The European Proceedings of
Social and Behavioural Sciences
EpSBS

www.europeanproceedings.com

e-ISSN: 2357-1330

DOI: 10.15405/epsbs.2020.10.03.138

ICEST 2020

International Conference on Economic and Social Trends for Sustainability of Modern Society

KNOWLEDGE MANAGEMENT MODELS AND ORGANIZATIONAL DESIGN OF DIGITAL ECONOMY

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Abstract

The tremendous rate of change in all production factors conditions the new role of knowledge at the macro- and microeconomic levels. This, in turn, results in the need to generalize, update and adapt the knowledge management models to the new conditions and necessary competencies. Since the basic models are focused at standard organizational structures that fail to give due consideration of the present-day realities, the authors have noted that the factor of robustness should be taken into account, when developing knowledge management models. The essay presents basic provisions underlying the robust strategies concept. The problem of impact of embodied knowledge on technology, resulting in disappearance of a number of existing professions and competencies and appearance of previously non-existent trades, has been raised. The article notes that end-to-end technologies can be viewed as an infrastructural subsystem and as an accelerator of new NTI Nets markets and competencies. The knowledge increment implementation takes place within a specific organizational design. The cyber configuration interaction process that takes into account the basic technology packages of the three waves of digital economy development is adopted as a basic element of organizational design. The multidimensional model of cyber configuration interaction will ensure integrity and adaptability of the system as well as improvement of technologies in terms of networking and digital footprint.

Keywords: Knowledge management models, robustness, organizational design, cyber configuration interaction model.

https://doi.org/10.15405/epsbs.2020.10.03.138
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Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

To ensure efficiency of organization in the conditions of knowledge economy, challenges not pertaining to managerial routine are prevalent, those not having the property of extrapolation of previous experience in this context. The non-triviality of the target is conditioned by the tremendous rate of change in production factors and the new role of knowledge at the macro- and microeconomic levels. We live in the VUCA world (volatility, uncertainty, complexity and ambiguity). We can rely on the following data:

- 90% of information known to the world has appeared within the past few years;
- 75% of the world population have access to mobile communications, however not all of these people have access to pure water;
- the cost of storage of one GB of information has decreased one billion times since 1980;
- the cost of human genome sequencing has decreased 100 thousand times;
- ten years ago, at least ten professions which are among the most sought-after and highly-paid today did not exist (BIG DATA specialist, APP developer, UAV operator, etc.).

In other words, knowledge generates exponential knowledge, so knowledge management models need actualization and adaptation to the new conditions and necessary competencies.

2. Problem Statement

The most important research problems include the following:

- the existing knowledge management models pay insufficient attention to organizational knowledge that is at the heart of digital economy;
- the process of development of knowledge management models ignores the robust approach that takes into account not only dynamic, but also technological change.
- the traditional organizational structures, with inherent expressed concentration of powers and responsibility against the evident dispersion of competencies, do not secure the rate required to reach the productivity plateau.

3. Research Questions

This research purports to find answers to the questions in two main areas:

- knowledge management models;
- organizational design of digital economy.

3.1. Knowledge Management Models

In what aspect should the knowledge management models be mainstreamed and how should they be adapted to the new conditions and necessary competencies?

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In what way is it possible to apply the key provisions of the robust strategies concept, when developing knowledge management models?

What is the advantage of the "creative destruction" method and how can its application be substantiated?

3.2. Organizational Design of Digital Economy

- Why can end-to-end technologies be viewed as an infrastructural subsystem and the accelerator of new NTI Nets markets and competencies?
- What processes are involved in cyber configuration interaction?
- What are the benefits of the multi-dimensional model of cyber configuration interaction?

4. Purpose of the Study

The purpose of the study is development of the organizational design of digital economy based on updating the existing knowledge management models and adapting them to the conditions of accelerated changes in production factors and digital economy development waves.

The achievement of this goal requires solution of a number of challenges in the following areas.

4.1. Knowledge Management Models

The main objectives for solving the problems inherent in this area are:

- generalization of the existing knowledge management models;
- identification of limited areas of these models operation;
- setting the way to adapt the knowledge management models to the conditions of digital economy and accelerated change.

The solution of the above tasks will make it possible to streamline the knowledge management models in the context of accelerated changes in the economy.

4.2. Organizational Design of Digital Economy

The topical issues are as follows:

- substantiation of the role of end-to-end technologies as an instrument of reorganization and restructuring of "old" markets and competencies;
- characterization of processes involving cyber configuration interaction;
- development of a multidimensional model of cyber configuration interaction.

Solving the above problems will help to form the organizational design of the digital economy.

5. Research Methods

The solution of the set objectives is effectuated on the basis of application of general scientific research methods within the framework of comparative and logical analysis. The research is based on the

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method of scientific analytics. To achieve the set goals and objectives, it is supposed to use the experience and achievements of foreign and Russian scientists.

5.1. Analysis, generalization, assessment and adaptation of theories and models of knowledge management

There are three classical approaches to the knowledge management analysis: American, Scandinavian (European) and Japanese, that emerged as early as in the 80-90s of the 20th century. As is known, an American artificial intelligence researcher Viig (1986) introduced the concept of "knowledge management" (1986). At the end of the 20th century, it was not only the scientists who proceeded to research in this area - among then Sveiby (1992), the author of the chapter "The Knowledge Company" in the international strategic management review, who subsequently presented a doctoral thesis "Towards a Knowledge Perspective on Organization" (Sveiby, 1994), or Senge (2006) with his concept of learning organization, - but also top managers of a number of American companies: for instance, the knowledge management experience at McKinsey (MacDonald, 2014) was covered by The Economist in 1989, and in 1991 the Swedish insurance company "Skandia" officially introduced the position of Chief Knowledge Officer.

The popular knowledge management models include the models by I. H. Nonaka, G. Hedlund, M. Earl, E. Karajanis, L. Edvinsson, A. Inkpen, A. Dinur, Van Buren, Despres and Chauvel (as cited in Marinko, 2004). A great contribution to the development of the knowledge management concept is represented by the work of Japanese scientists Nonaka and Takeuchi (1995) "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation". The researchers described two types of knowledge: formalized (explicit) - in the form of documents - and non-formalized (implicit, subjective) - intuitive knowledge, feelings, impressions, opinions. Japanese scholars set a high value on informal knowledge, while Western scholars pay particular attention to formalization of knowledge. It should be highlighted that synergy of both types of the above knowledge is necessary in inclusive education (Titova & Ilinskaya, 2020).

Today, organizational knowledge should be considered simultaneously as an information stock and as a progression (flow of this information). Information and knowledge, that form the basis of intellectual capital, have a number of specific characteristics in contrast to the monetary, natural, labour and technical resources of the organization: knowledge exists regardless of space, but is extremely sensitive to the time factor; the value of knowledge lies in its abundance, while the other resources are evaluated in terms of scarcity. Companies should use their unique organizational skills to gain sustainable competitive advantages in order to maximize their profits. One should agree with Sveiby's (2001) statement: "Knowledge Management is: The Art of Creating Value from Intangible Assets".

However, competitive advantages also change in the conditions of rapid changes in the external environment (Eisenhardt, 1989); therefore, the dynamic capability concept has gained relevance. One of the hallmarks of dynamic capabilities, as mentioned by Eisenhardt and Martin (2000), is related to organizational change management. A similar statement was made by Oxtoby et al. (2002) and his co-authors who noted that the key dynamic capability is the ability of organizational change, which is generic in relation to all other dynamic capabilities embedded in the organization.

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The principles of the dynamic capability concept were expounded in the works by D. Teece, G. Pisano and A. Shuen, R. Nelson, R. Amit, P. Shoemaker, B. Kogut, U. Zander, R. Henderson, I. Cockburn (as cited in Andreeva & Chaika, 2006). Amit and Shoemaker (1993) voiced the idea of the need for dynamic improvement of organizational business processes, talking about production flexibility and the reiterative process of product innovation.

The dynamic capability concept becomes even more important in the conditions of accelerated changes - not only in the external environment, but also in respect of the production factors as such - as was noted at the beginning of the article. But since recognition of the value of various resources often exceeds the rate of environmental change, the society faces the problem of formation of new resource combinations and "creative destruction", as described by Schumpeter (1934), an Austrian and American economist. Thus, the dynamic capability concept starts incorporating an entrepreneurial aspect.

5.2. Analysis of organizational design of digital economy in the environment of rapid technological changes

Of foremost importance, according to the authors, is the problem of influence of embodied knowledge on technologies and technological breakthrough entailing disappearance of existing and appearance of earlier inexistent professions and competencies. The knowledge embodied in end-to-end technologies shows a universal impact (NTI: End-to-End Technologies. The Story 2014-2018, 2020).

According to the national technological initiative promoted in accordance with the Decree of the Russian Federation No. 317 as of 18.04.2016 "On the Implementation of the National Technological Initiative" (2016), end-to-end technologies represent priority technologies involving big data, distributed registry systems, artificial intelligence, new production technologies, neurotechnologies, virtual and augmented reality technologies, wireless technologies, sensory studies and components of robotics, quantum technologies, new and portable energy sources, biological objects control technologies. The sequence demonstrates the scalability of end-to-end technologies at the microeconomic level, the possibility of their application in medium and small business, B2C business priority.

According to the experts of TechNet association, end-to-end technologies can be considered as an infrastructural subsystem, as an instrument of reorganizing and restructuring "old" markets, an accelerator of new NTI Nets markets and competencies (Forecast of Development of the Markets Included in the Direction NTI "TECHNET", 2020). I. S. Metreveli, CEO of TechNet Association (Accelerator of Technological Projects TechNet Project, 2020), noted that the mission of the acceleration programme within the framework of infrastructural projects is selection and development of innovative projects that aim at increased competitiveness of the national industrial companies in the global NTI markets and in high-tech industries.

Proceeding from the combination of the listed types of impact or account of the effective infrastructure factor (Ilinskaya & Titova, 2019) that cannot be excluded (end-to-end infrastructure technologies), it is necessary to elaborate a new design for embodiment of knowledge in management structures. The factual increment of knowledge takes place in a specific organizational design that is closely related to the specificity of objectives to be solved. It is obvious that organizational design encompasses a multidimensional process including the following intervals: early startups, technology holders, low-tech company, high-tech company. Deeming the productivity plateau to be the macroeconomic goal, it is

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possible to actualize the need for network and digital interaction, with scaling of a business model (Ilinskii et al., 2019), consideration of technological waves and market change specifics.

The process of cyber configuration interaction (CCI), that encompasses ad maximum the basic technological packages of the three waves of the Russian digital economy development, has been assumed to be the basic element of organizational design. CCI represents flexible management of acceleration elements and structures, a design tool for formats aimed at creating high-tech products, regional standards and spin-off (Titova, 2018). CCI includes two interconnected processes - change management and technological innovation management, with unique properties providing for Russian companies' priority positions (Ilinskaya, 2018).

The American analysts from Gartner, a research and consulting company founded by G. I. Gartner in 1979, postulated that every stage of development of a company offering a new technology to the world is characterized by a certain level of informational hype around the innovation. The "hype cycle" shows that every technological innovation goes through several stages: technological trigger, peak of inflated expectation, trough of disillusionment, overcoming shortcomings, productivity plateau (Gartner Hype Cycle. Interpreting Technology Hype, 2020).

The CCI structure depends on the choice of targets and can be adjusted even within a short period of time, in turn determining the characteristics of scenarios and the scale of changes. CCI ensures integrity and adaptability of the system, along with improvement of technologies in terms of networking and digital footprint. The traditional organizational structure (Figure 01) is as follows: 1 - management centre; 2-n - management functional subsystems in the value chain; a-g - reverse impact on operating business.

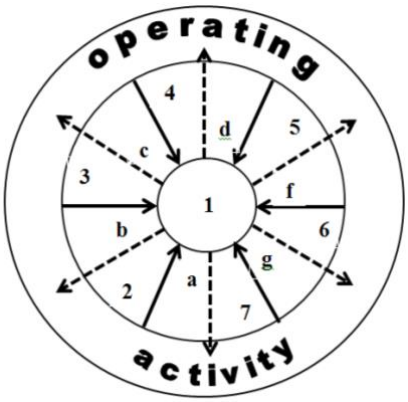

Figure 01. Traditional organizational structure in the "top view" projection

The traditional organizational structures have a pronounced concentration of powers and responsibility against a noticeable dispersion of competencies, therefore they have low efficiency in the conditions of high rate of environmental change and production factors.

6. Findings

The research results may be presented through a number of provisions.

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6.1. Robust approach to development of knowledge management models

It is generally accepted that the dynamic capability concept (DCC) appeared pursuant to the development of the resource-based approach, with a view to add dynamism to its static structures. In accordance with this concept, it is necessary to provide dynamic capabilities, i.e. the ability to modify and revise one's competencies in order to achieve better match with the changing goal or environment. The capabilities, in turn, are interpreted as changing internal and external organizational skills, resources and functional competencies. According to DCC, targeted results are created through the use of organizational and managerial processes, positions, i.e. assets of all types, as well as the methods aimed to develop highly efficient routines for a long term. Accordingly, dynamic capabilities are also characterized as "competency development trajectories" (Teece et al., 1997). Dynamic capabilities encompass flexibility needed to enable change and limitations derived from the specific features of nosology.

The analysis of the basic knowledge management models has shown that they are oriented at standard organizational structures that can be described as rigid, having a potential for technological breakthrough, though failing to give due consideration of the present-day realities. On the contrary, the robust approach to embodied and distributed knowledge, in terms of development of knowledge management models, takes into account both dynamic and technological change.

The robust strategies concept (Beinhocker, 1999) is based on the following provisions. First, the external environment is an extremely unpredictable complex system that develops according to its own rules under the influence of effects of periodically disturbed equilibrium and dependence on the covered distance. In this regard, the traditional methods of changing the external environment cannot be used. Second, the strategy is presented in the form of management cluster combining strategies for the current and perspective scenarios, complementing each other and oriented at different time periods, which makes it possible to apply a certain variety of alternatives. The possibility of reduced risks and increased probability of achieving targets alters the rigidity of goal-setting and business field planning. The dynamic components increase is shown through the expansion of business units owing to the experimentally oriented innovation component. Redistribution of resources, including investment ones, is supposed to take place in parallel with the changing activity fields.

6.2. Multidimensional network configuration modelling

It is possible to draw a conclusion, based on the analysis of the national technological initiative provisions and the hype cycle according to the Gartner’s analysts, on the increased non-reproducibility and nonrepeatability of dynamic and equilibrium processes and, as a consequence, on the impossibility of targeting in the organizational structure format.

H. Haken developed a synergy concept (Haken, 1991) in which he distinguished three attributes that bring a nonequilibrium system of any nature into the state of self-organization: rank parameters, principle of subordination and cyclical causation. Any open system depends on external or governing parameters; the system behaviour changes in the event of their drastic change. The new behaviour of a system is described with the use of rank parameters that condition the behaviour of its individual elements; that is, the behaviour of individual elements of a system is subordinated to the rank parameters. However, some parts of a system can evade submission and sometimes can set the rank parameters themselves, which means that there exists cyclic causation within the framework of the synergy concept.

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Change control can be rightfully considered within the timeline of fluctuations of numerous socio-economic parameters (the cycles described by A.L. Chizhevsky, S. Kuznets, R. Bagr, N.D. Kondratiev and others) and spatial restructuring. According to Ashby (1947), it is information that is the measure of change in time and space of the systems structural diversity. Structural diversity is of great importance in the analysis of economic systems where the structure is determined by their functional purpose setting the relationship between information and order. Ashby's law states that management can be secured only if the variety of means of the entire management system is at least comparable with the multifacetedness of the situation being managed by it.

Organizational diversity allows the system to absorb information from the environment more efficiently, which results in reduced uncertainty and mitigated chaos of the system and does not contradict to L. Boltzmann's concept of entropy as a measure of disorganization or transition from order to chaos, and does not oppose the entropy increase law. Economic and social systems receive negative entropy from the external environment in the form of information. The latter has a negentropic nature, as noted by Wiener (1948) confirming the idea of a French physicist L. Brillouin.

To ensure organizational diversity of a system, each level of organization should be divided into a number of sublevels (strata) and transitions between them. The levels will be governed by dynamic patterns, while the transitions between them - by chaotic patterns. According to Haken (1991), chaos (or fast oscillation mode, according to his terminology) is a condition for self-organization of a system at the next, higher level of organization of economy and society. The multidimensional structure of business subunits networking, in the conditions of adequate digital economy, is characterized by the following features:

- flexibility and adaptability of organizational structures;
- absence of any full and backup set of operational activity components;
- non-obligatory presence of own capital- and investment-intensive business units which include trend-setting and venture divisions;
- the ability of prompt generation of multi-dimensional configurations for the solution of particular innovative challenges;
- no orientation at build-up of property or towards complicating its structure due to a possibility of indirect ownership (lease, hire, access rights).

This is matched, in the area of organizational design, by a multidimensional model of cyber configuration interaction, illustrated by example of two enterprises (Figure 02).

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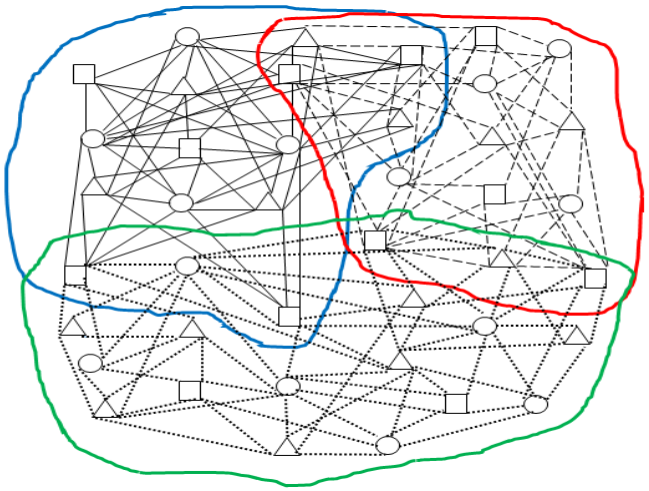

Figure 02. Multidimensional model of cyber configuration interaction

The squares depict various types of activities: outsourcing, franchising, other services. The circles mean top elements of the functional subsystems of the managerial apparatus. The triangles designate different levels of operational activity for functional management subsystems. The continuous line shows the interrelation within the enterprise A, the dashed line - for the enterprise B, the dotted line - for the enterprise C. Three different types of configurational interaction of the three enterprises are presented by three coloured lines.

7. Conclusion

The undertaken research enabled us to draw the following conclusions.

7.1. Knowledge management models

The review of the existing knowledge management models has shown that organizational knowledge is not paid due attention to in the conditions of rapid digitalization of the economy.

When developing knowledge management models, it is necessary to apply the robust approach that takes into account not only dynamic, but also technological change.

The dynamic components increase is manifested through the expansion of business units owing to the experimentally oriented innovation component.

The embodied knowledge has an impact on technologies and technological breakthrough entailing disappearance of existing and appearance of earlier inexistent professions and competencies.

7.2. Organizational Design of Digital Economy

The traditional organizational structures with inherent expressed concentration of powers and responsibility against evident dispersion of competencies do not secure the rate required to reach the productivity plateau in the conditions of digital economy.

End-to-end technologies can be viewed as an infrastructural subsystem, a tool for reorganization and restructuring of "old" markets, an accelerator of new NTI Nets markets and competencies. The cyber

configuration interaction process that takes into account the basic technology packages of the three waves of digital economy development is a basic element of organizational design.

The multidimensional model of cyber configuration interaction is most suitable for the organizational design of digital economy, when the levels are governed by dynamic patterns, and the transitions between them - by chaotic patterns.

Acknowledgments

We would like to thank the anonymous reviewer for the constructive comments to improve the manuscript.

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