

# BlockScience as a Cybernetic Organization (Cyb-Org)

## *An Internal Viable Systems Model Analysis*

Jeff Emmett\*

Aug 8, 2024

### **Abstract**

*BlockScience's work often entails adapting and applying institutional analysis frameworks to better understand the 'functional architecture' of our clients projects, in order to provide contextually appropriate systems engineering solutions for the environments they create and exist within. In this article we turn the microscope around, using those frameworks to map the functional architecture of BlockScience as a cybernetic organization. By sharing some of the internal sensemaking that we have used to better understand the interdependent flows of our own org, we aim to propagate these modes of organizational awareness to enable experiments with more emergent and adaptive institutional forms.*

## Understanding the BlockScience Organization

BlockScience is an engineering and R&D firm with a focus on the design and analysis of complex systems, as well as the cybernetic steering<sup>1</sup> processes that govern them over time. Our name is derived from how we use Blocks of Science to manage complexity with Systems Engineering<sup>2</sup>, for example in Model-Based Institutional Design<sup>3</sup>.

The organization is functionally structured as a semi-autonomous workers cooperative, with similarities to sociocracy in terms of empowering strategic and tactical autonomy<sup>4</sup> between sub-units. As a remote-first collection of professional engineers and researchers, integrity and autonomy are core values<sup>5</sup> upon which we build trust and engender independent thought, initiative, and innovation among our team members.

BlockScience's sub-units center around the functions that the organization performs, rather than as hierarchical management systems. Individuals can participate in fulfilling multiple functions (or sub-functions) in overlapping roles. Each group is guided by a council of peer members from all stakeholder groups, who meet periodically to discuss challenges, navigate trade-offs, identify opportunities for improvement, and facilitate overall coordination between organizational functions and stakeholder groups.

---

\*BlockScience

<sup>1</sup>Wikipedia. "Cybernetics."

<sup>2</sup>BlockScience. "Managing Complexity with Model-Based Systems Engineering."

<sup>3</sup>Zargham. "Model-Based Institutional Design."

<sup>4</sup>Zargham, et al. "Disambiguating Autonomy."

<sup>5</sup>BlockScience. "The Animating Purpose of BlockScience."

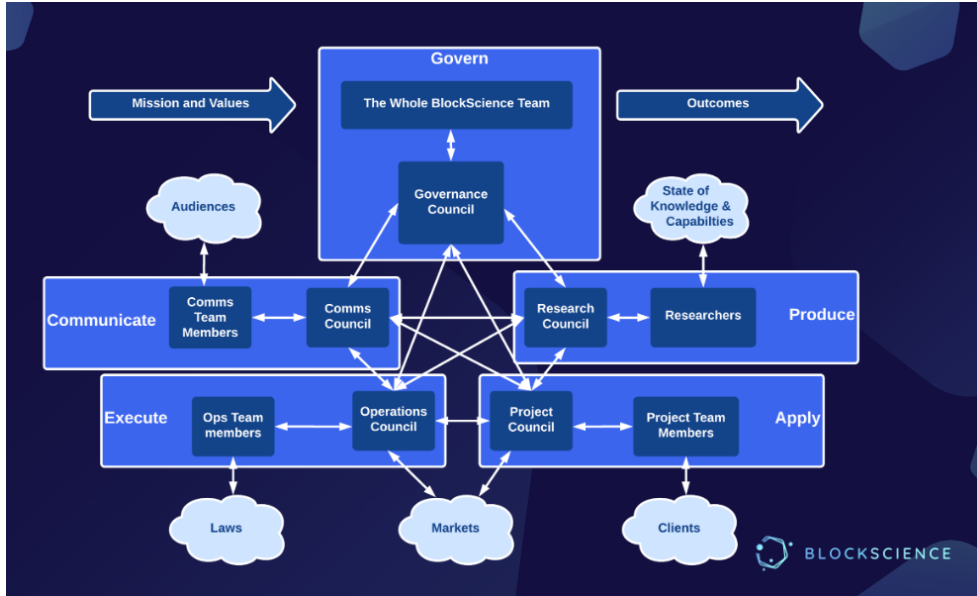


Figure 1: A diagram of BlockScience’s various functions, inputs & outputs, internal & external stakeholders, and their myriad interconnections.

## Mapping Our Functional Architecture

Our institutional analysis toolkit includes applying Stafford Beer’s systems thinking heuristic “the purpose of a system is what it does”<sup>6</sup> (POSIWID) to identify the primary functions that an organization fulfills. Through our mapping process, we discovered that our organizational architecture is currently defined by five multidisciplinary functional groups, which we will explore below.

**BlockScience’s primary functions include the following:**

- **Produce:** Research & development across three interrelated domains: Technology (enabling infrastructure), Economics (market and mechanism design), and Governance (computer-aided in particular).
- **Apply:** Application of R&D in professional services projects with aligned research collaborators, grant programs, and clients.
- **Communicate:** Disseminating information about tooling, experiments, research, and lessons learned from applications to wider audiences.
- **Execute:** Execution of internal and external contracts, policy-making, operational infrastructure production and maintenance, administrative authority.
- **Govern:** Collective organizational steering in accordance with internal and external feedback from all other functions, with a focus on subsidiarity (and supersidiarity<sup>7</sup>) where appropriate.

This depiction of our organizational architecture provides an overall view that emphasizes the “functional” (rather than hierarchical) structure and highlights the horizontal parallels between functions. It also illustrates the frequency of action, with primary functions being fastest, and overall organization governance being the slowest, by

<sup>6</sup>Wikipedia. “The Purpose of a System Is What It Does.”

<sup>7</sup>Schinger. “Coordi-Nations: A New Institutional Structure for Global Cooperation.”

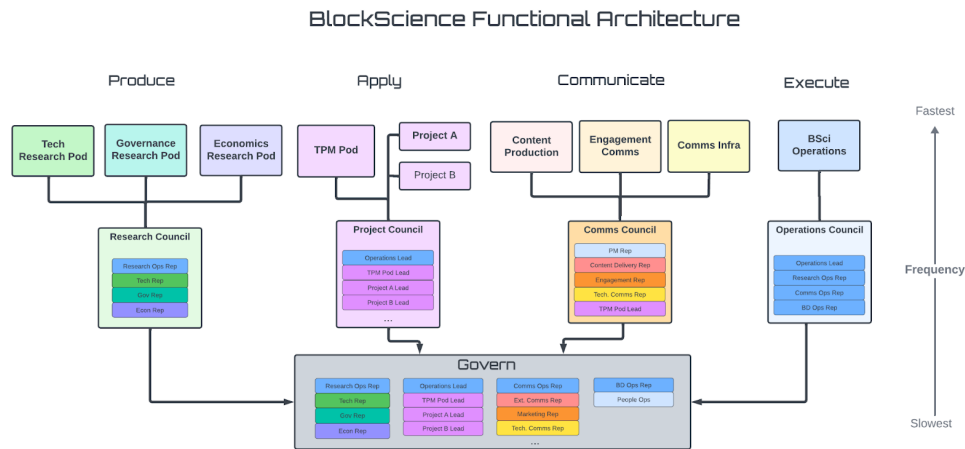


Figure 2: A diagram of BlockScience’s functional architecture, tying together the primary functions of Produce, Apply, Communicate, Execute, and Govern as semi-autonomous functional areas of the organization.

design. Team members can specialize in one function or contribute to several functions, creating value in various capacities according to their skills and interests.

For cross-functional communications and coordination, each group also operates a council consisting of peer members from within the group as well as representatives from the Operations Council or other stakeholder groups to ensure operational and strategic alignment with the overall organizational purpose, goals, and priorities. The Governance Council then consists of members from each of the other four functional groups.

While these diagrams are useful tools for describing the functional architecture of BlockScience, it is important to note they aim to describe, rather than prescribe, patterns of behavior that are already happening. Also, given that no single view can accurately represent all aspects of the organization (as George Box quipped, “All models are wrong, but some are useful”), it can be beneficial to view this diagram in concert with other models we’ve applied to our cybernetic organization, such as Viable Systems Models (VSM).

## Exploring “Organizational Cybernetics” and VSM

The founder of Management Cybernetics, Stafford Beer, introduced the Viable Systems Model<sup>8</sup> to represent the structures and functions necessary and sufficient for the long-term survival of a system in a changing environment. A simplified version of the five systems of Beer’s Viable System Model (VSM) can be seen below.

<sup>8</sup>Wikipedia. “Viable System Model.”

<sup>10</sup>Zargham. “From Viable Organizations to Viable Ecologies.”

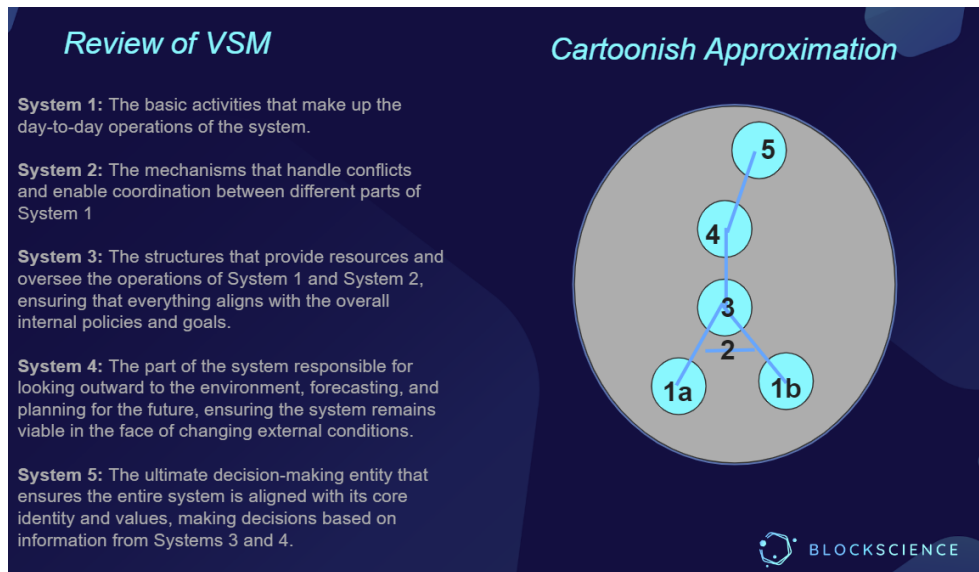


Figure 3: A diagram from Michael Zargham’s presentation on organizational cybernetics<sup>10</sup> to Metaphorum, a community of cyberneticists including colleagues of the late Stafford Beer.

The VSM presents five types of organizational subsystems and the mechanisms of self-regulation applied by and to organizational settings:

- **System 1: Productive Functions**, or day-to-day production-oriented activities conducted by constituent parts of the organization. There may be multiple system 1 functions in an org.
- **System 2: Coordinating Functions**, which align the day-to-day activities of System 1 with each other and the collective purpose.
- **System 3: Rules & Structures** (such as software), which support the activities in System 1 and System 2.
- **System 4: Strategic Functions** that look both outward and inward to consider how internal systems might adapt to external changes.
- **System 5: Governance Functions** to align the overall organization, define or refine the goal(s), and resolve resource conflicts between the other systems.

As Kelsie Nabben states in Applying Stafford Beer’s Viable System Model to Decentralized Organizations<sup>13</sup>: “The ‘*hierarchy of functions*’ that VSM distinguishes is different to a *hierarchy of roles*. Systems 1–5 are functions that anyone can participate in as long as they adhere to the stated processes or protocols for that function. To participate in multiple layers requires people to switch context between strategic and operational processes.”

One of the challenges faced by large organizations is that some issues are too complex for centralized decision-making groups. Management cybernetics<sup>14</sup> recognizes that critical expertise and knowledge is often dispersed in an organization, which can be channeled into organizational intelligence (i.e. efficiency, or “doing the thing right”) or

<sup>12</sup>Wikipedia. “Management Cybernetics.”

<sup>13</sup>Nabben, Zargham. “Applying Stafford Beer’s Viable System Model to Decentralized Organization.”

<sup>14</sup>Wikipedia. “Management Cybernetics.”

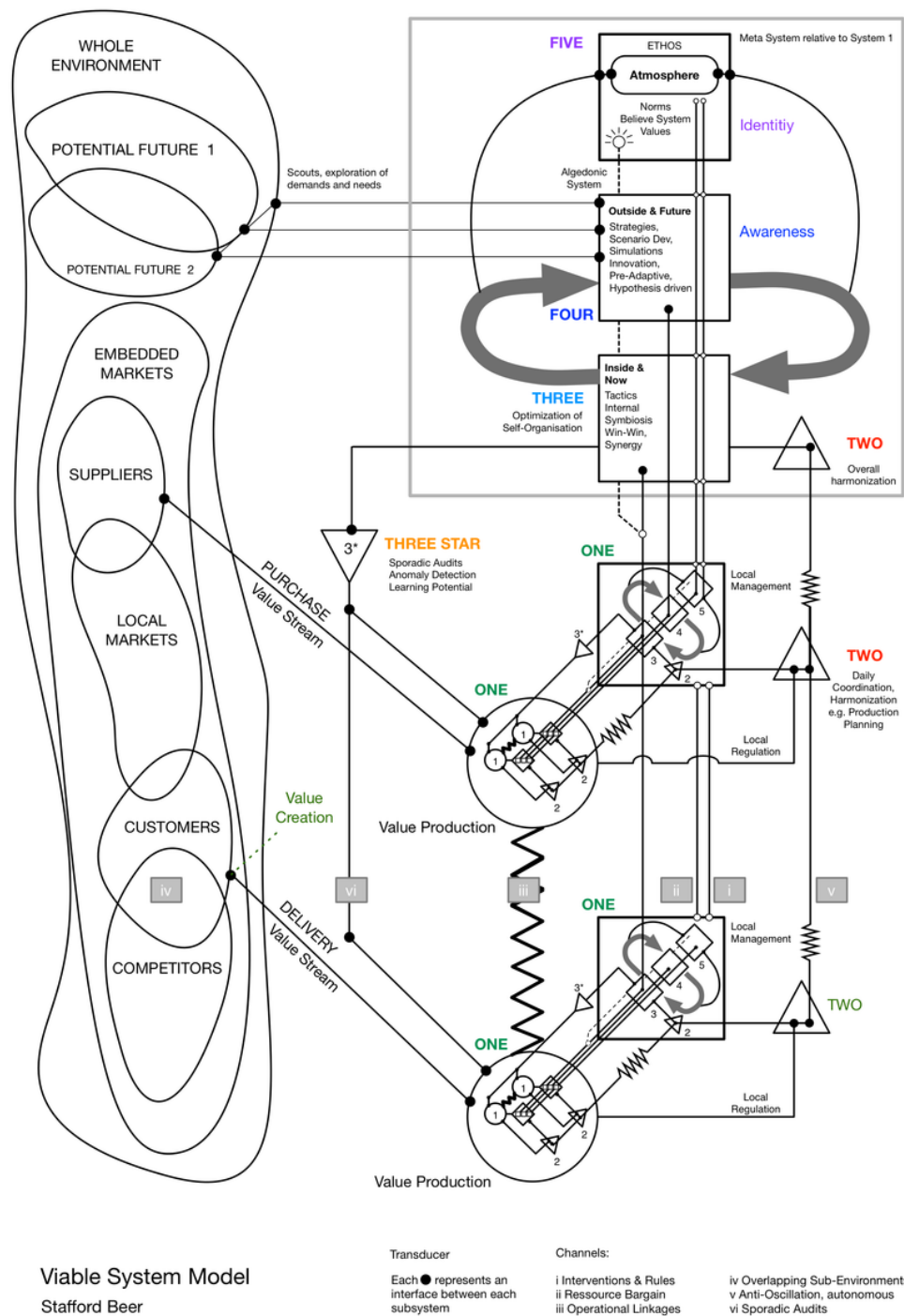


Figure 4: A diagram of Stafford Beer's Viable Systems Model (VSM), demonstrating the various 'systems' of an organization in responding to internal and external feedback loops.<sup>12</sup>

even organizational wisdom (i.e. effectiveness, or “doing the right thing”) by enabling functional autonomy<sup>15</sup> through organizational viable systems modeling.

## BlockScience as a Viable Systems Model

We often apply VSM as a tool to both design and diagnose challenges in organizational management processes for our clients. Mapping our own organization using this lens has already helped us identify functional improvements for incremental progress towards our shared mission.

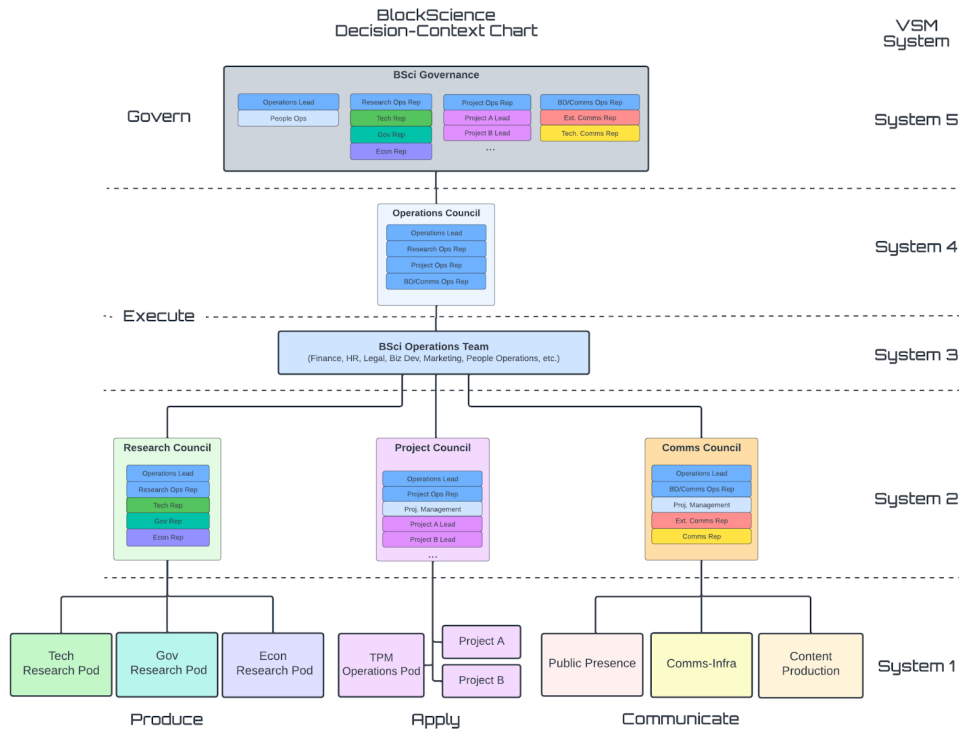


Figure 5: Aligning the BlockScience functional mapping with VSM systems 1-5.

The Viable Systems Model is useful for exploring how the different functions within our organization relate to one another, and how the overall organization can adapt to external changes in order to maintain resilience. As applied to BlockScience, the functions and councils fit into the five VSM subsystems as follows:

- System 1 - Primary Functions: Produce (R&D), Apply (in grant and client projects), and Communicate (to various audiences), carried out by each respective functional team.
- System 2 - Coordinating Functions: Councils exist within and between each primary function (Produce, Apply, Communicate) to coordinate them. Each primary research area (Gov, Econ, and Tech) also has its own coordinating council.

<sup>15</sup>Zargham, et al. “Disambiguating Autonomy.”

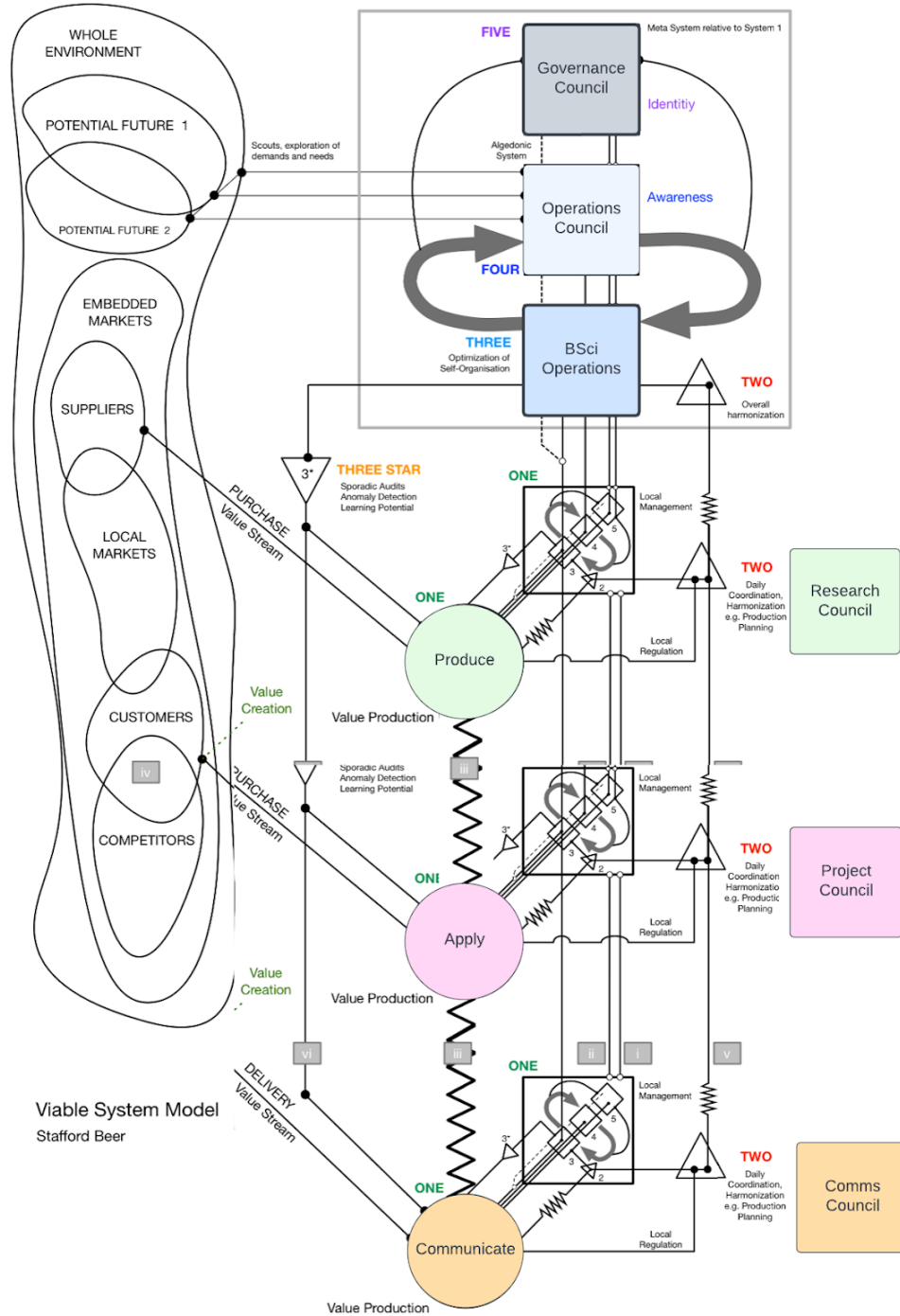


Figure 6: The primary functions of BlockScience mapped onto Beer's VSM model.

- System 3 - Rule Structures & Controls: Infrastructures consisting of people, processes and tools that are administered by the BlockScience Operations team to maintain internal cohesion. Provisioning and permissioning accounts, platforms and tooling provides the necessary “structure” of our digital office and collaboration spaces.
- System 4 - Strategic Functions: The Operations Council provides strategic functions, including external environmental scanning, forward planning, and policy-making, to ensure alignment with the overall company mission and values. The Operations Council consists of Ops team members who participate in each of the four functions (Execute, Produce, Apply, and Communicate). This ensures that each of the functions has representation in this council.
- System 5 - Governance Functions: The Governance Council is tasked with addressing policy or organizational changes, and is responsible for representing the interests of all stakeholders in the organization. This council consists of representatives from each of the other councils, allowing BlockScience to steer collectively as a cooperative organization.

## The Art of Steering in Cybernetic Organizations

The root word of cybernetics<sup>16</sup> is the Greek *kybernetes* which Ross Ashby described as “the art of steering”. As a system of dynamic governance in an organization, cybernetics provisions continuous feedback and control loops that allow for emergent maneuvering and adaptation to changing conditions.

**Our internal explorations around collective governance at BlockScience surfaced the need to focus less on *voting* and more on *steering*.** Ultimately, the function of governance is to enable individuals to engage in the collective steering of an organization - to decide which choices to make when circumstances force trade-off decisions. Real governance often lives where real-world constraints limit our action space and we need to trade off mutually desirable things<sup>17</sup>.

Across the organization, decisions must be made in a timely manner and thus by the actors (individuals or groups) with the appropriate vantage point. Tools and techniques like VSM and functional decomposition provide increased clarity about our interdependent decision-contexts and improve the feedback loops. These feedback loops enable mutual accountability and allow for the continued evolution of our organizations toward these collective steering processes.

---

<sup>16</sup>Wikipedia. “Cybernetics.”

<sup>17</sup>BlockScience. “An Introduction to: ‘Governance as Conflict: Constitution of Shared Values Defining Future Margins of Disagreement.’”



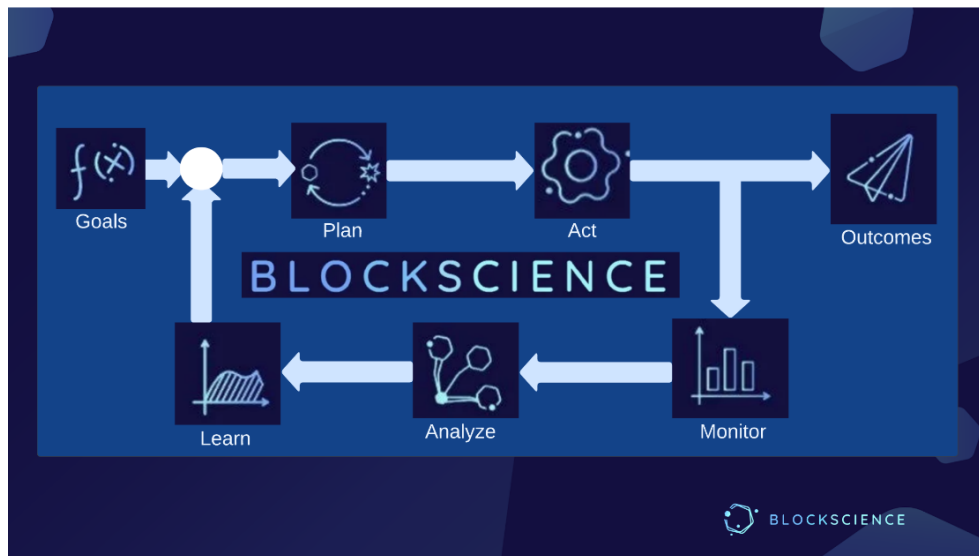


Figure 7: A block diagram of BlockScience’s Mission-Driven Cybernetic Feedback Loop.

## The Evolution of a Cyb-Org

An important factor in all cybernetic systems is their evolution over time. Complex systems evolve with the changing behaviors of their participants - as we need them to! However, we must keep in mind that the relationship between the map and the territory is always changing.

The diagrams above present a snapshot in time of the functional architecture of BlockScience, but these functions and processes are not set in stone. One of the strengths of a viable systems approach is the emergent process of organizational learning that is enabled through feedback loops that enable the iteration and adaptation to changing people, processes, and the internal and external environment that we exist within.

In the six months since producing initial diagrams, BlockScience already identified the need for several new functional groupings, taking action to mobilize a Technical Project Management (TPM) pod to improve process standardization across projects, and a Grant Ops unit to identify sources of more aligned funding for BlockScience’s deeper research areas. This functional mapping process has already proven useful for the emergent growth of our organization.

## Towards Greater Institutional Adaptivity

Fine-tuning our techniques for organizational analysis using VSM and cybernetics is not just a lot of fun (for us, at least!), it’s also an important institutional skill that we all need to develop in order to build towards a thriveable future. In an era of exponential change, industrial-era institutions can struggle to stay relevant in rapid-fire information environments. Cybernetics and systems thinking could give organizations the edge they need in order to remain agile.

As we continue to research, practice, and apply our expertise in model-based institutional design<sup>18</sup>, ethical cybernetic organizational design isn't something we can just talk about at BlockScience - it's a muscle we must continue to train, to take us beyond just "doing the smart thing" all the way to "doing the right thing". For any intrepid organizations out there, we invite you to join in this practice with us, and flex your institutional adaptivity. We hope you've enjoyed this exercise in cybernetic calisthenics!

## Acknowledgements

This article was written by Jeff Emmett, with organizational content and edits produced by Dan Furfari and Michael Zargham, and additional copy and edits contributed by Renee Lee, Jessica Zartler, and Nick Hirannet.

*Suggested citation: Emmett, J., 2024. "BlockScience as a Cybernetic Organization (Cyb-Org)". <https://doi.org/10.5281/zenodo.13882011>*

## References

"An Introduction to: 'Governance as Conflict: Constitution of Shared Values Defining Future Margins of Disagreement.'" BlockScience Blog, 24 Feb. 2023, <https://blog.block.science/an-introduction-to-governance-as-conflict-constitution-of-shared-values-defining-future-margins-of-disagreement/>.

"Cybernetics." Wikipedia, 19 Aug. 2024. Wikipedia, <https://en.wikipedia.org/w/index.php?title=Cybernetics&oldid=1241133279>.

"Management Cybernetics." Wikipedia, 3 Aug. 2024. Wikipedia, [https://en.wikipedia.org/w/index.php?title=Management\\_cybernetics&oldid=1238301508](https://en.wikipedia.org/w/index.php?title=Management_cybernetics&oldid=1238301508).

"Managing Complexity with Model-Based Systems Engineering." BlockScience Blog, 3 Aug. 2023, <https://blog.block.science/block-by-block-managing-complexity-with-model-based-systems-engineering/>.

Nabben, Kelsie, and Michael Zargham. "Applying Stafford Beer's Viable System Model to Decentralized Organization." BlockScience Blog, 19 Apr. 2022, <https://blog.block.science/applying-stafford-beers-viable-system-model-to-decentralized-organization/>.

Schlinger, Jessy Kate. "Coordi-Nations: A New Institutional Structure for Global Cooperation." Medium, 16 June 2023, <https://jessykate.medium.com/coordi-nations-a-new-institutional-structure-for-global-cooperation-3ef38d6e2cfa>.

"The Animating Purpose of BlockScience." BlockScience Blog, 14 June 2023, <https://blog.block.science/the-animating-purpose-of-blockscience/>.

"The Purpose of a System Is What It Does." Wikipedia, 8 Mar. 2024. Wikipedia, [https://en.wikipedia.org/w/index.php?title=The\\_purpose\\_of\\_a\\_system\\_is\\_what\\_it\\_does&oldid=1212469205](https://en.wikipedia.org/w/index.php?title=The_purpose_of_a_system_is_what_it_does&oldid=1212469205).

"Viable System Model." Wikipedia, 14 June 2024. Wikipedia, [https://en.wikipedia.org/w/index.php?title=Viable\\_system\\_model&oldid=1228993892](https://en.wikipedia.org/w/index.php?title=Viable_system_model&oldid=1228993892).

---

<sup>18</sup>Zargham. "Model-Based Institutional Design."

Zargham, Michael, et al. Disambiguating Autonomy. Jan. 2023. Zenodo, <https://doi.org/10.5281/zenodo.8239311>.

Zargham, Michael. From Viable Organizations to Viable Ecologies. Jan. 2024, <https://www.youtube.com/watch?v=AcrQUhhEmQw>.

Zargham, Michael. Model-Based Institutional Design. Apr. 2023. Zenodo, <https://doi.org/10.5281/zenodo.11066460>.