
Algorithm for Adoption of Managerial Decisions and Management of its Implementation Based on the System of Dynamic Indicators of Digital Transformation of Socio-economic and Ecological Systems¹

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Abstract. *The substantiation of the development and compliance with the algorithm for the adoption and implementation of management decisions regarding the digital transformation of the socio-economic and ecological systems of Ukraine is an urgent task for the long-term development of the country. The article presents an algorithm for making management decisions, as well as a holistic mechanism for their implementation. The main idea of the algorithm is to take into account certain aspects of the management decision-making process, to follow the general management methodology, as well as to correctly interpret and use the principles of the system approach. The decision implementation mechanism involves the formation of a complete system of implementation of organizational forms, principles, methods and management tools, taking into account the main functions of management, as well as the aspects of space and time.*

Keywords: *management decisions, digital transformation, socio-economic system, ecological system, decision-making algorithm.*

JEL Classification: *Q01, Q50, Q56, Q59*

1 Introduction

The development of managerial decisions is aimed at solving problems and contradictions in the functioning and development of an object, process or phenomenon. A comprehensive and

exhaustive analysis of the management object is important in this process. In turn, to conduct such an analysis, it is important to develop criteria for making management decisions. Management decision-making criteria are a normative basis

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for evaluating and further choosing alternatives for the functioning and development of the management object.

That is why the development of a system of indicators and criteria for evaluating the digital transformation of socio-economic and ecological systems, which takes into account the aspects of space and time (structure and dynamism), is an important task in the processes of digitalization of social relations as at the stage of making a management decision (evaluation and selection of alternatives for functioning and development of systems), and at the stage of implementation of management decisions (assessment and control of the management object, development of corrective actions, improvement of assessment methodology). At the same time, both at the stage of making management decisions and at the stage of their implementation, the developed system of indicators allows taking into account the fundamental aspects of the system under consideration – aspects of structure (complexity and balance of analysis, identification of internal patterns of system development) and dynamics (change of system parameters over time, changes and uncertainty of factors of the external environment of socio-economic and ecological systems regarding the implementation of digital transformation tasks). At the same time, the dynamic aspect also takes into account changes in development processes, and not only changes in system functioning parameters, since any socio-economic and ecological system is characterized by functioning and development processes. In the context of solving the tasks of digital transformation, development tasks, that is, structural and qualitative changes in objects, become especially important. Dynamism can also characterize a change in internal trends and patterns of development of socio-economic and ecological systems.

The process of making a management decision is described above. At this stage, a number of aspects need to be additionally taken into account. The next stage is the implementation of management decisions to achieve the goal of functioning and development of socio-economic and ecological systems at various levels. The process of implementing a management decision, as one of the basic connecting links of systems in the socio-economic and ecological spheres, involves the formation of another no less important connecting link – information flows in the system. First of all, these are the processes of bringing the decisions made to their executors, organizing the implementation of decisions and forming a system for evaluating and controlling the implementation of decisions, as well as

setting feedback from the object being managed. Systematization, generalization and substantiation of the basic methodological principles of making and implementing management decisions should take into account the above provisions.

2 Analysis of Recent Research and Publications

The outlined problem has been studied by many scientists. It is appropriate to consider the results of research on the system of digital transformation, digitalization in society, as well as the results of research on the development of management systems at the microeconomic level and in the public sphere.

V.A. Fostolovych, M. Dubina, R.V. Tulchynskyi, M.R. Horbatiuk, L. Shimchenko, D. Miroshnichenko, D. Kostenko, I.V. Yakushko, D.S. Tyshchenko and others researched managerial aspects of digitalization, trends in digitalization of regional economic systems, principles of development of economic systems based on digitalization in the conditions of globalization, communication component of digitalization, prerequisites of digital transformation and factors of its activation in economic systems, etc.

At the same time, the scientific literature does not highlight unified theoretical and scientific-methodical approaches to digital transformation, and a coherent system of digital transformation of socio-economic and ecological systems of various levels has not been formed.

A.P. Makhun, I.V. Shulzhenko, S.Yu. Ostapenko, V.A. Symonenko, S.V. Breus, Ye.O. Semchenko, I. Sokurenko, N.V. Vasylenko and others studied the issue of improving the process of managerial decision-making, as well as various methods and models of managerial decision-making, including in conditions of uncertainty, etc. The algorithm of managerial actions of the manager in the public sphere has also been studied. At the same time, the issue of a unified, systematic and effective algorithm for making management decisions and their implementation in the public sphere remains unresolved. In addition, there is a need to specify the algorithm for making and implementing management decisions, taking into account the features of the digital transformation of socio-economic and ecological systems.

Highlighting previously unresolved parts of the overall problem. Considering the results of the conducted research on the system of digital transformation of processes in society, it can be summarized that the unresolved parts of the research problem are the lack of a single, unified system of indicators of the state and dynamics

of the digital transformation of socio-economic and ecological systems at various levels, taking into account the introduction of breakthrough technologies, as well as the lack of unified decision-making and implementation algorithm for effective management of digital transformation processes in Ukraine at different levels.

Formulation of the goals of the paper (statement of the task). The purpose of the article is to justify the methodological foundations of the development of the management decision-making algorithm regarding the digital transformation of socio-economic and ecological systems, as well as the formation of an effective mechanism for the implementation of management decisions.

3 Presentation of the Main Research Material

The main, critically important aspects of making and implementing management decisions in the process of digital transformation of socio-economic and ecological systems at various levels are highlighted when the problems of this research are outlined. Let's consider additional aspects of management decision-making in more detail. At the stage of making a management decision when solving a problem that meets the set goal, it is important to take into account interrelated management decisions when performing all management functions (planning, organization, motivation and control). This aspect is important for the formation of the foundations for the future successful implementation of management decisions when solving specific tasks and achieving goals in the field of digital transformation of socio-economic and ecological systems.

The next aspect is control of the comprehensiveness of the decision and its balance. That is, it is necessary to take into account the interests of all interested parties in the process of digital transformation of a specific socio-economic and ecological system. The balance of the decision can be achieved by taking into account the interests of stakeholders in the goals of the system, which are based on the identified problem of the system in the field of digital transformation.

The next aspect to consider is the complexity of the control object. The complexity of the object of management (socio-economic and ecological systems) is expedient to investigate, relying on the system methodology of development. With the application of the system approach, in accordance with its main principles, it becomes possible to study the complexity of the object, the internal trends of its development, dynamism, the influence of environmental factors on it, the determination of the internal trends of its development and the

logical stages of the functioning of processes and their development.

The proposed system of indicators and criteria for evaluating the digital transformation of socio-economic and ecological systems at various levels takes into account the principles of the system approach. At the same time, certain directions and tasks of digitalization of social relations are highlighted, namely: socio-economic and ecological systems of various levels.

Based on the complexity of the management object, as well as taking into account factors of the external environment, its dynamism and uncertainty, management decisions can be programmed and unprogrammed, respectively. If the object of management is characterized by a high level of complexity, then the corresponding problems as a basis for making management decisions are unstructured, and the management decision is unprogrammed, that is, without a deterministic algorithm of actions. This means that management decisions must take into account the original complexity of the object, its dynamism and the uncertainty of decision-making conditions.

Socio-economic and ecological systems of any level belong to the class of very complex systems. Additionally, taking into account the nature of digital transformation processes and the dynamics of factors that influence these processes, the process of making and implementing management decisions regarding the management of socio-economic and ecological systems should be characterized as complex and carried out in conditions of uncertainty.

When implementing management decisions in this area, one should also be guided by the principles of dynamism and a comprehensive analysis of relevant factors influencing the object of management. That is, when implementing management decisions in the field of digital transformation of socio-economic and ecological systems, aspects of space and time should be taken into account.

The developed system of indicators and criteria for evaluating and planning the development of socio-economic and ecological systems allows for the elimination of internal and external uncertainty in the management process, as it provides an opportunity to assess the state of digital transformation of objects in a balanced manner based on indicators and criteria and to take into account the factor of the dynamics of the external environment.

Taking into account the above provisions, the management decision-making algorithm based on the system of indicators of digital transformation

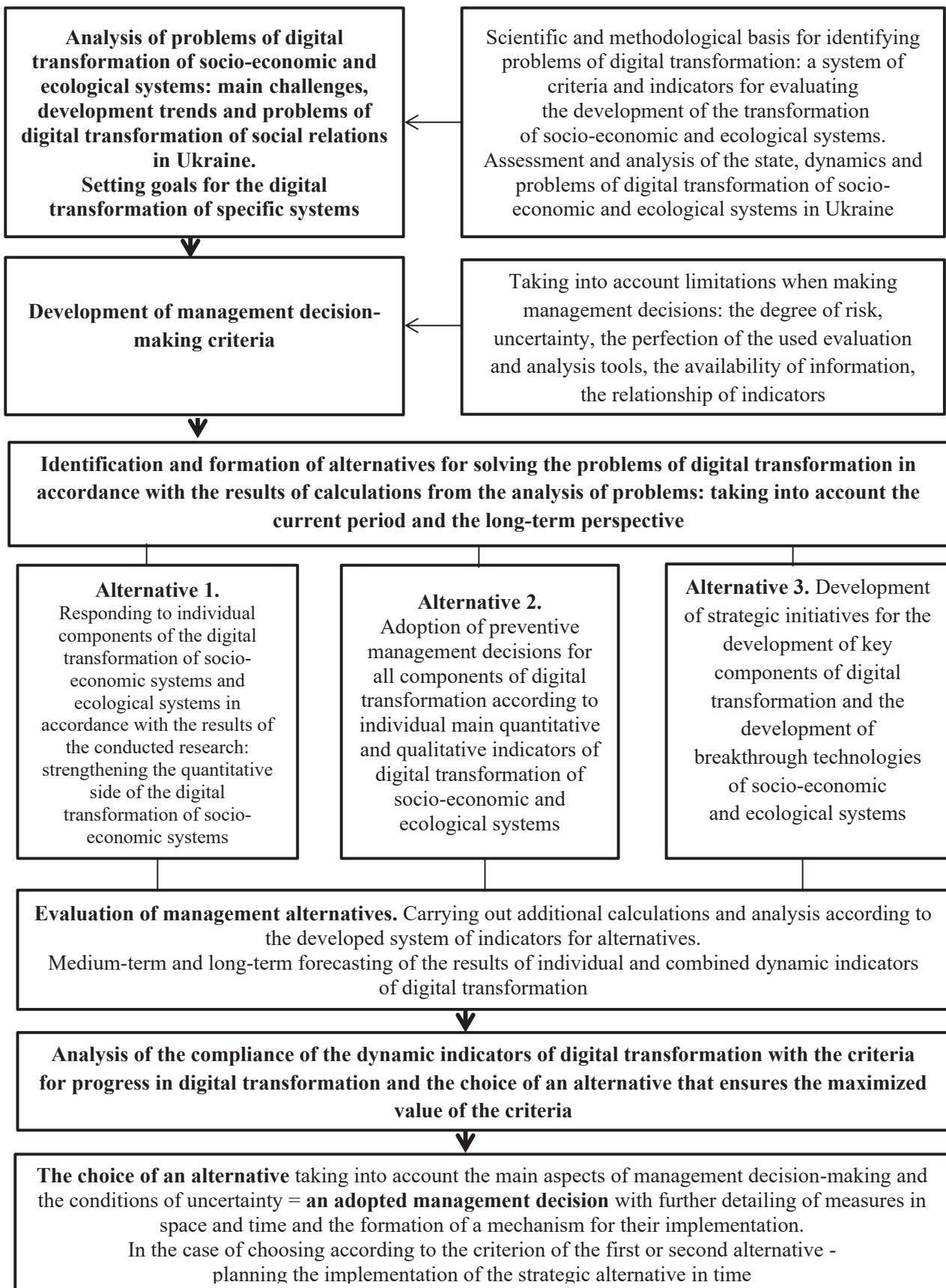


Figure 1 Algorithm for making a managerial decision on the digital transformation of socio-economic and ecological systems

of socio-economic and ecological systems can be displayed as shown in Figure 1.

The article (Voronenko, VKubatko, Kovalov, Hrytsenko, Omelianenko, 2022) presents a developed system of indicators and criteria for assessing the state and dynamics of digital transformation of socio-economic and ecological systems, as well as calculations regarding the state and dynamics of these processes for Ukraine.

The results of calculations and the use of absolute and relative indicators of the digital transformation of the socio-economic and ecological systems of Ukraine indicate positive developments in this direction of the country. At the same time, some of the absolute indicators make it possible to identify separate subproblems of the processes of digital transformation of Ukraine. The value of absolute indicators for individual areas of digital transformation, as well as strategic prospects for improving the entire process, serves as a result of an analysis of the problems and main challenges of the external environment with relevant factors regarding this area of the country's development in the algorithm for making managerial decisions regarding the digital transformation of Ukraine. At the same time, at this stage, outlining the problem completely, it is necessary to take into account the strategic aspect, that is, to rely on the prospects of digital transformation, and not only on the obtained values of absolute indicators in the evaluation system for individual directions of digitalization of social relations.

The basis that integrates all challenges can be the Goals of sustainable development, which take into account ecological, social and economic components of the system of social relations. The relevant individual factors and trends in the development of digital transformation should be taken into account in the context of the implementation of the Sustainable Development Goals.

According to the results of calculations of the state and dynamics of the digital transformation of socio-economic and ecological systems for Ukraine, negative dynamics of the composite dynamic indicator, calculated based on the absolute indicators of the digital transformation of the socio-economic systems of Ukraine, have been revealed. The main factors of the downward dynamics in this direction have been identified, namely: a decrease in the number of government institutions that have access to the Internet, the number of government institutions that provide for the use of electronic democracy tools, as well as the number of enterprises that use big data analysis methods and conduct such analysis.

With the help of a system of individual and combined indicators and criteria of digital transformation of socio-economic and ecological systems, the problem is analyzed and assessed comprehensively, which is the starting point of the management decision-making algorithm. According to the quantitative and qualitative indicators of the digital transformation of socio-economic and ecological systems, it is necessary to distinguish the sub-problems of the digital transformation of socio-economic systems in quantitative terms, the qualitative side of the digital transformation of socio-economic systems, the quantitative side of the digital transformation of ecological systems, the qualitative side of the digital transformation of ecological systems, and as well as subproblems of the digital transformation of socio-economic and ecological systems, taking into account the development of breakthrough technologies in qualitative and quantitative aspects.

At the same time, to the sub-problems indicated above, it is necessary to add defined strategic orientations with further strategic initiatives regarding the development of all directions of digital transformation and the development of breakthrough technologies in the country, which can serve as a strategic alternative, that is, an alternative when making management decisions, which can be chosen and implemented in planned period.

In addition to the analysis of strategic prospects for the development of the main components of digital transformation within the proposed system of its assessment, it is advisable to identify and monitor the main trends in the field of digitalization of social relations at the international and global levels to ensure proactive, not only preventive decisions and actions.

Selected sub-problems of the digital transformation of socio-economic and ecological systems as a result of calculations require management decisions to be made as soon as possible.

Within the framework of the analysis of the problem of digital transformation of systems, it is expedient to determine the factors that affect all these processes, as well as the relationship between the factors in the further analysis of alternatives.

The next stage in the management decision-making algorithm, after identifying and analyzing problems, is the development and selection of a system of management decision-making criteria. According to the criteria, it becomes possible to evaluate alternatives for further selection of the most acceptable one. The developed criteria reflect the main features of the researched processes,

based on the assessment and analysis of which decisions are made and implemented in the processes of managing the digital transformation of socio-economic and ecological systems at various levels.

The main criteria should be balanced, that is cover the entire management object in its key aspects and dimensions. The developed system of criteria and indicators characterizes the qualitative and quantitative aspects of the management object. At the same time, the indicators have been developed according to the key areas of digital transformation of socio-economic and ecological systems, as well as the development of breakthrough technologies.

At this stage, the main limitations of management decisions are revealed and substantiated, namely: the degree of risk, the degree of uncertainty, the scientific and methodological level of the selected evaluation tools, the availability of information, the interconnectedness of the components of the digital transformation of socio-economic and ecological systems.

The next stage of the management decision-making algorithm in the field of digital transformation of socio-economic and ecological systems is the identification of management alternatives for their further analysis and selection of the appropriate alternative. According to the calculations, the state of digital transformation of the socio-economic and ecological spheres in Ukraine is positive, only the dynamics of individual quantitative indicators of the digital transformation of socio-economic systems is declining. Therefore, as a first alternative, one can choose the development of measures and the development of those components of the digital transformation of socio-economic systems that have a downward trend during the studied period.

Taking into account the principles of the system approach, the second alternative is more appropriate – systematic and consistent improvement of all key components of the digital transformation of socio-economic and ecological systems. At the same time, this alternative requires an appropriate budget for its implementation or attracting investment funds.

The third alternative is strategic and can be chosen over time. That is, it is necessary to take into account the main trends and challenges of the digitalization of social relations, the introduction of breakthrough technologies in the world and specific problems in Ukraine on these issues, and on this basis plan strategic measures over time, taking into account measures to implement the first or second alternative.

Given these provisions regarding the identification of alternatives, it is possible to consider the identification of alternatives to be systemic according to the outlined problem.

For the final choice of an alternative, which will be considered a management decision, it is necessary to carry out additional calculations and research of socio-economic and ecological systems based on a defined system of individual and aggregated indicators. At the same time, an important task at this stage is the identification of the main factors that affect the value of the relevant indicators, as well as the analysis of the interrelationships of the components of the digital transformation of socio-economic and ecological systems.

On the basis of additional calculations and analysis of indicators of the state and dynamics of the digital transformation of the specified systems, it is necessary to forecast these indicators for the following periods within the selected horizon of planning the implementation of management decisions.

Taking into account the actual and forecast indicators of digital transformation, it is necessary to calculate the aggregated dynamic indicators of digital transformation, analyze their dynamics and compliance with the quantitative criteria of progress or regression of digital transformation. Based on the compliance of the dynamic indicators of digital transformation with the quantitative criteria and the possibilities of their optimization (maximization), a suitable alternative is selected for implementation in the current period. It is recommended to immediately choose and plan an alternative for the strategic period. This task requires additional efforts (carrying out scenario analysis, uncertainty analysis, strategic analysis to develop a specific system of measures to implement the developed strategic initiative).

The next step in the decision-making algorithm is the selection of an appropriate alternative, which is considered a management decision.

In the case of choosing according to the criterion of the first or second alternative, it is necessary to plan the implementation of the strategic alternative in time. In the case of choosing the third alternative, it is recommended to develop a strategy for the digital transformation of the socio-economic and ecological systems of Ukraine, taking into account different levels of the systems and with the development of specific plans, programs, projects and measures for the short-, medium- and long-term perspective of development.

Nevertheless, it is expedient for managerial decisions to be aimed both at solving the current problems of digital transformation of socio-

economic and ecological systems, and at solving strategic problems, which will create a reliable basis for the positive dynamics of digital transformation, the development and implementation of breakthrough technologies, as well as socio-economic ecologically sustainable development of the country as a whole.

When making a management decision one should take into account all aspects of management decision-making outlined above.

The next step after making a management decision is to detail the chosen alternative and develop specific measures for its implementation. For the implementation of the planned measures, it is important to build an appropriate mechanism for their implementation, which will take into account rational management decisions regarding also other areas of management (organization, motivation, regulation and control). An effective mechanism for the implementation of management decisions will allow to manage the process of implementation of management decisions and relevant measures and at the same time achieve the planned results.

Separately, we will consider the mechanism of implementation of management decisions to increase the positive dynamics of indicators of digital transformation of socio-economic and ecological systems, which covers basic principles, methods, organizational forms, tools, levers. Such a mechanism is a system formation that allows to ensure the integrity of the processes of implementation of management decisions regarding the object of management and the achievement of the planned goals of digitization. The mechanism of implementation of management decisions regarding the digital transformation of socio-economic and ecological systems is presented in Figure 2.

Management of the implementation of managerial decisions to solve the tasks of digital transformation of socio-economic and ecological systems should include consideration of aspects of space and time. The aspect of space means taking into account the complexity and internal mechanisms of functioning and development of socio-economic and ecological systems. At the same time, the scale of the management decision and the consequences of its implementation in relation to the development of the system at a certain level and the nature of the system under consideration should also be taken into account. The aspect of time involves the removal of external uncertainty in the process of planning and implementation of measures of digital transformation of systems.

A separate issue is the uncertainty in making management decisions, that is the insufficient amount of information about the current and

future state of the management object and its development trends. Uncertainty is also determined by the dynamism and complexity of systems, since if the object of management is not analyzed by its fundamental nature, internal patterns of development are not determined, and the change in the main influencing factors is not predicted, then the level of uncertainty in making management decisions increases significantly.

After making a management decision in the field of digital transformation, that is a justified choice of a management alternative for the current, medium and long-term perspective, the task of detailing the chosen alternative arises. The development of ways to implement the chosen alternative is carried out in the process of managing the implementation of management decisions.

The process of implementing a management decision begins with planning the implementation of the chosen alternative. At the same time, it is also possible to develop a separate strategy for the digital transformation of Ukraine in the event that a third alternative is additionally chosen as an alternative for implementation in time, taking into account the redistribution of available resources and the attraction of future financing of plans, projects and programs aimed at the development of digital transformation and the introduction of breakthrough technologies.

Planning the implementation of the selected alternative involves the development of a plan as a holistic combination of goals, target indicators and measures aimed at achieving the goals. Programs and projects, including investment projects, are being developed to implement measures within the management alternative of digital transformation. At the same time, it is important to integrate strategies, strategic initiatives, plans, projects and programs into the system of relevant documents in the field of digital transformation, socio-economic and ecologically sustainable development of the country, taking into account the principles of effective hierarchical planning and the features of the system of multi-level public administration in Ukraine.

As part of planning the implementation of the chosen alternative, various management decisions are also made regarding the development of plans and the possibilities of further successful implementation. A separate important issue is the development of target indicators of digital transformation and the introduction of breakthrough technologies. If the development of the digital transformation of any territorial system is planned, then the actually achieved successful results of the development of another territorial system in

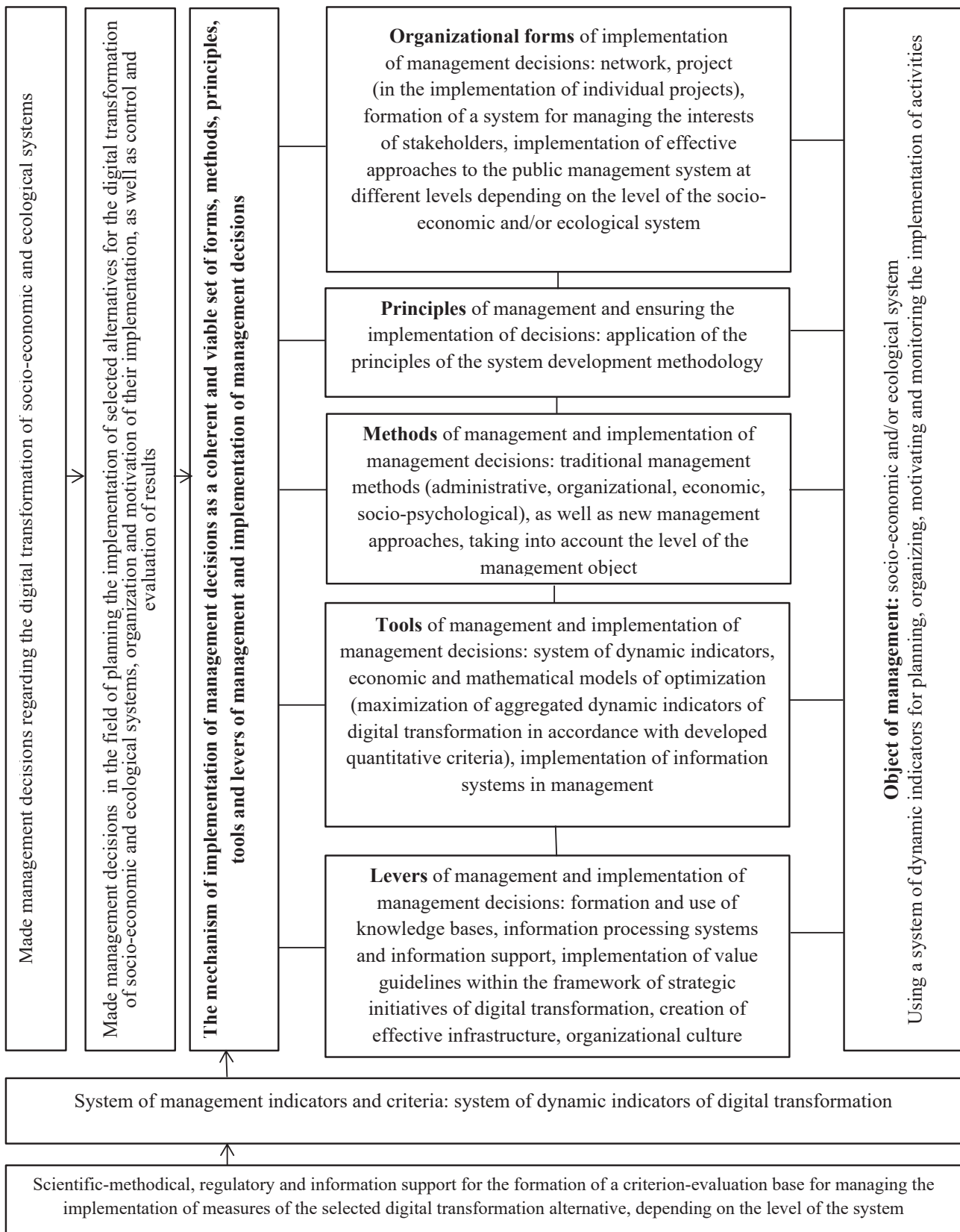


Figure 2 The mechanism of implementation of management decisions in the field of digital transformation of socio-economic and ecological systems

this area can be chosen as target indicators. In the case of planning the development of the country's digital transformation, it is important to take into account the main global challenges in this area and the development trends of digitalization of social relations in the world, as well as the potential of the country itself.

The next stage of implementation of management decisions (selected alternatives) is the implementation of the function of organizing the implementation of strategies, strategic initiatives, programs, plans, investment projects. An important issue in this regard is the choice of appropriate organizational forms, organizational structures, as well as the formation of a system of information flows within the information system of the management object. In a general sense, the organization involves the combination in space and time of performers, means and objects of work (necessary resources).

The motivation for the implementation of plans, projects, programs, and strategic initiatives involves decision-making in the field of forming a system for evaluating the work results of individual performers and project teams and means of measuring them. A system of internal and external remuneration of performers based on the results of measures and alternatives as a whole is also assumed. The motivation system should be based on the system of indicators for evaluating the components of transformation in space and time, that is, assessment of the components of digital transformation and evaluating the dynamics of their progress or regression.

The system of indicators and criteria of digital transformation serves as a regulatory and evaluation base for the performance of such management functions as monitoring and control. A detailed system of indicators and quantitative criteria of digital transformation is a prerequisite for reducing the strategic gap (deviation) between planned indicators and actually achieved ones. The system of indicators for control includes a larger number of indicators for assessing the state and dynamics of the object than the system of target indicators. Systems of these indicators should be interconnected. It should be noted that the system of indicators for monitoring the state and dynamics of the digital transformation of systems can be detailed further depending on the detailing of the measures for the implementation of the selected management alternative and the determined control points of the management decision implementation process.

In order to implement all decisions made in the field of planning, organization, motivation and control for the implementation of the chosen

alternative, it is important to ensure a holistic formation that covers the subject (management system, management apparatus) and the object of management – socio-economic and/or ecological system of a certain level, as well as basic rules, methods, tools and levers of influence on the object of management in their dynamic relationship. Such a holistic entity is the mechanism for implementing management decisions. In addition to the above-mentioned components of the management decision implementation mechanism, it is important to provide means of coordination and regulation of the management alternative implementation process in order to successfully achieve and maximize the target indicators of digital transformation.

For the effective implementation of the mechanism of implementation of the chosen management alternative of digital transformation in space and time and all decisions in the process of planning, organization, motivation and control of its implementation, it is important to apply the principles of the system methodology of development as the basic rules of management. The system approach is the original methodology for the formation of the management process itself. In particular, the application of the principles of the system approach will allow to take into account scientifically based control points, means of regulation and coordination of the process of implementation of the management decision during the current and long-term period. It is also important to apply other types of modern methodologies to increase the scientific and methodological level of the management process, which is important in view of the sphere of implementation of management decisions.

Tools and levers make it possible to ensure a more effective level of management and increase the integrability of the management object in the direction of achieving the planned target indicators. Tools and levers are used within the framework of defined methods of management and implementation of management decisions (methods of development of investment documentation, planning methods, methods of strategic analysis, methods of formation of modern organizational forms, information systems, etc.).

The following are the main recommendations for the implementation of the adopted management decisions in space and time regarding the digital transformation of socio-economic and ecological systems:

1. Development of proposals for improvement of individual components of digital transformation in accordance with the criteria of individual dynamic indicators of digital transformation and

implementation of breakthrough technologies for the socio-economic and environmental spheres.

2. Hierarchical planning and budgeting of the implementation of measures for the development of digital transformation of systems of different levels in certain areas.

3. Additional research of individual and combined dynamic indicators of digital transformation and implementation of breakthrough technologies based on their forecasting. Insufficient growth or its absence requires specific management decisions, plans, projects for their implementation for the current, medium and long-term perspectives.

4. Planning specific measures for the development of digital transformation of components of socio-economic and ecological systems, taking into account the interests of various groups of stakeholders, which are taken into account in the developed system of indicators (state, business, etc.).

5. Taking into account the interrelationships between socio-economic and ecological systems, it is advisable to simultaneously plan measures for the development of their digital transformation.

6. Integration of the developed criterion-evaluation base of digital transformation and breakthrough technologies in the socio-economic and environmental spheres into the system of state strategic planning and planning at other levels of public administration.

7. Development of proposals for the comprehensive improvement of the state and ensuring the development of digital transformation of systems of various levels in specified areas on the basis of scientific forecasts taking into account the main trends of technological development, analysis of technological systems of the leading countries of the world, challenges and trends in the field of information and communication technologies, digitalization of social relations.

8. Integration of strategic initiatives of digital transformation and introduction of breakthrough technologies into the system of state strategies, plans, programs and projects. Further integration of the directions of implementation of measures for the development of digital transformation into strategies, plans, programs, projects of the regional and local level of management.

9. Mandatory consideration of the strategic alternative of the systemic development of all components of the digital transformation of socio-economic and ecological systems, identification of key areas of development of breakthrough

technologies and planning for the implementation of the selected strategy or strategic initiative, taking into account budgeting and investment limitations.

10. Development of a holistic mechanism for the implementation of management decisions, which takes into account other areas of management decision-making (other functional areas of management) to ensure an effective management process and the achievement of planned goals and targets.

4 Conclusions

The results of the study are the following provisions:

1. The main and additional aspects of the management decision-making process, as well as the process of their implementation in the field of digital transformation of socio-economic and ecological systems at various levels, have been identified and systematized. These aspects are based on the basic principles of the general theory of management and the systematic development methodology (taking into account the aspects of time and space).

2. An algorithm for making managerial decisions regarding the digital transformation of socio-economic and ecological systems at various levels in the country has been developed, which is based on general principles of effective management and a system approach to management. As the basis of the algorithm, it is advisable to use the system of individual and aggregate indicators of digital transformation of socio-economic and ecological systems developed in previous studies. The indicated system of indicators should also serve as an effective tool for coordination, regulation, motivation and control of an object in the process of implementing the developed decisions.

3. A holistic organizational and economic mechanism for the implementation of management decisions has been formed, taking into account the peculiarities of the processes of digital transformation of social relations. The mechanism is based on the dialectical unity of the object and the subject of management, as well as the applied organizational forms, principles, methods, tools and levers of effective managerial influence on the object of management.

4. Recommendations on the implementation of management decisions in the field of digital transformation of socio-economic and ecological systems in space and time have been developed.

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