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## **METHODOLOGY FOR MANAGING INVESTMENT PROCESSES OF DIGITALIZATION OF THE ECONOMY**

*In the article the 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 precondition for its implementation in the field of digital technologies is civilizational development, consequences of globalization and digitalization. The focuses on the problems of reasonable and sustainable urban planning in the conditions of urbanization, which is the basis for the development and implementation of the «Smart City» concept. As a result, of theoretical analysis of the main definitions of «Smart City», the author's vision of this concept is proposed. The implementation of «Smart City» in the context of human rights protection, we will highlight the main tasks taking into account the development of cognitive technologies.*

**Keywords:** investment, digital economy, investment management, recursive model

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### **1. 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.

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 research 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.

## 2. ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

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.

Authors [12] claimsthat «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 [13].

### **3. IDENTIFICATION OF PREVIOUSLY UNFOLVED PARTS OF THE GENERAL PROBLEM TO WHICH THIS ARTICLE IS DEDICATED.**

The problem of forming a methodology for managing the investment processes of digitalization of the economy taking into account the development of the modern concept of smart city remains unresolved.

### **4. FORMULATION OF THE OBJECTIVES OF THE ARTICLE**

The aim of the article is to highlight in the structure of the methodology for managing the investment processes of digitalization of the economy an important component, namely the development of smart city.

### **5. PRESENTATION OF THE MAIN MATERIAL OF THE RESEARCH WITH FULL JUSTIFICATION OF THE OBTAINED SCIENTIFIC RESULTS**

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.

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.

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).

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.

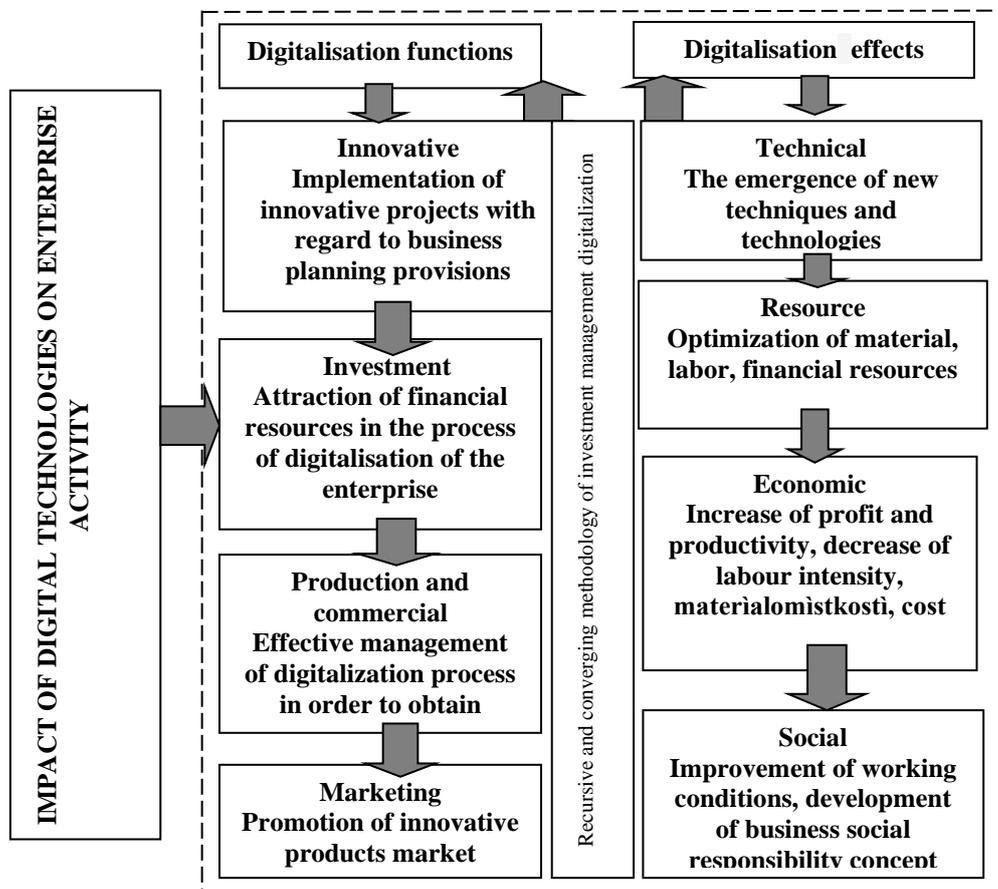
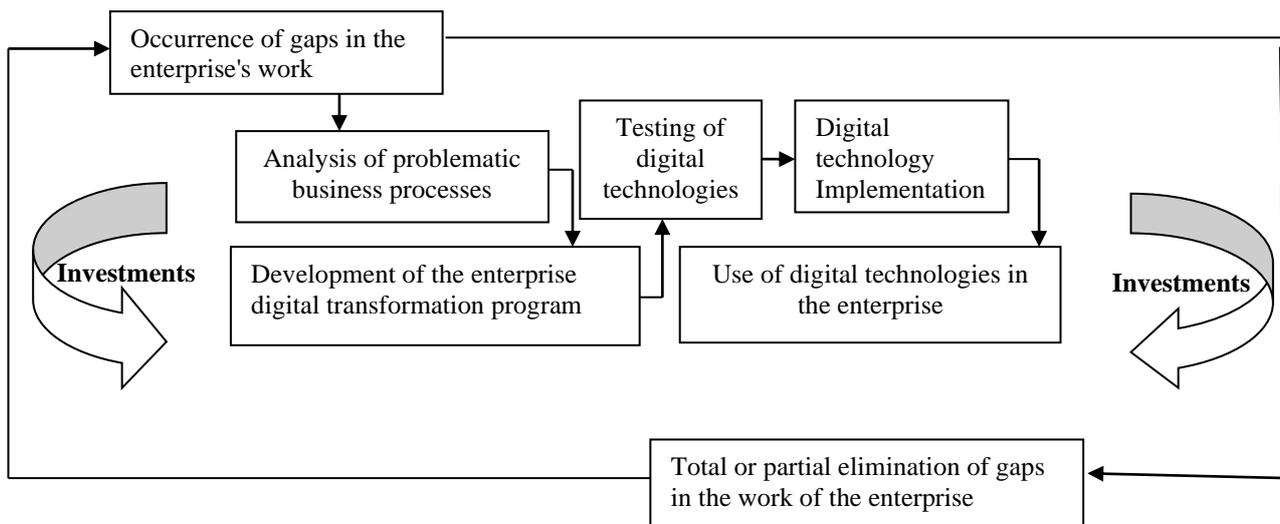


Fig. 1. Impact of digital technologies on enterprise activity

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]. 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**

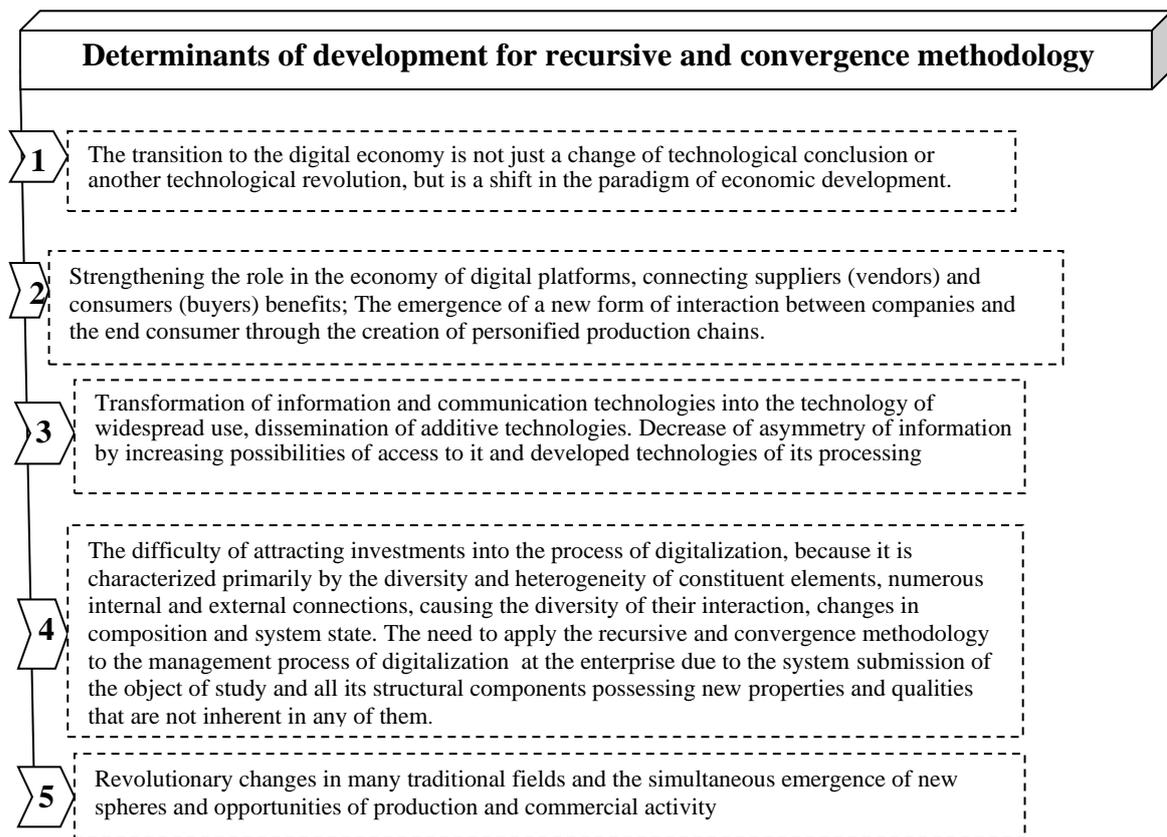
In the era of digital economics, the main resource is inexhaustible, accurate, reliable, true and timely information. The main platform for the development of digital economy is a virtual network of boundless Internet.

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 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 Raleigh 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.

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.



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

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.

The last decade trend is the «Smart City» concept development and implementation. This is due to the processes of globalization, urbanization, growth of urban population, and

their innovative transformation through the digitalization of all spheres of public life. Experts in the field of urban planning predict that the level of urbanization will grow further. They estimate that there will be 600 «Smart Cities» in the world by 2020 until 2025. They will provide more than 60 % of the domestic product global gross [6-7].

Special NBIC based social development programs have been adopted in America and Europe. The American program «Converging Technologies for Improving Human Performance» and the European Union program «Converging Technologies for European Knowledge Society» [19]. The main purpose of these programs is to improve the quality of life and protect human rights, in particular using cognitive technologies.

Nowadays, the NBIC-technology components synergy is seen as a basis for social progress, while the cognitive technology is an important component of it. For example, one of the most important applications of cognitive technologies to improve quality of life is medicine and education. When risks increase, it is especially important to have an adequate

application of knowledge and knowledge management. In cognitive science, the task of developing technology to obtain and use the knowledge is set.

Interdisciplinary scientific direction - cognitive science emerged as a result of synthesis of research in the field of theory of synergy (self-organization), cognitive psychology, artificial intelligence, neurophysiology, knowledge engineering, psycholinguistics and psychosemantics.

«Cognitio» is a Latin word which means knowledge. Cognitive technologies are ways of transforming the cognitive behavior of human, organizations, and nations through improving their intellectual potential or contributing to modern information systems. It should be noted that a separate type of cognitive technology is formed by those that change social behavior of people and certain societies [4]. In general, cognitive technologies relate to methods and algorithms of achieving different goals by people, companies, political parties through the tools of knowledge of the world, communication, information processing [22].

Digital technologies not only provide new opportunities for human and social development, but also increase the risks of violation of their rights and freedoms and, accordingly, contribute to strengthening state control in this sphere. This raises the problem of simultaneous study of these processes and forecasting of their development trends both on practical and theoretical levels.

The relevance of the «Smart City» study in the context of human rights protection is due to the growth of information volumes, intensive development of digital technologies and their introduction into various spheres of public life. In modern conditions, the digitalization of the social sphere and the development of approaches to the protection of human rights become not only the means of ensuring their observance, but also an object of influence of digitalization processes, as a result the content, system, structure, mechanism in the sphere of observance and protection of human rights change. Implementation of digital innovations in the creation of IT infrastructure for processing large data, training of specialists to work with «smart» systems based on cognitive technologies will ensure sustainable growth, accelerate socio-economic and technological

development, improve living standards, create conditions and opportunities for self-realization of each person.

Some of scientists are studying the use of digital technologies in various spheres of human activity. The formation of the scientific concept of effective interaction between society and digital technologies takes place; attempts are made to predict changes in the mechanism of digitalization and model of social regulation. The object of legal regulation of citizens' protection in the digital era is becoming more and more multidisciplinary.

The driver of innovative economic development and socio-economic progress is the introduction of information and communication technologies, which are based on effective management principles, approaches, methods, tools, technologies and strategies of the state development. In 2018 the Government approved the «Concept of development of digital economy and society of Ukraine for 2018-2020 years», which provides the implementation of appropriate incentives measures to introduce the digitalization of the economy and social spheres, awareness of challenges and tools for the digital infrastructure development, the acquisition of citizens digital competencies, and identifies critical spheres and projects of digitalization, stimulation of the domestic market production, use and consumption of digital technologies. The path to the digital economy lies through the domestic market production, use and consumption of information and communication and digital technologies [10].

International experience, in particular the «Digital Agenda of the Europe 2020», defines digital technologies as a driving force for economic and social progress of leading countries in the context of the implementation of the sustainable development concept. However, these processes take place in conditions of dynamic economic and political relations and certain threats to society due to the impact of information technologies.

At the Technical University of Vienna, a special laboratory was launched in 2007 to research cities in Europe, analyzing their compliance with the criteria of a «Smart City». Initially, small and medium-sized cities were studied, and since 2015 large cities, including metropolitan areas, have been studied [7]. The methodology of Austrian scientists' research is

to identify certain characteristics by which it is possible to determine the compliance of modern European cities with the principles of «Smart City». All characteristics are divided into two groups: the state of civic activity and level of education; readiness of social institutions for rapid modernization. The Vienna Laboratory identified six criteria, 31 formation factors and 74 factors that are indicators of compliance with «Smart City» [12].

The «Smart City» development in Singapore is guided by «Smart Nation Singapore» program, where the main fields of development are the digital economy, the digital government and the digital society [15]. A constant challenge for the development of Singapore is that having a small territory; the Government of Singapore is committed to constantly finding innovative solutions for improving the urban environment to make it safe and comfortable for citizens.

Foreign researchers, particularly M. Betty and his colleagues [4], note that the implementation of «Smart City» requires not only the automation of routine functions to service people, buildings and traffic systems, but also the use of certain technologies that can control, analyze and plan the development of the city to improve the efficiency and quality of their citizens' life in real time.

Currently, Amsterdam is an example of the modern approach to city management. There is a Portal Amsterdam Smart City ([amsterdamsmartcity.com](http://amsterdamsmartcity.com)) designed and implemented [3] that provides access to various initiatives and projects to improve city life, attract citizens and business structures to these processes. The city positions themselves as a «city Live Lab» which provides an opportunity for businesses to test and demonstrate innovative products and services. This partnership creates an infrastructure for knowledge-sharing and learning between all these entities and provides grounds for specific projects aimed at sustainable energy, innovative solutions in the healthcare industry, better transportation and more (digital) participation of citizens.

In 2015, the process of transforming Kiev into a «Smart City» began, which included three levels of key changes: technological - creation of a modern effective platform for urban infrastructure management, ensuring the efficiency of housing and communal services

functioning, use of security technologies, quick response to emergency calls, timely response to the problems of the city residents; changes in the city management - increase of transparency in administration and management main processes of forming a transparent and constructive model of public-private partnership, improving the investment climate and conditions for business development, reasonable integration of information between city departments, use of modern data management systems and introduction of quality analytics of events and processes in the city; social changes - development of modern social infrastructure and movement towards social equality, involvement citizens in decision-making by local authorities, ensuring financial stability and sustainable economic development of the city to improve the living standards of Kyiv citizens [5].

The modern «Kyiv Smart City» concept, which is implemented in practice with the purpose of reasonable city infrastructure development, unites the citizens, business structures and city authorities. The implementation of «Kyiv Smart City» is based on the principles of open data, smart use of digital services and transparent management.

The digital technologies integration provides an opportunity for efficient use of resources, creates new business opportunities as well as improves the living standards of citizens. In order to create a technologically advanced, socially responsible and comfortable metropolis it was approved the «Kyiv Smart City 2020», which defines the main ways for further infrastructure, technological and social development of the city. Thus, the concept is designed to create a new vector of the urban space transformation, combining a strategic approach, technological achievements and wide involvement of citizens in the decision-making process. The program was developed with the participation of the public, city experts, representatives of Ukrainian technology companies and international business, scientific and academic community. The document takes into account the interests of citizens, entrepreneurs, non-profit organizations and defines a new role and functions of the city government.

There is no clear interpretation of the «Smart City» definition, but a number of scientists are researching on this topic.

According to the developers of European «Smart Cities» - is a city that effectively uses all available information and resources to effectively perform its functions [7].

«Smart City» is defined as the use of digital technologies based on the principles of intellectualization, interrelation and efficiency for the formation of the city infrastructure, which provides for the management of education, health care, public safety, transport and utilities [14].

According to A. Greenfield, due to the Internet mass access development of nanotechnologies, the concept of «Smart City» is mainly reduced to understanding it as an effective work [8]. A smart city is a municipality that uses information and communication technologies to increase operational efficiency, share information with the public in order to improve the quality of public services and the well-being of citizens [7]. According to the definition proposed by K. Harrison [12], the «Smart City» means the engineering, social, business and IT infrastructure integration to the use of the city's collective intelligence.

T. Bakisi defines «Smart City» on the basis of high-tech and intensive development that unites people, information and elements of urban infrastructure to create a competitive and innovative economy, as well as a high standard of living [13]. After reviewing a number of definitions of «Smart City» concept, it can be concluded that it reflects to various aspects of the city's environment functioning, in particular, the territory with high standards of living, significant economic growth, favorable ecological environment and effective spatial planning.

«Smart City» is the interaction between the city's institutions and citizens through the innovative technologies introduction. Table 1 highlights structural components of the «Smart City» concept and provides the description.

The table below implies that the «Smart City» concept is heterogeneous and includes diverse structural components that collectively determine its essence. Among them, the most significant are the developed urban infrastructure, the large-scale of digitalization and innovation use, the orientation to the formation and use of new knowledge, reducing the environmental burden on the territory. The unifying component is the processes of

digitization and informatization of the socio-economic space of the modern city.

*Table 1*

**Structural components characterization of the «Smart City» concept**

<b>Components</b>	<b>Characteristic</b>
<b>Virtualization</b>	Based on digital concepts of cities within the framework of urban infrastructure functioning in the conditions of complex process automation.
<b>Intellectualization</b>	Territories with high capacity for learning and innovations that synthesize creativity of the population and institutions aimed at reproduction of knowledge on the basis of intellectual and information technologies.
<b>Digitalization</b>	Territorial complex, functioning on Internet Technologies. The implemented Digital City in the following fields: the social, cultural, political and ideological digital environment that accumulates on web portals, primarily in social networks, on the Internet sites, official and unofficial information, communities and civil representatives.
<b>Post-industrial society</b>	Society, residents and institutions are using information technology for a significant transformation of its region within the same geographical area. This cooperation covers all stakeholders who are interested in the development of urban space.
<b>Organizational development</b>	The purpose of the city is to develop knowledge-based development, encouraging their continuous creation, exchange, evaluation, renewal through continuous interaction between citizens from different cities. The effectiveness of such interaction is determined by factors such as the culture of knowledge-sharing between citizens, appropriate city design, the level of digital infrastructure development.
<b>Life long learning</b>	It is a well-known concept that promotes the growth of the general and professional capacity of the individual throughout his life through the use of the system of state and public institutions. Continuing education is driven by the progress of science and technology and widespread of innovative technologies use.
<b>Sustainable development</b>	It adheres to the principles of «green growth», in which economic development is accompanied by a simultaneous reduction in emissions and greenhouse gas pollution, i.e. minimal losses due to inefficient use of natural resources. Uses technologies to reduce carbon dioxide emissions for energy in order to reduce the environmental impact on its residents. Energy-efficient construction is being actively developed.

Generated by the author, based on the [6-8; 17]

Thus, the unifying component is the processes of digitalization and informatization of the modern city socio-economic space.

*Table 2*

**The «Smart City» development determinants**

<b>Determinant</b>	<b>Characteristic</b>
<b>Improving living standards</b>	In the context of increasing the living standards of people, not only new technologies are enough, and effective city development strategy and resource support are also needed.
<b>Innovative city development</b>	Approaches to creating a «Smart City» is changing due to the needs and requirements of sustainable development [2-5]. The application of the latest technologies will contribute to a more rational use of resources from the economic and environmental point of view.
<b>Digitalization</b>	The introduction of information and communication technologies is a priority in the planning process of cities that are considered as hubs of technological innovation [5].
<b>Development of e-management platforms</b>	The «Smart City» concept covers not only information and communication technologies [2; 7] but these are the main means of creating a platform for providing better services and effective city management ensuring. (e-governance) [8].
<b>Economic development</b>	Innovative technologies increase productivity, promote the provision of state executive authorities' services; increase the pace of economic development, thereby directing the development of society to the post-industrial stage.
<b>Crowdfunding</b>	Promising trend of the modern «Smart City» are crowdfunding projects, the essence of which is to implement certain charity accounts monetary contributions of the city residents to charitable projects.

The cognitive approach of the city modeling and development management is aimed at developing formal models and methods used in

the intellectual process of problem solving. These models and methods take into account cognitive capabilities (perception, presentation, cognition, understanding, explanation) of the subjects of management in solving management problems. The concept of cognitivity (from Lat. "Cognito" – to think), which means "the ability to think, explain, substantiate actions, ideas" [2], used initially in such sciences as philosophy, psychology, pedagogy, sociology, management, political science, military activity.

Recently, it has increasingly been encountered in economic science and eventually transformed into cognitive modelling. This concept is still not actively applied in the science of management, but its essence and purpose, in our opinion, fully meet the goals of managing the development of the city as a complex system that requires the development of nonlinear solutions in the changing conditions.

Cognitive modelling as a public administration tool allows you to explore the city by building predictive scenarios. The cognitive modeling methodology helps to solve direct problems of development and define the predictive values of indicators of each of the development spheres without intervention of higher-level managerial bodies. Cognitive models are built by an expert (a group of experts) in a given subject field based on theoretical, statistical and expert information on the object of study [21].

The adequacy of the model is determined by the completeness of initial knowledge; the model may be clarified in the process of research and application, being a source of structured knowledge itself. Thus, cognitive model – is a generalized structure of knowledge, a graphical formalized representation of links between concepts (notions, factors, indicators) of the city development. Considering the possibility of using such models in management, it is necessary to emphasize their ability of evaluation not only in quantitative characteristics, but also in qualitative estimates.

Generally, subjects of management generally perceive dissatisfaction with the current state of the local system, but their perception of the city as a complex economic system is blurred, indistinct and contradictory. The indistinct representations formalization is one of the main tasks that must be addressed to

the development of models and methods of decision-making in low-structured situations [22]. It is also important to take into account that management subjects have to make decisions under conditions of constant changes in limited time.

*Table 3*

**«Smart City» concept implementation benefits systemizing in the context of human rights protection**

Benefit	Essence
<b>Social</b>	The social infrastructure of «Smart City» is constantly developing, focusing on the real needs of society. This provides an opportunity to improve the quality of education, medicine, social services, to create a favorable environmental situation.
<b>Development of the education system</b>	The «Smart City» concept involves a completely new approach to the education system, which must develop dynamically in response to the challenges of time. Education should be affordable. The role of distance education using the latest technologies is increasing digital platforms, distance courses, webinars, hackathon, business training.
<b>Appropriate level of medicine</b>	The medicine of a «Smart City» is characterized by a high level of service, absence of queues in health care institutions, as appointments are made online. A unified register of patients and doctors and electronic versions of all medical records are being created for remote access (e.g., medical history). There are also plans to use the latest safe medical devices for diagnostics and related treatment [4].
<b>Security</b>	Video recording on the streets of the city and in public places will help to reduce the crime rate, which will significantly improve the safety of citizens.
<b>«Smart Buildings»</b>	Energy efficient construction technologies implementation for rational use of energy resources. Use of remotely controlled appliances in home to save time and financial resources.

We will distinguish the most common problems that are advisable to take into account for public authorities at development and realization of «Smart City» conception:

- organizational and management barriers, which include administrative barriers, lack of coordination and communication between the stakeholders of the concept development and implementation, lack of relevant labor resources;
- financial and economic, related to the lack of financial resources and caused by the absence of business models, which determine the return on investment in the «Smart City» concept;
- projects related to the implementation of the «Smart City» concept, which is due to the lack of clear quantitative and qualitative indicators of the concept effectiveness;
- infrastructural, reflecting the lack of integration of the «Smart City» concept into existing urban development plans, transport systems and development strategies.

According to the research results, the main problems and possible variants of «Smart City» concept implementation are systemized and detailed in Table 4.

In the context of human rights at «Smart City» implementation we will distinguish the main tasks:

- To identify human rights when using digital technologies;
- To develop packages of universal (standard) digital services in education, medicine, environment, security, social and other spheres, which should be digitally available for each citizen and meet certain technological and functional parameters;
- To propose a simulating system of «Industry 4.0» development, taking into account international standards in this field; mechanisms of formation technology transfer industry centers, engineering clusters, creation of the economy certain sectors digital map transformation;
- To form a comprehensive educational program of acquiring digital competences and skills. The EU defines 21 competences and appropriate adaptation programs for citizens.
- To define «National Digital Transformation Projects» in such fields as public safety and security; education; health care; e-democracy; digital television; ecology; smart infrastructure electronic payments and settlements;

– E-commerce; etc.,

– To present the model of management and digitalization processes introduction, including on the principles of public-private partnership.

Table 4

**Smart-city implementation: Major problems and possible solutions**

Problem description	Possible solutions
<b>Lack of financial resources</b>	One of the possible solutions to this problem is public-private partnership. The city authorities should initiate the implementation of such projects and support them at different levels of regional public funding programs participation
<b>Administrative barriers</b>	1.) Minimize decision-making deadlines and sign official documents. 2) Automate the process of reconciling all documents. 3) State authorities may act not only as the initiator, but also the main driver of the project
<b>Lack of coordination and communication between the stakeholders</b>	Developing a digital open platform that will reduce the number of communication barriers and open the discussion to all stakeholders on «Smart City» concept implementation.
<b>Lack of qualified staff and specialists in the field of relevant digital transformations</b>	Permanent learning, invitation of the best international and local experts in the field of town-planning, IT sector, economic development, ready to work out the problems of municipal environment transformation
<b>Lack of «Smart City» concept integration into the existing urban development plans</b>	Change of urban planning documents requires a significant number of approvals and takes a long time to achieve a high level of compliance for main town-planning documents with each other as the framework of the «Smart City» concept development and implementation

**6. CONCLUSIONS FROM THIS STUDY AND PROSPECTS FOR FURTHER INVESTIGATION IN THIS DIRECTION**

According to the results of the research, the main component of the development of the methodology for managing the investment processes of digitalization of the economy is the concept of smart city.

Under modern conditions, urbanization focuses on the problems of smart and sustainable urban planning, which is the basis for the «Smart City» concept development and implementation. According to the «Smart City» theoretical analysis of the basic definitions results, the author's vision of this concept is offered. The «Smart City» concept has an interpretation that gives an opportunity for effective use of resources by all stakeholders of city life to ensure comfortable and quality living conditions in the context of human rights protection at the implementation of the digitalization strategy. The study highlighted the following problems in the implementation of

«Smart City» among which organizational, management, financial, economic and infrastructure is crucial. It is justified that the directions of solving the formulated problems primarily relate to the processes of urban utilities digitization, energy, construction, public transport, as well as related to the large-scale use of integrated digital platforms in the management and education and control of environmental pollution as part of «Development concept for the digital economy and Society of Ukraine for the years 2018-2020» Implementation. There the main advantages and objectives of «Smart City» development in the context of human rights protection have been highlighted.

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## Анотація

**КЛИМЧУК Марина Миколаївна. Методологія управління інвестиційними процесами цифровізації економіки**

У статті досліджуються проблеми цифрових трансформацій управління інвестиціями на підприємстві, із виокремленням інструментальної бази на основі системної економічної теорії та інтегрованої теорії управління ризиками ІТ. Метою дослідження є розробка рекурсивної та конвергенційної методології інвестиційного управління процесами цифровізації підприємства.

Структурно відображено складові процесу інвестиційної цифровізації підприємств та сформовано детерміновану 5-компонентну модель розробки рекурсивної та конвергенційної методології управління на основі цифрової економіки. Визначено, що рекурсивно-конверсійна методологія базується на розумінні цифрових трансформацій управління інвестиціями на підприємстві як складної системи, що характеризується, насамперед, різноманітністю та неоднорідністю складових елементів, численними внутрішніми та зовнішніми зв'язками, що обумовлює різноманітність їх взаємодії, зміни складу та стану системи.

Рекурсивна модель забезпечує управління інвестиціями цифровізації в підприємство як послідовний перехід між процесами одного рівня лише після реалізації всіх циклів, передбачених для поточного процесу. Зосереджено увагу на проблемах раціонального та сталого містобудування в умовах урбанізації, що є основою для розробки та реалізації концепції «Розумного міста». У результаті теоретичного аналізу основних визначень «розумного міста» запропоновано авторське бачення цього поняття. Реалізація «Розумного міста» в контексті захисту прав людини виділено основні завдання з урахуванням розвитку когнітивних технологій.

**Ключові слова:** інвестиції, цифрова економіка, управління інвестиціями, рекурсивна модель

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