is-possible view of the role of AI/robotics in transformational learning involving entrepreneurship, innovation and creativity. In this sense, there may be over-optimism in this study. However, the examined case presents a vision of the past that could and should inform visions for the future.

Keywords: AI/robotics and human interaction, transformational education, entrepreneurship and innovation

Formation of a personal digital image while the educational process is based on "hybrid intelligence" technology

Samuil Gorelik, Vladimir Grudinin, Michail Kozlov, Alexander Khopyorsky

Institute integration and professional adaptation, Netanya, Israel

Abstract

Purpose - Education plays a crucial role in people's lives. To achieve professional success or a high level in the social system, every person must strive for self-development and progress in the educational process throughout his life. The result of the training is an intellectual "image", the digitisation of which in the learning process is the focus of this project. Creating technology for the formation of a "personal digital image" in the learning process is the goal of this development. For this purpose, hybrid intelligence (HI) technology and cross-testing methodologies are used in the learning process. The created solution is especially effective in the field of distance learning. The developed innovative service makes it possible to increase the efficiency and attractiveness of education using competitive principles. By shaping students' digital identities and purposefully developing their intellectual abilities, we strive to create a vibrant learning ecosystem in which all stakeholders actively participate and benefit.

Methodology - We use a hybrid intelligence and cross-testing approach to provide regular assessments of students' creative and analytical abilities. To do this, we ask them to create quizzes on the current topic for their teaching peers and to answer quizzes created by peers. Based on the test results, two grades are given: for creative abilities and the ability to answer the questions posed in the test. Personal ratings of students are formed on the basis of a course of lectures or training (thematic course of study) and form a "digital image" of students. During the learning process, a "smart bot" is quietly integrated into the group, which allows you to compare the results of different students and groups and form a special sample for additional training of the standard large linguistic model used for this bot. The developed solution increases the efficiency and attractiveness of the educational process, especially when using distance learning formats. The formed "digital image" of a student is used for the targeted development and assessment of a person's intellectual abilities in the process of moving to the next level of education or choosing a profession.

Findings - The educational process methodology presented in this research has revealed promising possibilities. By monitoring students' knowledge and skills using cross-testing technology, we observed significant improvements in their learning outcomes. The introduction of intelligent bots into the educational system has not only facilitated personalised learning but also promoted healthy competition among students. We hypothesise that this approach results in more engaged and empowered learners, ultimately leading to improved learning outcomes. Additionally, capturing digital images

of students provided valuable information for personalised recommendations, facilitating their continuous improvement and professional development. Through the collaborative efforts of students, teachers and educational institutions, our results suggest a paradigm shift in education towards a more dynamic and inclusive model. At the same time, good compatibility with standard teaching technologies is ensured.

Originality - This research realises innovative approaches to enhancing the educational process through the utilisation of hybrid intelligence and cross-testing methodology. The integration of an intelligent bot into the educational system represents a novel concept that goes beyond traditional methods, offering unique opportunities for the targeted development of students' intellectual abilities and the formation of their digital images.

Research implications - The paper provides significant implications for researchers, educators, educational institutions, and society as a whole. It offers insights into the potential of hybrid intelligence and cross-testing methodology to revolutionise the educational landscape, making learning more engaging, efficient, and personalised. The integration of intelligent bots into the educational system opens up new avenues for collaborative learning and skill development, ultimately benefiting individuals, educational institutions, and society by preparing students for success in the digital age.

Research limitations - One limitation of this research is the need for further empirical validation of the effectiveness of the proposed educational service in diverse educational settings. Additionally, the ethical considerations surrounding the integration of intelligent bots into the educational process warrant careful examination. Further research is needed to address these limitations and refine the implementation of hybrid intelligence in education.

Keywords: Hybrid Intelligence, Artificial Intelligence, Cross-testing, Digital Image, Educational Innovation, Intelligent Bot

Cybernetics and Systems Education: Critical Formative Activities During Its First Quarter-Century (1967-1992)

William J. Reckmeyer, PhD Professor | Cybernetics & Systems

School of Cybernetics, College of Engineering, Computing, & Cybernetics , Australian National University Canberra, ACT 2600 AUSTRALIA
William.Reckmeyer@anu.edu.au
https://cybernetics.anu.edu.au/people/william-reckmeyer/ +1 (408) 515-5771 (C)
Professor Emeritus | Leadership-Cybernetics-Systems, San José State University
Visiting Professor | Systems Studies, University of Hull
Kellogg Global Fellow |W. K. Kellogg Foundation
Distinguished Residential Fellow | Salzburg Global Seminar

Abstract

Purpose – I have two primary goals for this presentation. The first is to help frame our conversation about the past, present, and future of cybernetics and systems education writ large. The second is to illuminate relevant lessons that should help invigorate and inform its development in the 21st Century, especially in higher education around the world, in the hope that humanity can learn how to act more effectively and responsibly to address the evolving challenges of the Anthropocene that we have been and are creating.

Approach – this presentation will be primarily reflective about the past (based on my personal experience with cybernetics and systems programs in higher education during its early days and my knowledge of key sources about them), but it will also be partly speculative (based on my experience as an educator-scholar-practitioner during the past 50 years). The creation and development of cybernetics and other systems sciences during the 1940s-1950s attracted considerable professional and popular attention, which triggered the establishment of several professional societies and a variety of research centres at the time. But there weren't many places then where people could learn more about those new fields in an organized way. That began changing with the launching of the world's first two degree programs, at San José State University (United States) and Stockholm University (Sweden) during the mid-1960s, followed by the launching of more than 100 programs over the subsequent 25 years.

Findings – the presentation examines four critical formative activities from those early years: [1] the history and curricula of the San José and Stockholm programs during the 1960s-1990s; [2] two major studies of educational programs around the world from that era, one that I conducted in 1979 and a more comprehensive report by Blaine Snow in 1990; [3] the approval of an official HEGIS code for systems science (including cybernetics) that James G. Miller, Kjell Samuelson, and I helped secure in 1983; and [4] the organization of several related education-focused sessions at SGSR, ASC, and SDS
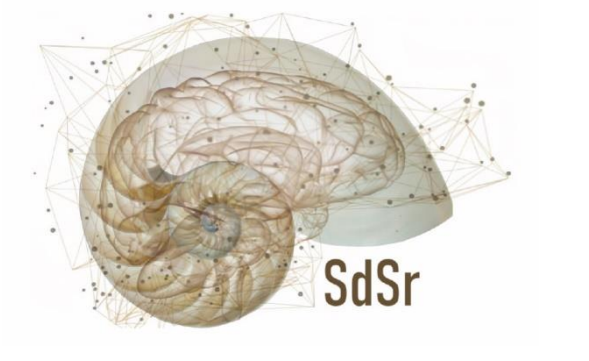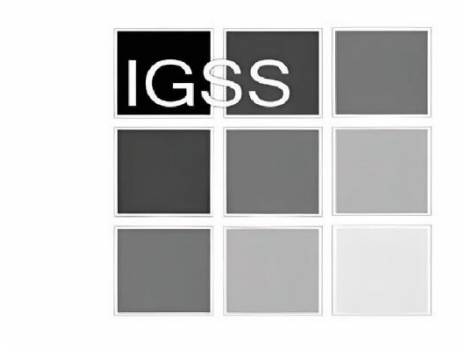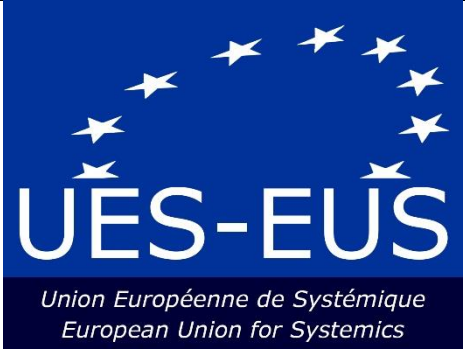
annual meetings from 1979-1985 that culminated in a Global Conference on Systems Science Education that I organized with Kjell Samuelson and Peter Gardiner in 1985.

Implications – the presentation is intended to help revitalize and support a transnational community of practice in cybernetics and systems education, especially in terms of several key recommendations for strengthening and scaling such education moving forward.

Keywords: Cybernetics, Systems, Higher Education, Transdisciplinary, Anthropocene

In collaboration with

Australian National University — School of Cybernetics

UES-EUS
Union Européenne de Systémique
European Union for Systemics

GSUA

IGSS

SdSr

DE MONTFORT UNIVERSITY LEICESTER

NUAA 1952

CYBERNETICS SOCIETY

UK Systems Society

University of St.Gallen
Institute of Management and Strategy

UNIVERSITÀ POLITECNICA DELLE MARCHE

THE FORUM
REDISCOVER RETHINK REIMAGINE

Club of Remy

Complex
Human
Adaptive
Organizations &
Systems

University of Maribor

INTERNATIONAL FEDERATION FOR SYSTEMS RESEARCH

metaphorum

MICENE
Mice Next Evolution