

RECURSIVE AND CONVERGENCE METHODOLOGY OF THE INVESTMENT MANAGEMENT OF THE ENTERPRISE DIGITALIZATION PROCESSES

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Abstract:

The article investigates the problems of the investment management digital transformations at the enterprise, where the instrumental basis based on the system economic theory and integrated IT risk management theory are allocated. The purpose of the study is to develop a recursive and convergence methodology of the investment management of the enterprise digitalization processes. The components of the process of investment digitalization of enterprises are structurally reflected and a deterministic 5-component model of developing a recursive and convergence management methodology based on the digital economy is formed. It is determined that the recursive and conversion methodology is based on the understanding of investment management digital transformations at an enterprise as a complex system, characterized primarily by the diversity and heterogeneity of the constituent elements, numerous internal and external connections, which causes a variety of their interaction, changes in the composition and state of the system. The recursive model provides management of the investment of digitalization in the enterprise as a sequential transition between processes of one level only after all the cycles provided for the current process are implemented. However, such a coherent sequence is possible at the expense of effective information support of each process, which should be implemented on a convergence basis. The pre-condition for its implementation in the field of digital technologies is civilizational development, consequences of globalization and digitalization.

Key words: *digital economy, enterprise, investment, recursion*

INTRODUCTION

The implementation of digital technologies at all levels of the economic system, increased competition in the domestic and foreign markets, increasing demand for energy resources make it urgent to study the problems of attracting investment in digitalization, because the production and commercial activities of enterprises for the production, exchange, distribution and consumption of public goods is directly linked to the creation, processing and use of a large array of information and knowledge presented in digital form. International innovation experts say that around 22% of global GDP is related to the digital economy and this percentage is constantly increasing and increasing productivity (the digital economy is calculated by incorporating all products and services into the existing digital component). The Boston Consulting Group estimates that the digital economy may reach \$ 16 trillion

by 2035. The lion's share of this value is produced in the world's largest economies: 35% in the US, 13 in China, 8 in Japan and about 25% in the European economic space [10].

The digitalization of the economy is primarily focused on increasing its effectiveness and competitiveness. Estimated digitalization reduces maintenance costs production (10-40%), equipment downtime (by 30-50%), terms for launching the market (by 20-50%), and costs of providing declining product quality (by 10-20%), storage costs (by 20-50%), etc. [3].

In the economic reality, many businesses do not require digitisation due to their specificity, the nature of the product, the nature of their relationships with contractors, and also due to competitive conditions, but the presented data and current trends of economic

development justify the feasibility of implementing digitalization in most enterprises.

Some companies are not focused on implementing digitalization because their goal is to grow sales and generate profits. And the result of optimization of internal processes, including digitalization, is not so obvious and lasting in time, so reforming here is difficult and not considered a priority. This is one obstacle to the complexity of making change decisions. For example, if a company needs to upgrade its sales, warehouse or logistics business, the director of the business will take on similar tasks. Digital transformation cannot be done by one unit or one person unless it is a CEO or a business owner. All decisions about transformation are taken collectively, which is often problematic and long. But for all its complexities, digital transformation is a process that must be a priority for today's business.

The majority of domestic enterprises are characterized by a reactive form of investment attraction, when managerial decisions are made in a fragmented manner, which causes a number of disagreements in the implementation of tactical and strategic objectives of investment processes. This approach to management raises problems both in the work of the enterprise itself and outside of it in the form of disagreement of objectives and interests of stakeholders – investors, management staff, contractors, the state bodies.

In this context it is suggested to apply a recursive and convergence methodology which is intended for the coordination of tactical and strategic investment priorities in the field of digitalization with objective of their structuration, identifying the interrelations and influencing factors.

The main hypothesis of the article is that the introduction of digital technologies in the work of an enterprise in order to increase its competitiveness in the market requires attracting significant investments. Developing a recursive convergence methodology will provide an opportunity to coordinate tactical and strategic investment priorities in the field of digitization in order to structure them, identify relationships and factors of influence.

In the economy, recursion manifests itself as one way of modelling a wide range of phenomena and processes from forming concepts as a result of cerebral activity [1] to the economic dynamics of the research object. In other words, it is a system reflecting the principles of internal organization or functioning, certain features and characteristics of the object under study. At such level it is possible to talk about recursive model of functioning, which is realized in the system «subject-object-reproduction of the object».

In economics, the term «convergence» is used for marking the convergence of different economic systems, economic and social policies different countries. The term «convergence» has been recognized in economic science in connection with widespread convergence theory in 1960-1970. Today, the term «convergence» is becoming more widespread and mostly used in describing

integrating processes. Current scientific research related to socio-economic aspects convergence aimed at: – the problem of convergence of economic models of countries (macro-level); – convergence-oriented development of regions and industries (meso-level); – convergence-oriented enterprise development and convergent approaches to enterprise management (micro-level) [11]. The process of convergence has become irreversible and necessary for modern ones businesses as a result of, on the one hand, technological progress through digitalization, on the other, new requirements for service consumers. Because convergence is a process, the integration of digital technologies into the work of the enterprise, which can significantly improve its competitiveness and promote investment.

The recursive model considers the peculiarities of the management cycle on the basis of the analysis of the management object and planning of its desired state at a certain point in time [3, 5, 14]. Stages of planning, organization, motivation, control are considered not as managerial functions, inherent in certain subject, but as objectively existing and necessary processes occurring in time and aimed at overcoming negative influence of external environment factors.

According to the recursive model, the content of each management process is determined taking into account the results of the previous process. That is, the nature of each stage will remain invariant: analysis – determination of the current state, planning – determination of the necessary state, organization – bringing the current state into compliance with the necessary one [19, 20]. Thus, the recursive model provides for the investment management of the enterprise digitalization as a consecutive transition between processes of one level only after all the cycles provided for the current process are implemented. However, such a consistent sequence is possible through effective information provision for each process, which should be implemented on the basis of convergence. The precondition for its implementation in the field of digital technologies is civilizational development, consequences of globalization and digitalization.

LITERATURE REVIEW

In his work, K. Clark [1] identified the digital economy as a precondition for dynamic growth in the sphere of postindustrial development. T. Yudina, I. Tushkanov [18] understand the digital economy as the creation of global, macro, meso and micro-level of economy information digital boards and operators in order to solve strategic problems in the field of new industrialization, government regulation, development of science, education, infrastructure, health and transport.

M. Rudenko [8] claims that "digital economy" from the scientific point of view is a process of economic evolution, social, industrial, technical and technological, organizational, managerial and other social relations and changes in the subject-object orientation associated with the development of digital technologies; from a practical perspective – as a mechanism to change the existing

business model in order to obtain competitive advantage, increase efficiency.

In order to study more thoroughly the question of preventing the emergence of IT risks in the process of enterprise digitalization, we propose to use the positions of Kleiner G. B. [6] systemic economic theory and the integrated IT theory of risk management [11].

M. Keil, K. Lyytinen and C. Sauer emphasize that there is a large number of scientific works on the topic of unsuccessful projects to eliminate IT risks [7, 20]. Thus, a description of the IT risks associated with the operational activity contains insufficient information about security breaches, unreliable systems [9]. The problems of IT exploitation systems on protection of confidential data, private information, elimination of strategic risks related to the use of new digital technologies are actively discussed [11].

In the article the authors deal with questions about the rules of effective, efficient and rational management through the results of marketing communications of administrative units of local self-government. The authors point to the Polish experience in this area with regard to systemic transformation since 1990, based on the decentralization of power and the effective dismissal of social potential, by focusing marketing communications of local governments on activating citizens to take action and ensure citizens' responsibility for the environment [13].

Pavel Fobel and Aleksandra Kuzior they highlight ethical risks in the context of developing the Industry 4.0 concept. They hold the opinion that Industry 4.0 constitutes a fundamental turning point that deserves ethical appreciation and solutions. The peculiarities of this paradigm should also be explored within ethics and enter, in a constructive manner, the discourse in the area of science and research, both within professional socialisation and within the area of institutionalisation of ethical instruments in order to minimise, to a maximum possible extent, the ethical risks and potential negative conse [17].

METHODOLOGY

The recursive-convergence methodology is based on the understanding the investment management of digital transformations at an enterprise as a complex system, characterized primarily by diversity and heterogeneity of the constituent elements, by numerous internal and external connections, which causes diversity of their interaction, changes in composition and state of the system. Implementation of this methodology requires the study of prejudice to the issue of IT risks in the process of digitalization of the enterprise.

In current researches, IT risks are generally divided into two groups: those related to the development of information systems, and those related to the current work of information systems. There are certain recommendations on project risk management [2, 6, 12, 15, 16].

E. Clemons, Lyytinen and R. Hirschheim proposed the following IT risk typologies, highlighting ten categories:

- 1) financial (high cost of technology);
- 2) technical (unreliable, outdated technology);
- 3) project risks (delay of project development);
- 4) political (project, system and technology struggle zone);
- 5) reserves (accidents, natural disasters);
- 6) risks of inappropriate use of IT technologies;
- 7) risks of internal abuse;
- 8) external;
- 9) risks of competition;
- 10) reputational [2].

The IT risks include everything related to information technology and can have a significant negative impact on the efficiency of investments in digitalization. As a part of IT infrastructure there are various types of users which too can lead to occurrence of various risks in IT system. In this context, the integrated theory of IT risk management allows to distinguish different types of management strategies and business processes of the enterprise.

This theory distinguishes four types of basic socio-economic systems in terms of space and time: object, external, project and process [6]. Enterprise according to this theory refers to the object type of socio-economic systems. At the same time, within the enterprise, as a system object, the spatio-temporal approach gives the opportunity to structure it, distinguishing the same four types of similar subsystems [7].

The application of this approach to the improvement of the digitalization investment management system makes it much easier to identify a number of possible economic risk factors, for the neutralization of which it is desirable to provide for preventive measures during the implementation of digital technology. In addition, this scientific and methodical method provides an opportunity to take into account the specifics of each of the selected subsystems of the enterprise, as well as the localization of digital technology and inherent corresponding subsystem of economic risk factors.

In some cases, the implementation time and budget of the project to introduce new digital technologies may exceed the scheduled time dates or the financial parameters of the project may be approved, or in some cases the project is not implemented at all. Certainly, investments in digital technologies are connected with the general increase of risk level of failure to achieve planned intermediate and final results of the project, however refusal of realization of projects on introduction of digital technologies in changing conditions can lead to negative economic consequences, such as the loss of a market or a significant part of it.

RESULTS OF RESEARCH

The conducted monitoring shows that applied researches of digitalization processes in the economy and management of microeconomic systems contribute not only to development of analysis methods and management of economic risk level in this field, but also

provide an opportunity to improve the enterprise investment management system. At the same time, it becomes possible to move to the formation of promising models of interaction with consumers, based, in particular, on the application of new ways of processing of large amounts of digital information. Implementation of digital technologies at all stages of social reproduction (production, distribution, exchange, consumption) provides new opportunities for socio-economic development. Among the most significant of them can be attributed:

- increasing labor productivity, reducing the amount of working time required to meet existing social needs;
- increase of efficiency of planning and management of economic activity (optimization of volume of stocks, business processes, systems of supply and sale) on the basis of access to information in the mode of real time and automation of decision-making processes;
- increase of transparency of production and commercial activity, leveling of conditions of competition;
- enhancing intellectual development through remote access to information.

As for the implementation of digital technologies in the work of the enterprise, their influence can be assessed according to the functions and effects of digitalization (Fig. 1).

Considering the conditions of the national economy functioning, the problem of investment process research loses its fragmentary character, acquiring a comprehensive study orientation. That's why it needs to develop scientific and applied principles of enterprise investment management digital transformations as a combination of theoretical and methodological provisions and methodical tools that provide an opportunity from the standpoint of the systemic approach to coordinate the issues of investment flow management, implementation of digital technologies in the enterprise in order to achieve its economic growth.

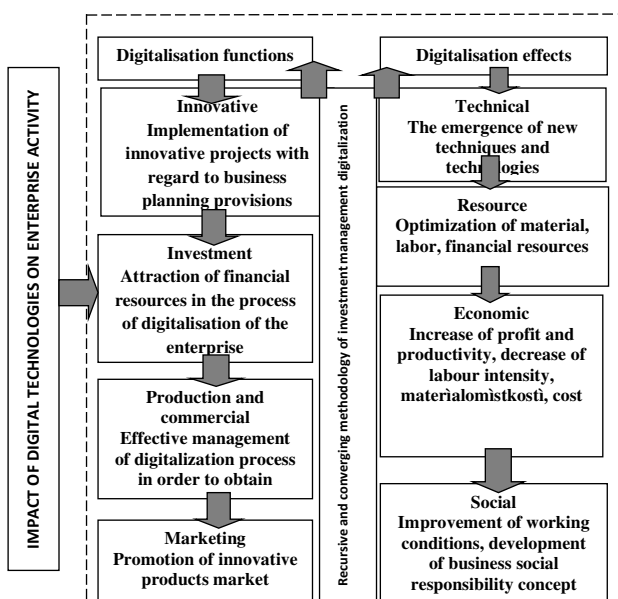


Fig. 1 Impact of digital technologies on enterprise activity

Economic and production processes digitalization is the main factor of enterprises competitiveness in the foreign and domestic markets, which determines the expediency of investment process detail study and intensification of its role in the market relations. It is especially important to take into account the relationship of the concept of investment management digital transformations with the economic development strategy, to ensure the high quality of development and implementation of state programs as an investment, and economic nature in general.

Davos Forum experts in 2015 highlighted 21 goals, achievement of which are expected to 2025. The Cabinet of Ministers of Ukraine on January 17, 2018 approved the "Concept of development of the digital economy and society of Ukraine for 2018-2020 years" and approved the plan of measures for its implementation. This is the road map of digital transformation of the economy of Ukraine which the Ministry of Economic Development and trade has developed together with leading IT experts [10]. This concept envisages implementation of the relevant incentives' measures for the digitalization of the economy, public and social spheres, awareness of existing challenges and digital infrastructure development tools, the acquisition of citizens digital competencies, and identifies the critical areas and digitization projects.

It should be noted that the issue of economics is not the subject of consideration of this program, since it is a change of technological base that should lead to socio-economic transformations. The process of the production and economic sphere digitalization requires significant investments, but most domestic enterprises have limited financial sources, which stipulates the urgency of researching the problem of attracting investments and their effective use. The content analysis of digital technologies implementation into the work of the enterprise provided an opportunity to conclude that the main strategic priority is to improve the investment process, which contributes to the improvement of the approbation mechanism, implementation, reproduction and use of digital technologies (Fig. 2).

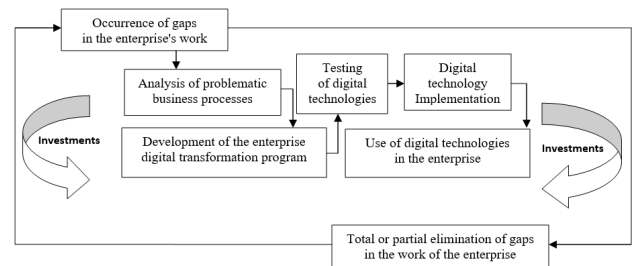


Fig. 2 Components of the process of investing in the enterprise digitization on the basis of recursive and convergence management methodology

In the era of digital economics, the main resource is inexhaustible, accurate, reliable, true and timely information. The main platform for the development of digital economy is a virtual network of boundless Internet (Fig. 3).



Fig. 3 Determined 5-component model of recursive and convergence methodology of digitalization investment management development at the enterprise

Capital investment in digital transformation enables businesses to remain competitive in the market through dramatic change. Such investments directly influence the clients' expectations, and their efficiency estimation is not exhausted by one only indicator of return on investment. Significant changes apply to the entire customer lifecycle, ranging from the supply and ending with aftermarket service.

The Forrester has researched the impact of digital technology on the quality of customer service and return on investment (ROI). The main points of this study are:

- It is advisable to view revolutionary transformation as a strategic investment. The actual value of investing in digital transformation is determined by the long-term growth in revenue, not by the short-term return on technology implementation. To maximize the impact of digital investment, business executives and IT professionals need to learn how to evaluate such investments from the point of view of the company's customers.
- The traditional ROI calculation cannot always be used for digital investment. Digital transformation changes business processes and models, and ROI works in the case of one-off digital projects, rather than system transformations in business models.

The company that implements digital technologies can take advantage from convergence, in which the data on the product is available at all stages of its life cycle—from development to implementation. That enables the company's management to make more effective managerial decisions and contributes to the implementation of certain transformations in terms of market entry, flexibility, quality, security, operational efficiency, and the creation of new business opportunities. American expert Matt Ra-

leigh in his blog "CEO of Briefing-The Global Agenda: Competing in a Digital World " noted that 87% of companies represented in the study plan to increase the investments in innovation and development. At the same time, a significant part of these investments are focused on digital technologies, such as mobility, cloud technologies, analytics, social networks, e-commerce and M2M-communications.

CONCLUSIONS

The conducted research allowed to determine the directions of development of digital technologies, advantages of their inclusion in industrial and commercial activity of the enterprise and to present theoretical and instrumental bases of research of problems of digitalization of investment processes. The theoretical basis of the investment management of digital transformations in the enterprise in the context of a comprehensive approach became the system of economic theory and integrated theory of IT-risk management. The components of the process for investment of digitalization of the enterprise, and a deterministic 5-component model of development of the recursive and convergence methodology of investment management digitalization at the enterprise are presented.

Therefore, based on the conducted research, a recursive and convergence methodology is proposed, which will enable the process of digitalization of the enterprise to be provided with investment resources. Because, the recursive model assumes management of the digitalization investment in the enterprise as a consistent transition between the processes of one level only after all the envisaged cycles of the current process are implemented. It is proposed that such a coherent sequence is possible due to the effective information support of each process, which should be implemented on the basis of convergence.

The prerequisite for the implementation of the developed recursive and convergence methodology in the field of digital technologies is civilization development, the consequences of globalization and digitization. The recursive and convergence methodology is based on the understanding of digital transformation management in an enterprise as a complex system, characterized primarily by the diversity and heterogeneity of the constituent elements, the numerous internal and external relationships, which causes the diversity of their interaction, changes in composition.

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