

Collective Intelligence: The Contribution of Cybernetics and Systems Science

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Introduction

Collective intelligence is a phenomenon that must be distinguished from individual intelligence. It refers to the intelligence of social systems such as organizations or societies. The intelligence of individuals is a classical topic of psychology, and more recently, of neurology. In contrast, the intelligence of social aggregates has been the object of sociological research. More recently, systems science has started to address the notion of collective intelligence. This is a relatively new topic that has not been studied much, yet. One example features an analysis of collective intelligence as an emergent phenomenon (Yolles, 2026). Another example is University College London, where Sir Geoff Mulgan has been appointed Professor of Collective Intelligence, Public Policy and Social Innovation.

The purpose of this contribution is to examine the potential of the systems approach—i.e., cybernetics and systems (“CyberSystemics”)—for enhancing the collective intelligence of social systems. The systemic lens we will draw on is primarily that of Organizational Cybernetics. Our units of analysis will be organizations of all kinds.

CyberSystemic concepts

CyberSystemics is a combination of concepts from systemic and cybernetic approaches to science and practice. *Systems Science* and *Systems Practice* are pertinent terms. The Systems Approach is based on Systems Theory—a formal science for the explanation and design of systems of any kind (Von Bertalanffy, 1968; Rasmussen, 2024), and Cybernetics—the science of communication and control of and in complex dynamic systems (Wiener, 1948).

In the following, the term *CyberSystemics* is used to denote this integrative perspective, which combines systemic and cybernetic reasoning to capture both structural interdependencies and the dynamics of communication and control in complex social systems.

For dealing with the topic of collective intelligence meaningfully, a systemic perspective is needed—a thinking in terms of dynamic wholes, interdependencies, and structures. Grounding these concepts cybernetically calls for including communication and control into the analytical scheme (Wiener, 1948). Methodologically, this implies the adoption of a transdisciplinary approach to the study of complex systems.

Intelligent Organizations: An Embodiment of Collective Intelligence

Organisms of any kind need intelligence to survive. Apart from the individual intelligence of living beings, social systems such as organizations and society (can) exhibit traits of collective intelligence.

If there is a key to mastering complexity, it is in the design of intelligent organizations. For that purpose, a precise set of conceptual tools is available, which goes beyond pragmatic recipes and anecdotal insights. Systems Science is the basis for such a distinctive approach.

How should organizations be conceived so as to be capable of behaving in an intelligent and sensitive way?

From a systems point of view, the basic faculties that distinguish intelligent organizations are the capabilities

1. *to adapt to changing situations*, i.e., to change as a function of external stimuli or requirements;
2. *to influence and shape their environment*;
3. if necessary, *to find a new playing field ("milieu") or to reconfigure themselves anew* with their environment, and finally
4. *to make a positive net contribution* to the viability, development, and sustainability of the larger wholes in which they are embedded.

These faculties can be developed purposefully. As social, and especially socio-technical, systems are at stake, the set of capabilities enumerated here goes far beyond the criteria of intelligence as established by diverse disciplines such as psychology or information technology, wherein "business intelligence" has been defined as a set of technical instruments which support decision making. It also transcends those theories of management in which organizational performance is conceived of and measured in terms of criteria such as profit, efficiency or shareholder value only. In turbulent times these short-term indicators are of limited value. A long-term perspective becomes more important: the focus shifts to a broader view with distinct orientators—the viability of the organization, with the pertinent attributes of sustainability and development. It is a matter of definition if these attributes are subsumed under "viability", as they are here. Viability, as we understand it, reaches beyond mere survival.

The concept of viability has been defined "as the ability to maintain a separate existence" (Oxford English Dictionary), i.e., maintenance of identity, and is widely considered the ultimate criterion of organizational performance. Accordingly, the question "how can the viability of the organization be ensured?" is critical to managerial success.

Designing Intelligent Organizations

Literature provides us with a conceptual tool for answering that question: the Viable System Model (VSM), which goes back to Stafford Beer, the father of Organizational Cybernetics. The Viable System Model can be interpreted as a generic organizational architecture for collective intelligence: it specifies the regulatory functions that are essential to enabling intelligent behavior at the level of a system as a whole. The VSM incorporates a very strong theory. Indeed, it claims to specify *not only necessary, but the sufficient preconditions for the viability of organizations* of any kind. In other words, if these preconditions are met, then the respective company, or other organization, is viable (Beer, 1981). This bold assertion has been corroborated over the last years empirically (Schwaninger & Scheef, 2016), and the VSM is

increasingly convincing in meeting the complex systemic challenges facing all kinds of organizations—large, small, public and private.

To outline the model, here is a diagram (Figure 1) with a high-level brief (Beer, *passim*): According to the theory, an organization (or any other social organism) is viable if and only if it has a management system containing the following regulatory components—shortly named “systems” in the graph:

System 1: Local operations, i.e., basic units with their management. Optimizes daily business.

System 2: Coordination. Reduces oscillations.

System 3: Operative, Executive Management. Assures a global performance optimum in a short and mid-range time horizon.

System 3: Auditing.* Complements and validates information flowing over the channels 1-3 and 1-2-3.

System 4: The Intelligence function, also Strategy and Development. Stands for the long-term and external orientation and relationship with the environment.

System 5 (“S5”): System Identity and Ethos / Normative Management. Establishes an equilibrium between present- and future-orientation. Embodies the supreme values, principles and norms, which govern the organization.

This description is only comprehensive, if the relationships between the components of the model are taken into consideration. We can do this *in nuce* here. For example, diagnostic evidence often reveals imbalances between Systems 3 and 4: that is, operational management overwhelms strategic management, so that strategy is at risk. Or vice versa: strategic ideas are valued higher than operational efficiency until financial substance is undermined. In many cases, there is also a discrepancy in the channel from Systems 3 to 1, in that executive management gives instructions that are then not implemented, or it can only deal insufficiently with the messages coming from System 1.

This model is applicable recursively to different organizational levels, e.g., the company as a whole, a division, a business unit, etc. (Figure 2). This recursion features a set of organizations, each of which strives for viability. Each unit is embedded in units of higher recursive order. The components described above as “Systems” 1 to 5 are NOT to be viable. They are regulatory subsystems supporting a system-in-focus, e.g., a company as a whole, or a business, in their quest for viability.

Recursive organization enables a system to cope with huge complexities. The issues emanating from the overall environment and the organization as a whole manifest themselves at each recursive plane as shown in Figure 3 by a generic component of a recursive strategy made up of the organization—basic operative unit and its management / governance—and its environment. An example following the diagram in Figure 2 would embrace a range of organizations from, e.g., business units to a group of companies, individual to world.

The example we are using in Figure 3 is the application of this triad (operation, management, environment) to the case of coping with global warming. The scheme refers to the highest recursion level: Civilization confronting climate change. The Basic Unit (ellipse) in the diagram represents System 1—the operations that fulfil the purpose of the organization, in this case society and nature coping with global warming. The Governance / Management Unit (Rectangle) entails Systems 2 to 5, with operative, strategic and normative management. The Environment embraces diverse interest groups (stakeholders), markets and technologies, competition, etc.

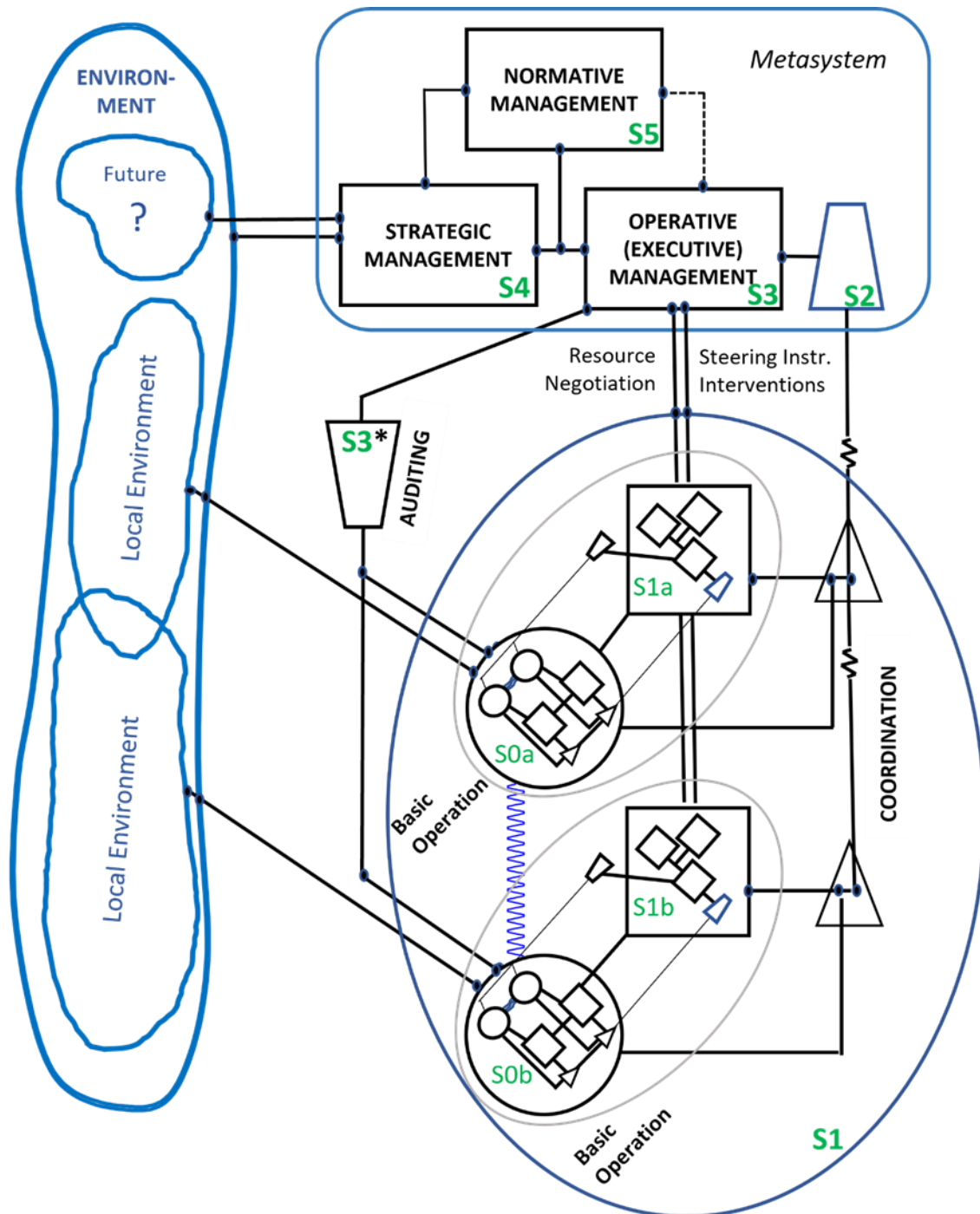


Figure 1. The Viable System Model (after Beer)

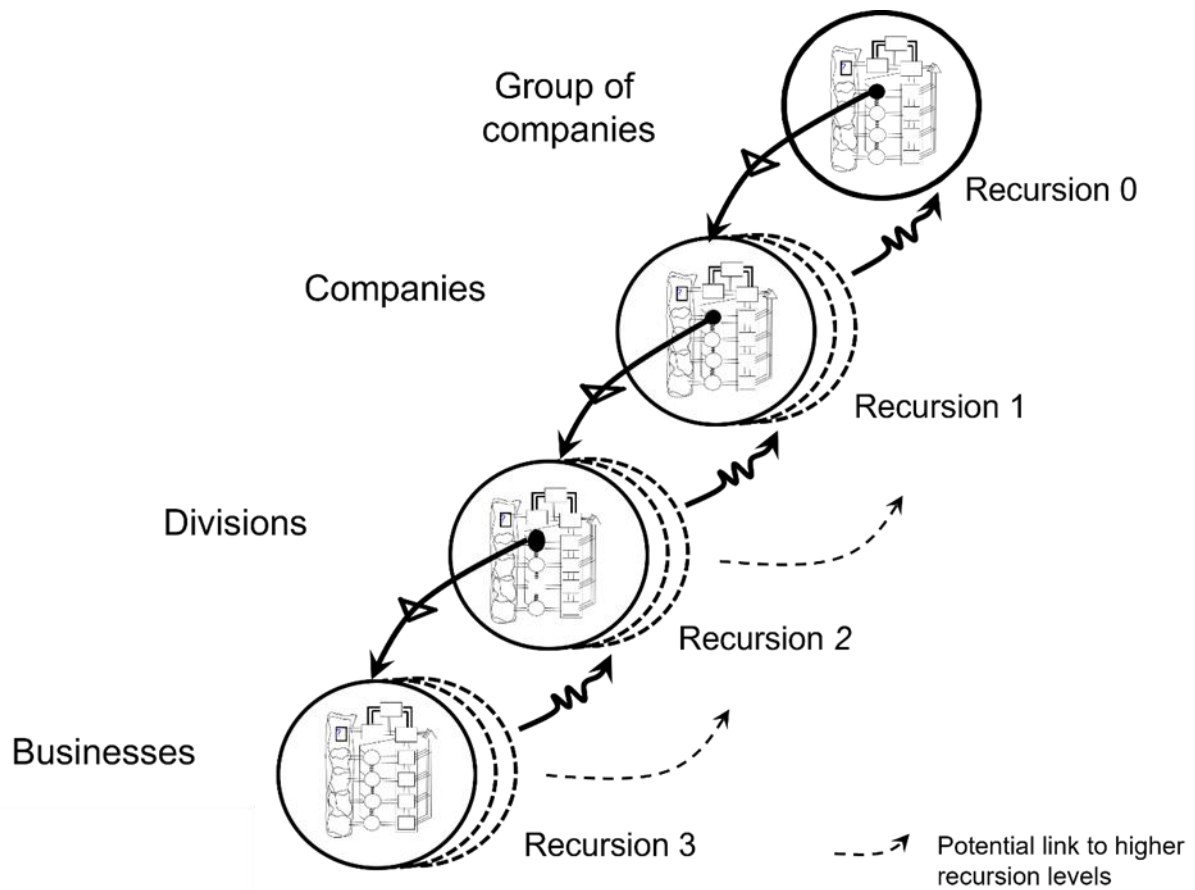


Figure 2. The recursive concept of the Viable System Model

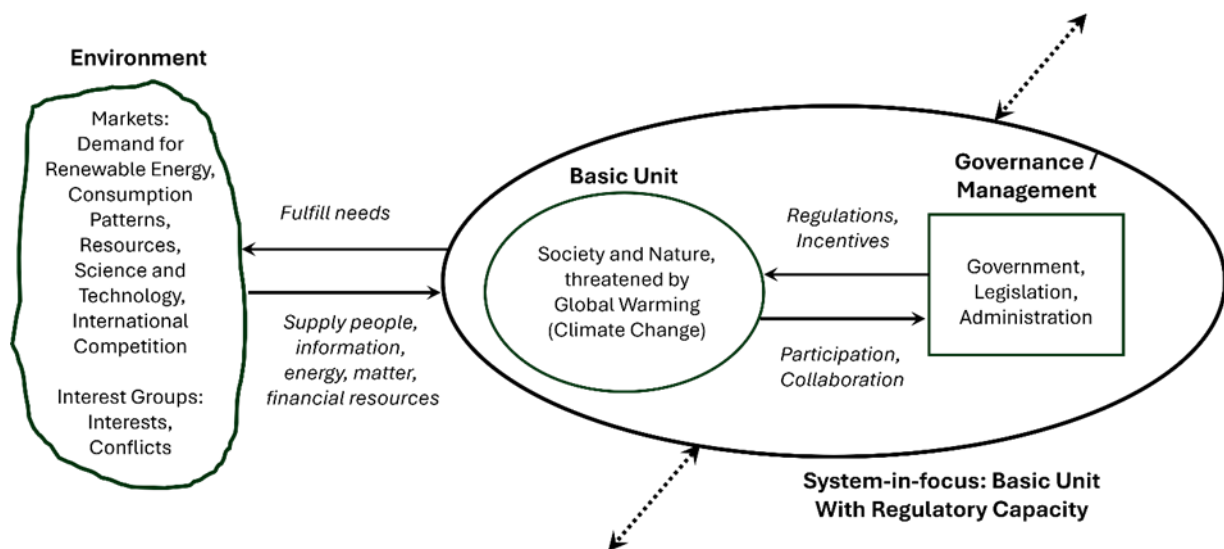


Figure 3. Generic component representing a system at a recursion R_i of a recursive set R

Outlook

The VSM is potentially highly effective for purposes of both diagnosing and designing organizations. The structures outlined here are abstract frameworks, but people are at the center. Autonomy and participation are the salient features of VSM-based organizational designs.

I have elaborated on the VSM and its principles comprehensively in prior work, to make it accessible for readers with diverse backgrounds (e.g., Schwaninger, 2009). The model has been successful with a wide variety of constellations. Practical examples of applications abound, but they would overstretch this article. Several books have been written about the VSM, e.g., Clemson (1984), Espejo & Harnden (1989), Hoverstadt (2008), Espejo & Reyes (2011), Pérez Ríos (2012), Lassl (2019-2020), Pfiffner (2022). A volume that gathers more case studies of pertinent applications than any other recent publication, is Espinosa (2023).

Taken together, CyberSystemics—and in particular the Viable System Model—offers both a conceptual lens and an operational architecture for fostering the emergence and self-organization of collective intelligence in organizations. Other systemic approaches, namely System Dynamics and Complexity Theory, as well as the concepts of Soft Systems and Critical Systems offer complementary perspectives and methodologies (see Jackson, 2019).

Intelligent organizations are designed for viability, including sustainability and development. In this sense, the model presented here provides a theory of the systemic architecture of organizational intelligence grounded in systems theory and cybernetics. The VSM opens up a high potential for progress in organizations. This potential for improvement has only been realized to a small extent and is ready for being tapped.

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Acknowledgements

The author wishes to thank Dr. Sven-Volker Rehm for his competent and valuable editorial support.

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Received March 12, 2026; revised manuscript accepted by Senior Editor Andreas Gröbler on March 24, 2026 (editorial review).

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Collective Intelligence Perspectives

ISSN 3055-7615

ci-perspectives.org

Published by the **Society for Managerial and Social Cybernetics**

Gesellschaft für Wirtschafts- und Sozialkybernetik (GWS)

gws-kybernetik.org