

UDC 005.57:007:338

Borovyk M.*Doctor of Economics, Associate Professor,**O. M. Beketov National University in Urban Economy in Kharkiv, Ukraine;**e-mail: borovik.marina@gmail.com; ORCID ID: 0000-0001-7362-7830***Novikova M.***Doctor of Economics, Professor,**O. M. Beketov National University in Urban Economy in Kharkiv, Ukraine;**e-mail: novikova@kname.edu.ua; ORCID ID: 0000-0002-5939-0926***Kozyrieva O.***Doctor of Economics, Professor,**National University of Pharmacy, Kharkiv, Ukraine;**e-mail: yakakos74@gmail.com; ORCID ID: 0000-0002-2014-4584*

IMPLEMENTATION OF PRINCIPLES OF NETWORK CENTRAL MANAGEMENT IN THE ACTIVITY OF MODERN BUSINESS STRUCTURES

Abstract. The article examines the essence of network-centrism and network-centric management, as well as the features, capabilities, advantages and disadvantages of implementing the principles of network-centric management in the activities of modern business structures. The contribution of A. Sebrowski, J. Garstka, D. Alberts and F. Stein to the formation of the concept of network-centric management is considered. The origin of the concept of «network-centrism» and «network-centric management» is studied. The essence of the network-centric approach is investigated and the specifics of its use in the process of managing complex socio-economic systems are determined. It is proposed to improve the management of modern business structures by implementing the principles of network-centric management in their activities. The main levels at which business structures should be managed in accordance with the network-centric approach to management are identified. On the basis of the analysis of traditional principles of network-centrism, it is proposed to introduce into the management of business structures the principles of: formation of a single distributed information infrastructure, unimpeded information exchange; individual information management; interdependence and coherence of the elements of the management system, mandatory validation of information and intellectual integration of the elements of the management system of the business structure. The main advantages and disadvantages of implementing the principles of network-centric management in the activities of modern business structures are identified. The expediency of implementing the principles of network-centric management in the activities of modern business structures, in order to increase the effectiveness of their activities through effective management of information support based on the construction of an information network that allows interconnection of all elements of the management system using available information is substantiated.

Keywords: management, business structures, network-centrism, network-centric approach, network-centric management, principles of network-centrism

JEL Classification C44, D7, D8, I23, I25

Formulas: 0; fig.: 0; tabl.: 1; bibl.: 11.

Боровик М. В.*доктор економічних наук, доцент,**Харківський національний університет міського господарства**імені О. М. Бекетова, Україна;**e-mail: borovik.marina@gmail.com; ORCID ID: 0000-0001-7362-7830***Новікова М. М.***доктор економічних наук, професор,**Харківський національний університет міського господарства**імені О. М. Бекетова, Україна;**e-mail: novikova@kname.edu.ua; ORCID ID: 0000-0002-5939-0926*

Козирєва О. В.*доктор економічних наук, професор,**Національний фармацевтичний університет, Харків, Україна;**e-mail: yakakos74@gmail.com; ORCID ID: 0000-0002-2014-4584*

УПРОВАДЖЕННЯ ПРИНЦИПІВ МЕРЕЖЕЦЕНТРИЧНОГО УПРАВЛІННЯ В ДІЯЛЬНІСТЬ СУЧАСНИХ БІЗНЕС-СТРУКТУР

Анотація. Проведено дослідження сутності мережецентризму та мережецентристського управління, а також особливостей, можливостей, переваг та недоліків впровадження принципів мережецентричного управління в діяльність сучасних бізнес-структур. Розглянуто внесок А. Себровскі, Дж. Гарстка, Д. Альбертса і Ф. Стейна у формування концепції мережецентричного управління. Досліджено виникнення понять «мережецентризм» і «мережецентричне управління». Досліджено сутність мережецентричного підходу і визначено специфіку його використання у процесі управління складними соціально-економічними системами. Запропоновано удосконалити управління діяльністю сучасних бізнес-структур за допомогою впровадження принципів мережецентричного управління в їхню діяльність. Визначено основні рівні, на яких повинно здійснюватися управління бізнес-структурами згідно з мережецентристським підходом до управління. На основі аналізу традиційних принципів мережецентризму запропоновано впровадити в управління діяльністю бізнес-структур принципи: формування єдиної розподіленої інформаційної інфраструктури, безперешкодного інформаційний обміну; індивідуального управління інформацією; взаємозалежності та погодженості елементів системи управління, обов'язкового підтвердження достовірності інформації і інтелектуальної інтеграції елементів системи управління діяльністю бізнес-структури. Виявлено основні переваги та недоліки впровадження принципів мережецентричного управління в діяльність сучасних бізнес-структур. Обґрунтовано доцільність впровадження принципів мережецентричного управління в діяльність сучасних бізнес-структур, з метою підвищення результативності їхньої діяльності за рахунок ефективного управління інформаційним забезпеченням на основі побудови відповідної інформаційної мережі, яка дозволяє здійснювати взаємозв'язок усіх елементів системи управління, використовуючи наявну інформацію.

Ключові слова: управління, бізнес-структури, мережецентризм, мережецентричний підхід, мережецентристське управління, принципи мережецентризму.

JEL Classification C44, D7, D8, I23, I25

Формул: 0; рис.: 0; табл.: 1; бібл.: 11.

Introduction. Modern trends in society make their adjustments to the activities of modern business structures. All this leads to the need for a radical overhaul of the main aspects of management, which, in turn, stimulates the introduction of newer information and communication technologies in the process of managing the activities of business structures. In recent years, the use of network-centric management principles has become widespread. It is the application of these principles in building a management system for their activities that can contribute to a more efficient use of existing potential and ensure the achievement of sustainable development in modern economic conditions.

Research analysis and problem statement. Research on the management of business structures is devoted to the work of many domestic and foreign scientists. However, despite the significant amount of work devoted to the study of various aspects of management of domestic business structures, the application of new management methods in the rapid development of information and communication technologies still requires in-depth research.

One of the modern approaches to management, which has recently been actively implemented in the activities of many foreign companies is the network-centric approach. This approach is based on the concept of network-centric management, which is based on the works of

A. Sebrowski, J. Garstka, D. Alberts and F. Stein [1, 2], who first began to use the concept of «network-centrism» and used it to build complex control systems. military action. Further application of the network-centric approach in management was considered in the works of such researchers as: A. A. Ambartsumyan [3], V. I. Annenkov [4], A. Y. Efremov [5], Y. S. Zatuliviter [6], V. V. Karpov [4], D. Y. Maximov [5], A. V. Moiseev [4], I. V. Surma [4] and other scientists. However, despite the fact that the network-centric approach is increasingly used in the management of complex socio-economic systems, the activities of which are associated with obtaining and processing large amounts of information, the principles of network-centric management have not been adequately covered in research domestic business structures. That is why it is proposed to consider the possibilities and prospects of using the principles of network-centric management in the activities of domestic business structures.

The purpose of the article is to study the essence of network-centrism and network-centric management, as well as to identify features, opportunities, advantages and disadvantages of implementing network-centric management principles in modern business structures, which will increase their management and achieve sustainable development.

Results of the research. The analysis of scientific works in various fields of knowledge demonstrates that in recent years, research has been actively conducted to improve the efficiency of management systems. One of the directions of such increase is the transition from traditional control systems, based on the scheme «object of management — the governing entity», to a new concept of building control systems, so-called «network-centric concept», which is a set of principles of construction and operation network-centric control systems. Increasing the attention of scientists to this concept indicates the relevance of this area of research and justifies the feasibility of implementing the principles of network-centric management in the activities of domestic business structures. The application of the principles of network-centric management can contribute to a more rational use of the existing potential of business structures through the effective use of information and communication support, which in turn will contribute to achieving their sustainable development.

First of all, it is necessary to define the essence of the concept of «network centrism». The use of this term is mainly associated with the use of networked computer technology, but understandings of its meaning differ significantly.

As already mentioned, the concept of network-centric management was born in the military environment on the basis of analysis and assessment of modern capabilities of military operations. This concept is based on the works of A. Sebrowski, J. Garstka, D. Alberts and F. Stein [1; 2], who first began to use the concept of «network-centrism» and used it in the construction of complex control systems in the conduct of hostilities. Further application of the network-centric approach in management has been considered in the works of many other researchers. However, despite the fact that the network-centric approach is increasingly used in the management of complex socio-economic systems, the activities of which involve obtaining and processing significant amounts of information, the principles of network-centric management have not yet been applied in the study of domestic activities. business structures.

The term «Network-Centric» was first used by U.S. Navy Vice Admiral A. Sebrowski and U. S. Department of Defense expert J. Garstka in their article «Network-Centric» (1998) war: its origin and future [1]. The concept of network-centric war presented in this article was refined and presented in the book by J. Garst, D. Alberts and F. Stein «Network-centric warfare: development and use of information advantage» [2]. In conceptual and theoretical terms, A. Sebrowski and J. Garstka presented the model of network-centric warfare as a system consisting of three lattice subsystems: information, sensory and combat. The basis of this system is the information grid, which is superimposed on the intersecting sensor and combat grilles. The information grid-subsystem permeates the entire system in full.

Thus, it can be noted that network-centric war is characterized by fighting in a single information and communication space. The success of these actions, above all, depends on the unification of all participants in hostilities within this space, as well as all the impressive, logistical,

informational, diplomatic, social and other means in a network-centric system that includes all levels and areas of management. Currently, the term «network-centric» is widely used in the activities of the US Department of Defense and defines the characteristics of a reliable, globally interconnected network environment (including infrastructure, systems, processes and people) in which data for sharing is provided to users in a timely manner and in full [5]. Thus, it can be noted that the concept of network-centric war characterizes not a new type of military actions, but a new approach to their organization and conduct, where the focus is on the information and communication network. It should be noted that the most important aspect of the application of network-centric warfare is the principles of its organization and, in many respects, self-organization.

The further spread of network-centrism is associated with the use of network-centric approach in the management of complex systems, which involves significant delegation of authority to the lower elements of the management hierarchy, giving them the whole information picture, freedom to make their own decisions to achieve common goals. At present, the term «network-centric management» is mainly used by the military and specialists who deal with management problems in large (primarily technical and socio-technical) systems, consisting of many autonomous centers (facilities) combined into a common network. Among economists there is no generally accepted and unambiguous interpretation of the terms «network-centrism» and «network-centric management».

Thus, it can be noted that network-centrism is a principle of organization of management systems, which allows to implement the mode of understanding the situation (Situational Awareness), and get all the necessary information for making and implementing management decisions, by forming and maintaining a single, holistic, contextual information and communication network, as well as the inclusion in the process of continuous receipt and updating of information as many sources of primary information [5]. It should also be noted that network-centrism is based primarily on the formation of network-centric environment, i.e. a certain information and communication space, which includes human and technical resources, as well as technologies that ensure their effective interaction, which works in the interests of performers in a form they understand. This environment provides the properties of information security (confidentiality, integrity, accessibility) in the face of destabilizing influences of various natures.

Currently, the application of a network-centric approach in the management of complex systems is becoming increasingly important with the growing use of information technology in all areas of economic activity. This did not go unnoticed by the activities of modern business structures, which are complex socio-economic systems. We can say that the organization of modern business structures based on a network-centric approach is a management model based on the use of the latest methods of work, which are reflected in the information infrastructure, processes, personnel and culture in the business structure. In this case, the development, deployment and use of information infrastructure of the business structure should be carried out according to the following rules:

- rapid adaptation to changing requirements, priorities and impacts in the transfer of information within the information infrastructure;
- combination and coordination of collective and individual users in the global information and communication network of the business structure, removal of barriers created under the influence of various factors, the physical location of all technical components of the network.

In addition to the availability of information infrastructure, one of the main features of network-centrism is that the management system must have a multilayered structure. Minimum configuration — the presence of at least three layers, which are directly controlled. In the classical network-centric system, the first layer consists of decision-makers and specialize in specific areas and issues. They prepare information and form intermediate decisions for the second layer — responsible for tactical decisions. The third layer on the basis of these directives forms the operational management which arrives on executive bodies. This configuration allows you to make an integrated self-consistent solution that has a high synergistic potential due to its proximity to the

optimum. Thus, control can be network-centric only if it contains all three of these components. For business structures, the following levels at which management should be carried out are:

- strategic level — the level of management/administration of the business structure;
- tactical level — the level of the structural unit of the business structure;
- operational level — the level of the employee of the business structure.

In network-centric management, employees of business structures can create and use information to increase their competitive advantages through effective cooperation. To apply this type of management, business structures must move from a hierarchical management structure, when the decision is made by one person (manager), to an adaptive hybrid form, which consists of several levels of management.

Thus, the management of modern business structures is proposed to be based on the use of network-centrism and its traditional principles. The basic document in which these principles were first formulated is the document of the US Department of Defense NCE JFC (Centric Environment Joint Functional Concept), published in 2005 [8]. Other interrelated regulations on the construction of the concept of network-centric management were also developed and implemented, namely: The concept of operational integrated integration based on the network-centric environment — NCOE JFC (Net-Centric Operational Environment Joint Integrating Concept) [9]; Strategy for building network-centric associations of forces and means in the interests of the US Department of Defense (Department of Defense Net-Centric Services Strategy for a Net-Centric, Service Oriented DoD Enterprise) [10]; Strategy of the transition of organizations of the US Department of Defense to network-centric architecture (Department of Defense Enterprise Architecture Transition Strategy) [11]. Based on the analysis of these documents, the basic principles of network-centric management are determined, which should be implemented in the activities of modern business structures, namely:

1) formation of a single distributed information infrastructure of the business structure, namely the construction of an extensive, multi-level information and communication network, which provides access to available information on the functioning of the business structure;

2) unimpeded information exchange between elements and users of the information and communication network of the business structure;

3) individual information management by each user of the information and communication network of the business structure, which provides that the requirements for information may be set by the information wrappers themselves, in accordance with their requests;

4) the interdependence of the elements of the management system of the business structure, which characterizes the form of action in which various users of the information and communication network of the business structure contribute to the achievement of objectives;

5) consistency of the elements of the management system of the business structure, which provides that the networks receive only agreed information, which avoids the receipt of unnecessary information;

6) mandatory confirmation of information on the activities of the business structure, characterizes that all information received by the information and communication network of the business structure is reliable;

7) intelligent integration of elements of the management system of the business structure, provides that removing barriers to information flows and connecting all elements, resources and tools network-centric environment gives them the opportunity to take advantage of the specialization of each element of the system in performing the target to achieve the set goals.

Among the above principles, the most important is the principle of unimpeded information exchange between the elements and users of the information and communication network of the business structure, which characterizes the openness of the system to the exchange of information for all its elements. Information generated, processed and used in the information and communication network must be accessible, understandable, verifiable, relevant and authentic to all users. It is this fundamental principle that underlies the other, network-centric principles of management mentioned above.

The implementation of the principles of network-centric management in the activities of modern business structures should be aimed at combining interconnected forces and resources, namely employees of business structures and technical means. Their organization and effective functioning is aimed at achieving a certain goal, and is characterized by the following features:

- the presence of a single strategic goal of business structures in the absence of clear planning at the tactical level;
- lack of a clear hierarchical structure of subordination of employees of business structures, and in some cases lack of central management;
- decentralization and parallel work of employees of business structures;
- achieving the set goals through a well-established exchange of information and the ability to quickly reorganize the business structure if necessary;
- multilevel structure of the organization with an extensive and complex system of relations between structural units and individual employees of business structures;
- coordination of the activities of individual forces and means using the resources of global information and communication networks.

The above features are typical for the organization of business structures based on a network-centric approach, because its effectiveness directly depends on the speed and quality of information exchange, these characteristics must be much higher than in traditional hierarchical management structures.

The introduction of the principles of network-centrism in the activities of modern business structures helps to increase the efficiency of their management, but is also associated with the emergence of certain problems. Among the main advantages of implementing the principles of network-centric management in the activities of modern business structures the following should be noted:

- reduction of time for approval of management decisions;
- improving the quality of management decisions through coordination between levels of government;
- flexibility in planning the activities of the business structure, the ability to make changes;
- transition to modern management methods based on the rational use of information resources;
- improving the quality of business structure management;
- obtaining reliable and up-to-date data through the introduction of a system of information and communication support of the business structure;
- preservation of accumulated experience in electronic form in the information network and its operational use in the implementation of management;
- establishing effective communication links between different elements of the system;
- increase the efficiency of the business structure by reducing the cost of development and decision-making.

Among the problems that may arise in the management of business structures based on the principles of network-centrism there are:

- high material and financial costs associated with the construction and configuration of information and communication network;
- the need to establish a process of effective communication of users of the information and communication network of business structures with the necessary databases;
- obtaining the necessary information from external and internal sources;
- use of modern tools for processing and analyzing information.

Despite the problems that may arise in managing business structures based on the implementation of the principles of network-centrism, the main advantage is that this type of business management reduces the overall error of making the wrong management decision, which leads to stability and ability to cope with crisis processes and phenomena, and thus contributes to sustainable development.

Conclusions. The study of the essence of network-centrism and network-centric management, as well as identifying features, capabilities, advantages and disadvantages of implementing network-centric management principles allows us to conclude that these principles should be applied to modern business structures to improve their management through a more flexible decentralized management approach, which provides for the delegation of a significant number of decision-making powers to lower levels in the management hierarchy. Thus, the introduction of the principles of network-centric management in the activities of modern business structures will increase the effectiveness of their activities through effective management of information and communication support based on the construction of an appropriate information network. Further research on the implementation of network-centric management principles in the activities of modern business structures requires the development of management decision-making mechanisms and the development of recommendations to reduce the likelihood of ineffective management decisions through effective use of available information.

Література

1. Cebrowski K., Garstka J. Network Centric Warfare: Its Origins and Future. *Proceedings Magazine*. 1998. Vol. 124. Is. 1. P. 28—35.
2. Alberts D. S., Garstka J. J., Stein F. P. Network Centric Warfare: Developing and Leveraging Information Superiority. *CCRP Publ.* 2nd Edition (Revised). 1999. August. P. 284.
3. Амбарцумян А. А. Сетевое управление на сетях Петри в структурированной дискретно-событийной системе. *Управление большими системами. Спецвып. 30.1 «Сетевые модели в управлении»*. Москва : ИПУ РАН, 2010. С. 506—535.
4. Surma I. V., Annenkov V. I., Karpov V. V., Moiseev A. V. The «network-centric management»: the modern paradigm of development of management systems in the military forces of the leading global powers. *National Security / nota bene*. 2014. № 2. P. 317—327.
5. Ефремов А. Ю., Максимов Д. Ю. Сетевое управление — что вкладывается в это понятие? *Технические и программные средства систем управления, контроля и измерения : труды 3-й Всероссийской конференции с международным участием*. Москва : ИПУ РАН, 2012. С. 158—161.
6. Затливетер Ю. С. Компьютерный базис сетецентрического управления. *Технические и программные средства систем управления, контроля и измерения (теория, методы, алгоритмы, исследования и разработки) : сборник трудов Второй российской конференции с международным участием*. Москва : ИПУ РАН, 2010. С. 492—511.
7. Тихонов А. Н., Иванников А. Д., Соловьёв И. В., Цветков В. Я., Кудж С. А. Концепция сетецентрического управления сложной организационно-технической системой. Москва : МаксПресс, 2010. 136 с.
8. Net-Centric Environment Joint Functional Concept. 2005. URL : https://dodcio.defense.gov/Portals/0/Documents/netcentric_jic.pdf (date of access: 11.02.2021).
9. Net-Centric Operational Environment Joint Integrating Concept (NCOE). Washington, 2005. October 31. URL : https://dodcio.defense.gov/Portals/0/Documents/netcentric_jic.pdf (date of access: 11.02.2021).
10. Grimes J. G. Department of Defense Net-Centric Services Strategy for a Net-Centric, Service Oriented DoD Enterprise. 2007. URL : https://dodcio.defense.gov/Portals/0/documents/DoD_NetCentricServicesStrategy.pdf (date of access: 11.02.2021).
11. Department of Defense Enterprise Architecture Transition Strategy. 2008. February 29. URL : http://extras.sltrib.com/Utah_Data_Center/EATransitionStrategy.pdf (date of access: 11.02.2021).

Статтю рекомендовано до друку 24.03.2021

© Боровик М. В., Новікова М. М., Козирева О. В.

References

1. Cebrowski, K., & Garstka, J. (1998). Network Centric Warfare: Its Origins and Future. *Proceedings Magazine*, Vol. 124, 1, 28—35.
2. Alberts, D. S., Garstka, J. J., & Stein, F. P. (1999). Network Centric Warfare: Developing and Leveraging Information Superiority. *CCRP Publ.* 2nd Edition (Revised). P. 284.
3. Ambarcumyan, A. A. (2010). Setecentricheskoe upravlenie na setyah Petri v strukturirovannoj diskretno-sobytijnoj sisteme [Network-centric control on Petri nets in a structured discrete-event system]. *Upravlenie bol'shimi sistemami. Specvyp. 30.1 «Setevye modeli v upravlenii» — Management of large systems. Special issue. 30.1 «Network models in management»*. Moscow: IPU RAN, 506—535 [in Russian].
4. Surma, I. V., Annenkov, V. I., Karpov, V. V., & Moiseev, A. V. (2014). The «network-centric management»: the modern paradigm of development of management systems in the military forces of the leading global powers. *National Security / nota bene*, 2, 317—327.
5. Efremov, A. Ju., & Maksimov, D. Ju. (2012). Setecentricheskaya sistema upravleniya — chto vkladyvaetsya v eto ponyatie? [Network-centric control system — what is embedded in this concept?]. *Tekhnicheskie i programnye sredstva sistem upravleniya, kontrolya i izmereniya: trudy 3-j Vserossijskoj konferencii s mezhdunarodnym uchastiem — Hardware and software for control, monitoring and measurement systems: Proceedings of the 3rd All-Russian Conference with international participation*. Moscow: IPU RAN [in Russian].
6. Zatliveter, Yu. S. (2010). Komp'yuternyj bazis setecentricheskogo upravleniya [Computer basis for network-centric control] *Tekhnicheskie i programnye sredstva sistem upravleniya, kontrolya i izmereniya (teoriya, metody, algoritmy, issledovaniya i razrabotki): sbornik trudov Vtoroj rossijskoj konferencii s mezhdunarodnym uchastiem — Hardware and software for control, monitoring and measurement systems (theory, methods, algorithms, research and development): Proceedings of the Second Russian Conference with International Participation*. Moscow: IPU RAN [in Russian].

7. Tihonov, A. N., Ivannikov, A. D., Solov'yov, I. V., Cvetkov, V. Ya., & Kudzh, S. A. (2010). *Koncepciya setecentricheskogo upravleniya slozhnoj organizacionno-tekhnicheskoy sistemoy* [The concept of network-centric management of a complex organizational and technical system]. Moscow: MaksPress [in Russian].
8. Net-Centric Environment Joint Functional Concept. (2005). Retrieved February 11, 2021, from https://dodcio.defense.gov/Portals/0/Documents/netcentric_jic.pdf.
9. Net-Centric Operational Environment Joint Integrating Concept (NCOE). (2005, October 31). Washington. Retrieved February 11, 2021, from https://dodcio.defense.gov/Portals/0/Documents/netcentric_jic.pdf
10. Grimes, J. G. (2007). Department of Defense Net-Centric Services Strategy for a Net-Centric, Service Oriented DoD Enterprise. Retrieved February 11, 2021, from https://dodcio.defense.gov/Portals/0/documents/DoD_NetCentricServicesStrategy.pdf.
11. Department of Defense Enterprise Architecture Transition Strategy. (2008, February 29). Retrieved February 11, 2021, from http://extras.sltrib.com/Utah_Data_Center/EATransitionStrategy.pdf.

The article is recommended for printing 24.03.2021

© Borovyk M., Novikova M., Kozyrieva O.