European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com

e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2021.04.02.119

GCPMED 2020
Global Challenges and Prospects of the Modern Economic Development

CYBERNETIC CONTROL MODEL: DOCTRINE, PRACTICE, TECHNOLOGY

A. V. Loshkarev (a)*
*Corresponding author

(a) Samara State University of Economics, Soviet Army Str., 141, Samara, Russia, 2482337@mail.ru

Abstract

The article analyzes the cybernetic control model. The author notes the universality of this model, its determinism absolutely in any system: technical, biological, social. For the latter, the most relevant qualities of the cyber-model are stability and diversity. These opposites do reject each other for each of them is an objective quality of matter. At the same time, sustainability seeks to limit diversity, while diversity, on the contrary, seeks to destroy sustainability. Yet these two phenomena are important for control as any management is a priori aimed at ensuring sustainability and diversity is necessary to prevent the transformation of sustainability into stagnation. The cybernetic model of control is unique because it organically combines diversity and sustainability in governance. The article attempts to highlight the aspects of such a combination, to discover the factors that positively and negatively influence the symbiosis of diversity and stability. A distinct aspect of the research is the study of the phenomena of instrumental properties, aimed directly at the harmony between diversity and sustainability. Therefore, the study is about the implementation of fundamental management principles in the social system. At the same time, it is observed that the driving force behind human participation in management process is the satisfaction of their interests. The latter also has an objective-subjective character. The cybernetic model, projected on managerial relations, considers the essence of the interest and allows to integrate the individual, collective and general demands of people as subjects of managerial relations that take place in the social sphere.

Keywords: Cybernetics, diversity, interest, management, model

https://doi.org/10.15405/epsbs.2021.04.02.119
Corresponding Author: A. V. Loshkarev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Cybernetics is an ancient Greek word (κυβερνητική) that literally refers to the art of management. In this aspect, Plato interpreted cybernetics, designating the term specified in the "Laws" as the art of the helmsman (from kybernáo - steer the steering wheel, steer) - that is, the art of controlling the ship". It should be noted that, despite the objective historical transformations, the word cybernetics has not lost its original meaning and is perceived as the science of control, communication and information processing (Wiener, 1965). Cybernetics as a science aims at the study of various types of systems (Langrod, 1958) Here it seems appropriate to note that an abstract cybernetic system consists of many interrelated components. These components of any cybernetic system are capable of perceiving, remembering and processing information, as well as exchanging it. Examples of cybernetic systems are different types of automatic regulators in technology (for example, an autopilot or a controller that maintains a constant temperature in a room), electronic computers (computers), the human brain, biological populations and human society. In addition, cybernetics research is currently underway as a theoretical basis, for example, in the field of design (Herr, 2019). Therefore, researchers claim that design can serve as an example of how cybernetics can be applied cybernetically, thus, in harmony to its own standards and principles (Sweeting, 2019). In addition, researchers have attempted to philosophically analyze basic principles of cybernetics and present ways to define the essence of cybernetics (Malapi-Nelson, 2017a). Additionally, researchers have not ignored the events in higher mathematics that led to the emergence of cybernetics (Malapi-Nelson, 2017b). Apart from that there is an ongoing study of the ways legal philosophy has approached and conceptualized the emergence of information technology between the 1960s and 1970s. This approach is rather popular and relevant as it seems. For example, Contissa et al. (2021) study the contributions of four thinkers with different philosophical and ideological backgrounds.

Scientists also research a not very new, yet an utterly relevant topic of comparing the human brain and the computer. For example, Chirimuuta (2021) believes that the brain and the computer relationship is an eternal theme in theoretical neuroscience, but relatively little attention has been paid to it in the philosophy of neuroscience, and that much of the popularity of the brain-computer comparison is simply due to the usefulness of it in simplifying the brain. The scientist believes that the relationship between the brain and the computer should be understood as an analogy and considers the consequences of this interpretation for the concepts of multiple realization.

The work of Structures and Complex Systems whereas the authors consider a philosophy embedded in a realistic view of nature, coexisting with scientific perspectives in a dialectical sense, is not of little interest too. Recently, in the field of science and philosophy, systemic approaches have been widely used to define some general, if possible, simplifying principles that underlie them. However, references are often made to structures and systems of various types without carefully defining the basic properties and functions of either one or the other. The relationship between philosophy, complexity and complex systems is discussed, considering that themes do overlap (Brenner & Igamberdiev, 2021).

Systems in cybernetics can be diversified on various grounds. Consequently, due to the nature of the signals which circulate therein, one can distinguish continuous and discrete systems; depending on the level of complexity, they are called complex (large) and simple (of the same type) systems. In this case, the main criterion for delimiting cybernetic systems remains, in our opinion, the sphere of localization:

https://doi.org/10.15405/epsbs.2021.04.02.119
Corresponding Author: A. V. Loshkarev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

technology, biosphere, society. It is in accordance to the sphere that we draw cybernetic systems into technical, biological and social systems. This criterion is extremely universal - after all, technical, biological and social systems can be continuous and discrete; complex and simple. Naturally, recognizing the universality of the sphere as a criterion for the stratification of a cybernetic system, we must not allow a certain reductionism to allow the mechanical identification of systems of a different nature. The dissimilarity of the latter is confirmed by the objects of influence of the system and the predominance of one or another management theory in them (for example, in technical systems, the theory of algorithms and the theory of automatons are prioritized, and in social systems, information theory is the backbone).

At the same time, it is more than legitimate to speak of general categories which make it possible to affirm a unique conceptual character of technical, biological and social systems. A social system is a specific kind of a biological system. The specificity lies in the fact that human individuals, in addition to biological properties, have social qualities determined by the presence of reason. The fundamental concepts of cybernetics are governance, resilience and diversity. In addition, stability is linked to balance and development; variety with multitude; and control with adjustment. In our opinion, the essential qualities of an e-management model should primarily include stability and diversity.

2. Problem Statement

Control is a fundamental concept in cybernetics. From a cybernetics perspective, control is any intentional impact of one relatively independent system on another in order to bring about certain process changes in the controlled system. Management consists of issuing decisions based on information about the state of the controlled process and the knowledge of the management object. Management involves regulation, which is necessary to ensure the sustainability and dynamic development of society. The potential threat to society lies in the invariants that determine outrage. The basis of this outrage lies in an objectively existing diversity. This is what plurality presupposes; in this case, plurality of interests. Interest (from the Latin inter esse “to be inside”) is a complex polysemantic concept, closely related to cybernetic attitudes such as management, stability and diversity, in our opinion. At the same time, interest is unique because it is inherent in social systems.

3. Research Questions

Control is a process of reducing chaos and entropy to the level required to improve the functional qualities of the system. And in this sense, control focuses mainly on the gradual development of the system. The dynamic development of the system presupposes the achievement of sustainability. Achieving sustainability is the main objective of management performed in a particular system. Stability in cybernetics is understood as the achievement and provision of progressive development, which presupposes (paradoxically) either the conservation of the system, its growth or even its destruction. Stability, along with control, is one of the most important categories of the conceptual apparatus of cyber science. More specifically, sustainability is the ultimate goal of the management process. In this regard, stability can be perceived as a component of reliability theory: the more stable a system is, the more reliable it is. Reliability, the antagonist of which is failure, is a synthesis of quantitative and qualitative

https://doi.org/10.15405/epsbs.2021.04.02.119
Corresponding Author: A. V. Loshkarev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

indicators. Resilience is inextricably linked to balance and resentment. In this case, the indignation is directed towards the state of equilibrium. The ability of the system to resist indignation and at the same time to be adequate to the perception of objective changes and to develop dynamically serves as the maximum indicator of the equilibrium of the system, which in turn is the basis of the stability of the system. Resilience, in turn, encounters another fundamental concept of cybernetics: diversity. Diversity in cyber science has traditionally been associated with such quality as “plurality”. Plurality implies the heterogeneity of its constituent elements; it is heterogeneity that allows diversity to be measured logarithmically. Diversity as a concept in cybernetics means that two things are significantly different or one thing changes over time.

4. Purpose of the Study

The aim of the study is to argue that the cybernetic model can integrate control, sustainability and diversity using its fundamental categories. Sustainability is the very existence of the system; the capacity of the latter not only resists the disturbances caused by invariance, but also develops, synthesizes the objectively existing diversity. Control aims to regulate and limit diversity. It is impossible to limit diversity completely because of its objective laws; therefore, all that remains is to regulate diversity. Control is the regulation of diversity necessary for sustainability (i.e. the development of the system). The last thesis is more than relevant for biological and especially social systems. “Ways to use control”, wrote Ashby (2015), are numerous; they cover most types of activities in psychology, sociology, ecology, economics and many types of activities in almost all fields of science and life (p. 303).

5. Research Methods

The main method of scientific knowledge of exceptions is dialectical materialism. This choice is explained first by the inextricable relationship between objective and subjective in the categories of dialectics. Among the laws and principles of dialectics, the most important in the study of the cybernetic model of control is the law of unity and the struggle of opposites, the personification of which is stability and diversity. In addition to this law, dialectical principles such as the principle of symmetry, the principle of unity of the general and the specific, the principle of interdependence and the principle of causality can be used. The interdependence of the abstract and the concrete control processes explains the methods of their cognition such as the ascent from the abstract to the concrete and the ascent from the concrete to the abstract. The systemic-structural approach allows us to conclude that the cybernetic knowledge of an element is based on one principle: each element of the system has its own internal structure, while each of these elements is a structural component of a more complex system. Cybernetics as an interdisciplinary science that determines the emergence of the cybernetic method used in scientific research. Control as a central link in cybernetics is certainly linked to the definition of “regulation”. The presence of this method is determined by the cybernetic law of the essential diversity of life. Diversity, which is an objective property of matter, is integrated with stability by cybernetics. The modelling method makes it possible to create an ideal model for the legal regulation of social relations, the criteria of which are the categories “necessary”, “possible”, “desired”. Cyber black box is a subtype of simulation; in the “black box” the external functioning of the system is modelled, the structure of which is

https://doi.org/10.15405/epsbs.2021.04.02.119
Corresponding Author: A. V. Loshkarev
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

hidden in the “black box” imitating the behavioral characteristics of the system. The system representing the “black box” has an “input” for the information and an “output”, which shows the result obtained with the information entered in the “black box”.

6. Findings

Cybernetics assumes a multi-vector nature of the control process; in cybernetics there are different types of software and automatic control. The so-called optimal control deserves a separate discussion, aimed at ensuring the maximum (or minimum) value of a specific function performed by the system. The ultimate goal of optimal control is to design a stable system or (if the system already exists) to ensure the sustainability and development of an existing system. Cybernetics is the science of control (Berestovaya et al., 2000). The latter applies to all systems without exception: technical, biological, social. A social system is a specific kind of a biological system. The specificity lies in the fact that human individuals, in addition to biological properties, have social qualities determined by the presence of reason. The fundamental concepts of cybernetics are governance, resilience and diversity. In addition, stability is linked to balance and development; variety with multitude; and control with adjustment. Such a correlation scheme is more relevant for biological and especially social systems than for technical systems. It conditions the generalized use of cybernetics in the human sciences in general, in the social sciences in particular and in the legal sciences in particular. A social system (society) is a collective of individuals with common interests and therefore is purely selfish. Researchers point out that all branches of law are constantly under the influence of the social environment (Bortnikov & Denisova, 2021). The emergence of such regulations of human community is more than an objective process. Such standards should be characterized as rules: typed models of behavior. It should be emphasized that we are talking about tools that guarantee the integration of society and its very existence. Compared to the cybernetic model, the rules serve as a means of control. Control involves regulation, which is necessary to ensure the sustainability and dynamic development of society. The potential threat to society is contained in the invariants that lead to outrage.

The basis of this indignation lies in the objectively existing diversity. This is what plurality supposes; in this case, a plurality of interests. Interest (from the Latin inter esse “to be inside”) is a complex polysemantic concept, in our opinion closely correlated with cybernetic attitudes such as control, stability, diversity. At the same time, interest is unique as it is inherent only in social systems. Many interests can be explained precisely by the cybernetic law of the necessary diversity of life. The dilemma is that the maximum limitation of individual (group) interests is unrealistic and sometimes harmful, as these interests often ensure the proper development of the system, thus ensuring its stability. On the other hand, “public interests, even in their ideal version, do not represent a simple unification of the interests of individuals, it is a contradictory and rather unpredictable phenomenon. Cases where the interests of the company are contrary to the interests of the individual are not so rare. It is impossible to live in a society in conditions of unlimited freedom, and any restriction of it already provokes some protest of an individual.

Therefore, we can state the following. Sustainability means bringing people together in a social system. The balance of this system is ensured by the unity of interests. This unity is achieved by limiting individual interests (personal, group). It is impossible to completely limit, let alone eliminate, these

interests. The point is not even that this liquidation determines the stagnation of the system, but that the existence of individual interests is objective, even for the cybernetic concept of diversity. The latter precisely provides a multitude of interests, the center of which is again the social community of human individuals, which inevitably implies the limitation of individual interests. There is still a way out of this methodological impasse. In our opinion, the harmony between diversity and, therefore, multitude of interests, on the one hand, and the stability of the system and its proper development, on the other hand, is introduced by the main category of cybernetics: control.

7. Conclusion

The general cyber categories “control”, “stability”, “diversity” take place in a social system, in absolutely all its kinds. They correlate with objective and subjective components of the social sphere. The essence of such correlation in the social system is that diversity (the interests of society) causes outrage, which directly affects the stability of the system; to level out the negative qualities of diversity and ensure not only the balance, but also the development of the system (society), control is necessary, the essence of which is the presence of subjects and rules of government, which reflect the rules of collective life. At the same time, social norms are strikingly diverse, reflecting a complex conglomeration of diverse interests and diverse topics. In the social field, it is quite difficult to uniquely uniform rules, to precisely determine the integrated interests. For example, the canons of Christianity do not allow a polygamous form of the family; Islam, in turn, accepts the rule of polygamy. The same goes for different ethnic, professional and cultural norms. Therefore, a special place among these norms (means of social control) is occupied by legal norms, all of which constitute law (Tsukanova et al., 2020). At the same time, control (as has already been noted more than once) aims at the objectively present variety of social relations (variety of incidents in life, heterogeneity of participants in regulated relations, variability of the processes that fall under the legal regulations) to in order to achieve what cybernetics calls sustainability (Turanin et al., 2020).

References

Ashby, R. W. (2015). *An introduction to cybernetics.* Martino Fine Books.

Berestovaya, S. N., Kapitonova, Y. V., & Knyazkova, Z. V. (2000). Analysis of publications of the journal Kibernetika during 35 years. *Cybernetics and Systems Analysis, 36,* 1-11.

Bortnikov, S. P., & Denisova, A. V. (2021). The digital economy, cyber security and Russian criminal law. In S. Ashmarina & V. Mantulenko (Eds.), *Current Achievements, Challenges and Digital Chances of Knowledge Based Economy. Lecture Notes in Networks and Systems, 133* (pp. 851-856). Springer.

Brenner, J. E., & Igamberdiev, A. U. (2021). Structures and complex systems. In J. E. Brenner & A. U. Igamberdiev (Eds.), *Philosophy in Reality. Studies in Applied Philosophy, Epistemology and Rational Ethics, 60* (pp. 373-422). Springer.

Chirimuuta, M. (2021). Your brain is like a computer: Function, analogy, simplification. In F. Calzavarini & M. Viola (Eds.), *Neural Mechanisms. Studies in Brain and Mind, 17* (pp. 235-261). Springer.

Contissa, G., Godano, F., & Sartor, G. (2021). Computation, cybernetics and the law at the origins of legal informatics. In S. Chiodo & V. Schiaffonati (Eds.), *Italian Philosophy of Technology. Philosophy of Engineering and Technology, 35* (pp. 91-110). Springer.

Herr, C. M. (2019). Constructing cybernetic thinking, design, and education. In T. Fischer & C. Herr (Eds.), *Design Cybernetics. Design Research Foundations* (pp. 153-170). Springer.

Langrod, G. (1958). La applicazioni della cibernetica alia pubblica amministrazione. https://www.regione.emilia-romagna.it/affari_ist/rivista_5-6_09/733%20simeoli.pdf

Malapi-Nelson, A. (2017a). Cybernetic tenets: Philosophical considerations. In A. Malapi-Nelson (Ed.), *The Nature of the Machine and the Collapse of Cybernetics. Palgrave Studies in the Future of Humanity and its Successors* (pp. 113-138). Palgrave Macmillan.

Malapi-Nelson, A. (2017b). Pre-cybernetic context: An early twentieth-century ontological displacement of the machine. In *The Nature of the Machine and the Collapse of Cybernetics. Palgrave Studies in the Future of Humanity and its Successors* (pp. 81-112). Palgrave Macmillan.

Sweeting, B. (2019). Why design cybernetics. In T. Fischer & C. Herr (Eds.), *Design Cybernetics. Design Research Foundations* (pp. 185-194). Springer.

Tsukanova, E. Y., Turanin, V. Y., Sumenkov, S. Y., Saidov, Z. A., & Levshin, V. V. (2020). The theory of legal facts in various legal systems. *Geplat: Caderno Suplementar, 2.* http://natal.uern.br/periodicos/index.php/RTEP/article/view/1185

Turanin, V. Y., Yarychev, N. U., Senyakin, I. N., Sumenkov, S. Y., & Vasekina, E. M. (2020). Means of legal terms systematization in lawmaking. *Geplat: Caderno Suplementar, 2.* http://natal.uern.br/periodicos/index.php/RTEP/article/view/1177

Wiener, N. (1965). *Cybernetics or control and communication in the animal and the machine*. The MIT Press.