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METHODOLOGY FOR ASSESSING THE INFLUENCE OF EXTERNAL AND INTERNAL FACTORS ON THE DEVELOPMENT OF THE DIGITAL ECONOMY

Purpose. To develop a mathematical model and propose an algorithm for analyzing and evaluating the impact on the digital economy and forming the method for choosing the factors of the external and internal impact which require institutional management measures.

Methodology. Special and general methods of scientific knowledge are used: mathematical methods – for developing a model for assessing the effects on the digital economy and choosing institutional management measures; methods of analytical research – to distinguish groups of factors; the method of analysis and synthesis – when determining the most important factors and groups of influence and developing a management algorithm.

Findings. Factors influencing the directions of investment in digital technologies for mass and corporate consumers and a significant difference in the amount of financing according to them have been identified. The possibility of a decrease in the level of competitiveness of the country due to the inadequacy of investing in digital technologies for the corporate sector is indicated. Management actions to increase investment in digital technologies for the corporate sector are recommended.

Originality. The mathematical model and algorithm have been developed for the analysis and assessment of impacts on the digital economy and the formation of a method for selecting impact factors that require management measures. Using a mathematical model, the area of investing in the development of the digital economy was analyzed and management proposals for this area were developed.

Practical value. The developed mathematical model for the analysis and assessment of impacts on the digital economy and the algorithm for monitoring, analysis and management of impacts can be implemented for scientific and practical purposes.

Keywords: *methodology, digital economy, influence factors, external and internal influence, algorithm*

Introduction. The development of information technologies (IT) forms various directions of influence on the country's economy. First of all, the sphere of information services is developing; secondly, the use of digital technologies in other industries is expanding; thirdly, the impact of IT on the socio-economic sphere is increasing; fourthly, digital technologies are radically changing management processes at all levels – from enterprise management to management of economic sectors and public administration in general. All this creates a complex multi-level system, which is called the digital economy. This leads to the fact that the influence of external and internal factors increases in importance, which leads to an increase in the importance of their consequences for the economy and society. This necessitates the assessment of the effects of external and internal factors on the development of the digital economy, the development of methods for choosing priority areas that require institutional management. Today, according to world rating indicators, Ukraine is significantly inferior to neighboring Eastern European countries in terms of the level of the digital economy, which may lead to a loss of competitiveness on the global market. Increasing efficiency in assessing the impact of external and internal factors on the development of the digital economy and managing them can be a tool for correcting this situation.

Literature review. Many scientific works are devoted to the problems of the development of the digital economy. Thus, the article by Hanna [1] provides a general assessment of the digital economy: “goals, frameworks, pilot projects, results and lessons”. The approaches proposed in [1] regarding the assessment of impact factors and the need to implement measures to manage them are used in this article. Evans, et al. [2] using the example of

business implementation of corporations indicated that external and internal factors of IT influence should be considered as a single system, which also influenced the presented research. Okhrimenko, et al. [3] indicated the need to consider the impact of IT not only on the economy, but on the socio-economic system as a whole. Luo, et al. [4] indicated the possible synergistic effect of external and internal factors on the digital transformation of the economy and society. The analysis of works [1–3] indicated that the methodology for assessing impact factors, its analysis and management should take into account the needs of society and the economy. An analysis of the implementation of effective state support and management of the digital economy is provided in the article by Pang, et al. [5], which indicated the need to take into account not only economic, but also political factors. Zayed, et al. [6] provided an assessment of trends in the management of information technologies and systems using NRI technology, which is, in our opinion, an overly generalized approach. This is more specified in the article by Shkvaryliuk, et al. [7]. Gurbaxani, et al. [8] provided a qualitative approach to assessing the effects of internal and external factors and managing the process of adaptation of enterprises to these effects.

The identification of factors influencing the development of the digital economy was carried out in the scientific literature, mainly industry-wise. So Jabłonski, et al. [9] analyzed the social factors of digital transformation of railway companies. Werth, et al. [10] detailed the factors influencing the digital transformation of financial companies. Trachenko, et al. [11] analyzed factors influencing the digitalization of service companies. Agarkov, et al. [12] carried out an assessment of the factors of the digital economy in the sphere of social services by region. This indicated both differences in the impact of digital economy factors for specific industries, and common features used in our analysis. Zhang, et al. [13] studied the factors and the mechanism of their influence on digital transformation for

small enterprises. Demianchuk, et al. [14] studied the mechanisms of action of the mentioned factors due to their influence on management activities in companies and enterprises. In general, an integrated analysis of the results of the abovementioned scientific works made it possible to assess the impact of IT on the economy as a whole. In the article by Trenerry, et al. [15], an important point is indicated – the presence of multi-level influence of external and internal factors on the digital economy. The work by Lozovik, et al. [16] is devoted to the improvement of methods for assessing the influence of external factors and the formation of their groups, that is, the need to manage their influence is pointed out. Kuang-Hua, et al. [17] indicated that the determination of the key factors influencing certain areas of the digital economy should be performed only by using mathematical methods. In the article by Lim, et al. [18], the catastrophic impact of military operations on the territory of Ukraine on the process of implementing the digital economy is indicated. The authors believe it necessary to consider this influence in a tangential way – due to the change in the dynamics of influencing factors. In general, the analysis of literary sources proved that, apart from the Network Readiness Index methodology, which is based on a qualitative rather than a quantitative approach, a thorough mathematical methodology for assessing the effects on the development of the digital economy has not been proposed. The methods for choosing key factors for managing the development of the digital economy have also remained unresearched.

Purpose. To develop a mathematical model and propose an algorithm for the analysis and assessment of the effects on the digital economy and the formation of a method for selecting factors of external and internal influence that require institutional management measures.

Methods. As it has been shown by the established method of analytical research of literary sources, the system of external and internal factors influencing the development of the digital economy in the first approximation, in accordance with the proposals of Trenerry, et al. [15], should be considered at the level of groups of factors. This is also useful given the fact that the composition of factors in each group can change and these changes can have a distinct dynamic character. At the same time, groups of factors and, accordingly, the results of the influence of each of the groups are relatively stable. The identification of the results of the influence of each of the groups makes it possible to analyze the dynamics of change in each of the directions and, accordingly, creates the prerequisites for change management or, in the case of the impossibility of using control levers, the development of mechanisms for adapting the digital economy to changes.

A mathematical model has been developed to assess and analyze the effects on the digital economy and to develop a method for choosing directions for managing these effects using methods of mathematical formalization. The proposed model has three components: assessment of the impact of groups of factors; identification of factors in these groups that have a greater impact than others on a certain sphere of the digital economy; formation of management decision directions.

The entropy approach, proposed by Bazaluk, et al. [19] and modified by the authors for the above-mentioned problems, is the basis for estimating the magnitude of the effects of groups of factors. The modification was as follows. The entropy function, in this case, is a qualitative and quantitative representation of the total influence of groups of internal and external factors in their dynamics on the development of the digital economy. For the analysis, it is not so much the absolute values of the factors that are important, but the dynamics of the effects of their groups, which provides the opportunity to choose the best option for their change. For scalar quantities, the indicator of change is their first derivative in time. Since groups of factors that can be presented in a matrix or vector form are analyzed, the so-called “derivative in the direction” is used to represent their changes over time. The indicated derivative is a generalizing concept for the partial derivatives of individual scalar components of the matrix. The de-

rivative in the direction shows the rate of change in the value of a group of parameters according to the direction of their vector.

The next problem that needs to be solved is the different mathematical scales of variables: fuzzy, deterministic, stochastic, linguistic, etc. In general, this problem is solved according to the method described in the work by Bazaluk, et al. [19]. Since the external and internal factors of influence have, in their considerable quantity, a fuzzy nature, it will be considered in more detail. The fuzzy set is represented as intuitive (IFS), i. e., such that is represented by the fuzzy variables of the function f_i^s on the general space of variables U . Mathematically, this can be represented as

$$E[\nabla_r \vec{x}] = E\left([\nabla_r x_1] \dots E[\nabla_r x_n]\right)^T \text{ for } \nabla_r \vec{x} = (\nabla_r x_1, \dots, \nabla_r x_n)^T : U \rightarrow R, f_i^s = f_i^s(\nabla_r \vec{x}),$$

where E is the entropy of the group of factors x_1, \dots, x_n herein after referred to as the “base group”; n is the number of factors in the group; $\nabla_r \vec{x}$ is the time derivative in the direction of the vector \vec{x} , whose components are the factors x_1, \dots, x_n defined on the space U .

The task of management is to minimize undesirable trends in the development of the digital economy, i. e.

$$E[\nabla_r \vec{x}] \rightarrow \min.$$

The following mathematical approach was used for the component determination in groups of factors that have a greater influence than others on a certain sphere of the digital economy in order to use management tools specifically for them. Let us call the starting, widest, set of influence factors the “base group” and denote it by the abbreviation “bg”. The starting set can be described by the matrix $Q_{bd} \in \nabla^{a \times b}$, where $a = a_1 a_2$, $b = b_1 b_2$. The formation of new groups of factors $a_1 a_2$, the formalization of the exclusion of less influential factors from the base group for comparison with the influence of the base group can be represented mathematically as $Q_1 = a_1 b_1$, $Q_2 = a_2 b_2$ then, for their comparison, we use the following approach

$$\varnothing(Q_1, Q_2) = \|Q_{bg} - Q_1 Q_2\|_F = \|Q'_{bg} - \text{vec}(Q_1) \text{vec}(Q_2)^T\|_F = \text{opt}.$$

The problem of managing the effects on the digital economy is that certain factors can have both positive and negative effects. Therefore, the mathematical approach of determining the derivative by direction was chosen for the component of the formation of managerial influence. As it is known the derivative of the function $f(x) = f(x_1, x_2, \dots, x_n)$ by the direction $\vec{V} = (v_1, \dots, v_n)$, where v_1, \dots, v_n are the directions of action of individual factors x_1, \dots, x_n in multidimensional space, allows determining the tangent vector to the response surface

$$\nabla_V = \frac{f_{av}(x) - f[x + h(\vec{V})]}{h},$$

where h is the negative influence of the factors of the corresponding group; $f_{av}(x)$ is the function of the comparison group according to the corresponding set of factors.

That is, the value of $\vec{L} = \left\{ f_{av}(x) - f[x + h(\vec{V})] \right\}$ forms the direction of management action under the condition $h(\vec{V}) \rightarrow \min$, and $\vec{L}/f_{av}(x)$ is a relative indicator in this direction.

The method of analysis and synthesis was used in determining the most important external and internal factors of the development of the digital economy, their groups and identifying the results of their influence. This method was also used in the construction of the algorithm for the implementation of the methodology for evaluating external and internal factors of influence on the development of the digital economy in order to manage this influence.

Results. According to the analysis of the scientific literature, researchers of the digital economy rely mainly on the study of changes in the rating assessments of the country and study the reasons for the increase or decrease in the country's position according to the specified ratings. When analyzing the factors influencing the digital economy, the attention of researchers is mainly focused on the positive consequences of this influence. The negative consequences of the influence of the mentioned factors are mostly ignored. In our opinion, when analyzing ratings, attention should be paid primarily to the dynamics of changes in the difference between the rating assessment and the average indicator. The reason for this, in particular, is that various common factors, for example, the pandemic, or the state of the world economy, etc. can have a general impact on the fluctuations of the ratings of all countries. A change in the position of an individual country in the rating can also be influenced by a change in the number of countries that are subject to evaluation from year to year and the method of their inclusion in the list for rating. The analysis of relative indicators allows excluding the influence of errors in the assessment of each of the named factors separately.

The dynamics of changes in relative indicators makes it possible to assess the short- and long-term effects on the development of the country's digital economy. Evaluating the difference in assessment by groups of factors and their average indicators of other countries allows one to reveal the specifics of the influence of each of the groups on the development of the country's digital economy and the weight of this influence on the dynamics of change as a whole. This approach to the assessment of external and internal influences creates prerequisites not only for the selection of factors that require institutional management. When the negative impact can be predicted in the early stages, relatively small adjustments allow achieving the desired result in the long run. In management theory, this is called the "butterfly effect". In the analysis, it is worth separating the impacts, the consequences of which are achieved in a relatively short time, from the impacts, the consequences of which are delayed for a longer perspective. It should also be taken into account that in Ukraine the influence of factors on the development of the digital economy is not uniform due to unevenness in development between regions, communities, social communities, etc. Equalizing interregional and territorial disparities in IT development, accelerating the spread of digital skills of the population of depressed locations is one of the management tasks for accelerating the development of the country's digital economy. Unfortunately, in the conditions of war, these inequalities in development tend to increase catastrophically. The above mentioned makes it necessary to: estimate the relative parameters, determine the directions of their changes, identify the degree of use of the influence potential of each of the factors; assessment of not only positive but also negative impacts to neutralize unwanted trends in the digital economy.

According to the analysis of scientific works, in particular, given in the literature review, the main directions of the formation of the digital economy can be distinguished: personnel support for the development of IT; compliance of the legal and regulatory framework of the country with the requirements of the development of the digital economy; the formation of an appropriate political and institutional environment for the formation of general social factors for the spread of digital skills among the population; the level of design and implementation of modern architecture of information systems, distribution of open standards and open source software; level of implementation of digital infrastructure in the country, etc. On the basis of the specified analysis, it is also possible to determine the spheres of influence of the named factors. Personnel policy, regulatory and legislative activity, internal policy of formation of social factors promoting the development of the digital economy create groups of factors of internal influence. The formation of directions for the development of digital technologies by the leading countries of the world, the pace of their

implementation forms a general trend of the world economy, which determines the level of competitiveness of countries. This sets the pace of development of the national economy, the pace of its digitalization, which together forms an external influence. The distribution of influence factors in the indicated directions is to some extent subjective. A more formalized approach, in our opinion, is the division into groups proposed by the Huawei company when introducing the Global connectivity index [20] (Table 1). In order to implement the above-suggested approach to evaluating the dynamics of the difference between the rating and the average indicator and determining the relative indicators of Ukraine using the data of the Global connectivity index [20], the calculations used a comparison with the relevant data for the EU countries that are territorially close to Ukraine: Poland, Romania, Bulgaria (Table 1). The relative indicators (%) were calculated according to the formula $a = (a_{ukr} - a_{gr}) \cdot 100 / a_{gr}$, where a_{ukr} is the factor of the digital economy of Ukraine, a_{gr} is the average factor of the economy of the countries of the group defined for comparison.

This makes it possible to implement the first component of the proposed mathematical model regarding the estimation of the influence of groups of factors in their dynamics. Unfortunately, according to the available sources [20, 21], the necessary information is provided at intervals of a year, not a month. This slightly reduced the possibilities of applying the proposed mathematical model as an example of its implementation.

The formation of directions according to the groups of factors specified in Table 1 requires significant financial resources, especially since the analysis of the implementation of digital economy technologies indicates uneven changes in their indicators in dynamics (Table 2). As it can be seen from the data presented in Table 2, with a certain lag in the implementation of cloud technologies, artificial intelligence, the direction in relation to the installed base of IOT has significantly better results. This, in particular, shows the unevenness of investments in these directions.

Using the proposed mathematical model, we will consider the sphere of investment in the development of the digital economy. According to the information provided by the State Statistics Service [21], the volume of investments in software and databases is growing year by year (Table 3). But to what extent does this growth meet the needs of Ukraine's digital economy?

To establish the needs of the digital economy of Ukraine, let us focus on the analysis of investment directions in the digital economy and select from the starting group of factors [20]

Table 1

The dynamics of changes in the relative indicators of Ukraine by groups of factors

No	Groups of factors	Years				
		2017	2018	2019	2020	2021
1	Supply	14.29	13.00	18.69	15.51	10.50
2	Demand	28.00	28.99	32.96	30.99	9.99
3	Experience	0.00	7.82	11.76	8.41	6.89
4	Potential	17.24	16.39	18.40	8.33	4.73

Table 2

Dynamics of lagging behind relative indicators of Ukraine in the implementation of digital economy technologies

No	Factors	Years				
		2017	2018	2019	2020	2021
1	Broadband access	28.26	32.65	34.00	30.83	33.12
2	Software updates	4.06	9.30	17.69	29.30	33.30
3	Artificial Intelligence	4.55	14.38	28.70	39.85	50.22
4	The IoT base is installed	14.20	25.00	14.29	5.33	1.89

those that, according to the definition of the Global connectivity index, relate to investment (Table 4).

The investment directions listed in Table 4 and proposed as an indicative Global connectivity index [20] can be divided into two groups on the basis of the results of the analysis.

The first group, as it can be seen from Table 4, is mainly intended for the sphere of mass consumption of digital services: IoT, 4G and 5G connection, fiber optic networks, telecom technology. Investment needs for this group are mostly satisfied to a greater extent than for the group aimed at the needs of the corporate sector.

The second group is intended mainly for the corporate sector: cloud technologies, artificial intelligence, R&D Expenditure, Software Developers. This group, as it can be seen from Table 4, needs a significant increase in investments. This conclusion is confirmed by the analysis of the indicator “ICT Influencing New Business Models” [20]. The value of this indicator demonstrates that Ukraine is lagging behind even the average indicator for the group of neighboring countries, and its dynamics – the growth of this lag from year to year.

The reason for this is confirmed by the analysis of the data presented in Table 4, which indicates the need to take certain

management measures regarding the backlog of investments in those directions that are intended for the corporate sector.

The revealed disparity in investing in the areas of digital services for mass consumption and those intended for enterprises, organizations and corporations, in our opinion, is explained by the fact that investors in the IT sphere chose the following path – the pace of implementation of those directions that lead to mass use of IT is ahead of the pace the development of directions that allow the development of the IT business of corporations, with the exception of those industries whose activities are impossible without the introduction of IT (for example, the banking sector). This makes it possible to quickly pay off investments in IT for mass consumption. But the condition of parallel growth of the economy also requires increased investment in IT for industry, agriculture and other spheres of economic activity. Payback of these investments will take more time.

This makes it necessary to choose the goals of managing the influence of external and internal factors on the development of the digital economy. That is, it is worth highlighting the achievement of short-, medium- and long-term results. This is due to the fact that the action of each of the factors may differ from the action of others with its own lag in time.

The above conclusions are confirmed by the results of our study. For example, it was found out that investments in the direction of “IT and other information services” have the maximum value of the correlation coefficient (0.8846) with the volume of services implemented in this direction with a time lag of three years. At the same time, the correlation coefficient between the volume of implemented services and the number of trained IT specialists with bachelor/s degree is the highest from year to year (0.58).

Also, our research revealed that the correlation coefficient of investments in the direction of “IT and other information services” with the number of recorded criminal offenses for cyber-crimes from year to year has the highest value (0.782), which is a clear confirmation of the presence of not only positive, but also negative effects of groups factors by direction. The identified correlation requires an increase in spending on cyber security at least at a proportional level with the dynamics of the volume of investments in the direction of “IT and other information services”, which is indicated in the corresponding line of Table 4. The analysis of Table 4 also indicates that the investment opportunities of Ukrainian business for the development of the digital economy are not unlimited and monetary resources are not enough to simultaneously achieve short-, medium- and long-term results.

This, according to the algorithm of the mathematical model, conditions the selection of groups of influential factors $a_1 a_2$ with the set goal of management action – a faster increase in mass consumption, and, accordingly, in taxes in this direction of the development of the digital economy or the promotion of the development of the digital corporate sector. The group chosen in this way can also be further reduced by taking into account other limiting realities, for example, the choice of tactics for the development of the digital services market or taking into account the country’s strategy for equalizing disparities in the development of the digital economy by region and industry.

Impact management tools can be different. At present, for example, education in the IT sphere is largely financed from the state budget. The formation of the areas of this education will influence the provision of personnel for the relevant areas of development of the digital economy. One of the management tools can also be institutional support at the international level for the protection of intellectual rights of Ukrainian IT developers. This is due to the fact that there is a significant lag ($\bar{L}/f_{av}(x)=0.55$) in the sphere of protection of intelligent IT developers from EU countries. The following management tools can also be used: increasing the effectiveness of regulatory support for producers and consumers of the IT sphere; tax benefits and favorable taxation regimes, etc.

In particular, for the implementation of tactical tasks of the development of the digital services market, the problem of the

Table 3

Investments in software and databases

Years	The volume of investments in actual prices, million hryvnias	Share of the total volume of investments, %
2017	7776.9	1.9
2018	10719.9	2.0
2019	9886.6	1.7
2020	10330.7	2.5
2021	13731.5	2.6

Table 4

Investment directions based on the results of data analysis

Direction of investment	$\bar{L}/f_{av}(x)$	Conclusions
R&D expenditures	0.3	The need to increase investment rates is high
IT personnel	0.33	Increased investment in security software is needed
Software development	0.33	The need to increase investment rates is high
4G and 5G connection	0.2	There is a need to increase the pace of investment for the corporate sector
Telecom Investments	0.1	The need to increase investment rates is minimal
Fiber optic networks	0.1	The need to increase investment rates for the population is minimal
Information and communication technologies	0.3	There is a need to increase investment rates for the corporate sector and the population
International bandwidth of the Internet	0.5	The need to increase investment rates is minimal
Cloud technologies	0.33	There is a need to increase investment rates for the corporate sector
Internet of Things IoT	0.2	The need to increase investment rates
Artificial Intelligence	0.5	The need to increase investment rates for the corporate sector is significant

high price of digital equipment and software needs to be solved, relative to the level of the population's solvency and the discrepancy between the budgets of enterprises and organizations. This influence may induce customers to buy cheaper, used equipment and use unlicensed software. The use of such equipment and software in the future will lead to a decrease in the quality of services and the reliability of their provision. A deepening of the difference between the level of consumer solvency and the price of digital equipment and software may result in a further sharp reduction in demand, which, accordingly, will have a negative impact on the development of the digital economy. This emphasizes the importance of each component of the model for the formation of management decisions.

Since the system of factors affecting the digital economy is complex and multi-level, the methodology for evaluating factors, managing them, and adapting the economy and society to their changes requires the implementation of an appropriate level of algorithmization. For this purpose, an appropriate algorithm for the implementation of the methodology for assessing external and internal factors influencing the development of the digital economy and managing this influence has been developed (Figure).

The implementation of this algorithm is more effective for reducing the time intervals (month, trimester) of obtaining information for the implementation of monitoring, conducting an assessment and analysis of the dynamics of internal and external factors influencing the digital economy, and choosing the directions of managerial influence.

The effectiveness of the algorithm will be increased not by the occasional introductions of management actions regarding the digital economy by institutional structures, but by establishing a system of permanent monitoring of the state of the country's digital economy, assessing the dynamics of changes in internal and external factors influencing the digital economy; prompt decision-making regarding the adjustment of the digital economy implementation strategy and the implementation of relevant tactical management measures; development of forecasts and implementation of appropriate measures in political, regulatory, tax, social and other spheres.

Conclusion. As nowadays the importance of the influence of external and internal factors on the development of the digital economy is increasing, this leads to an increase in the importance of their consequences for the state and society. The proposed model has three components: assessment of the impact of groups of factors; identification of factors in these groups that have a greater impact on a certain sphere of the digital economy than others; formation of management decision directions. The entropy approach, modified to evaluate the dynamics of the effects of groups of factors using the directional derivative, is the basis for assessing the magnitude of the effects of groups of factors. Derivative in the direction of groups of influence factors allows revealing the rate of change of influence in the direction of their vector. For the use of management tools, the method for selecting factors from the most representative group by analyzing the dynamics of changes in relative indicators is used. Such an analysis makes it possible to assess the short- and long-term effects on the development of the country's digital economy. Using a mathematical model, the area of investing in the development of the digital economy is considered. When analyzing the largest representative group of factors given in the source of information taken as a base – the Global connectivity index, the factors influencing two areas of investment – technologies for mass consumers and technologies for use by enterprises, organizations, and corporations – were identified. It was found out that the level of investment in the technologies of these areas is different. They mainly invest in technologies for the mass consumer. This leads to a significant lag of the country in the digital sphere, which is confirmed by the analysis of the "ICT Influencing New Business Models" indicator. The duration of such a lag in time can lead to a significant decrease in the level

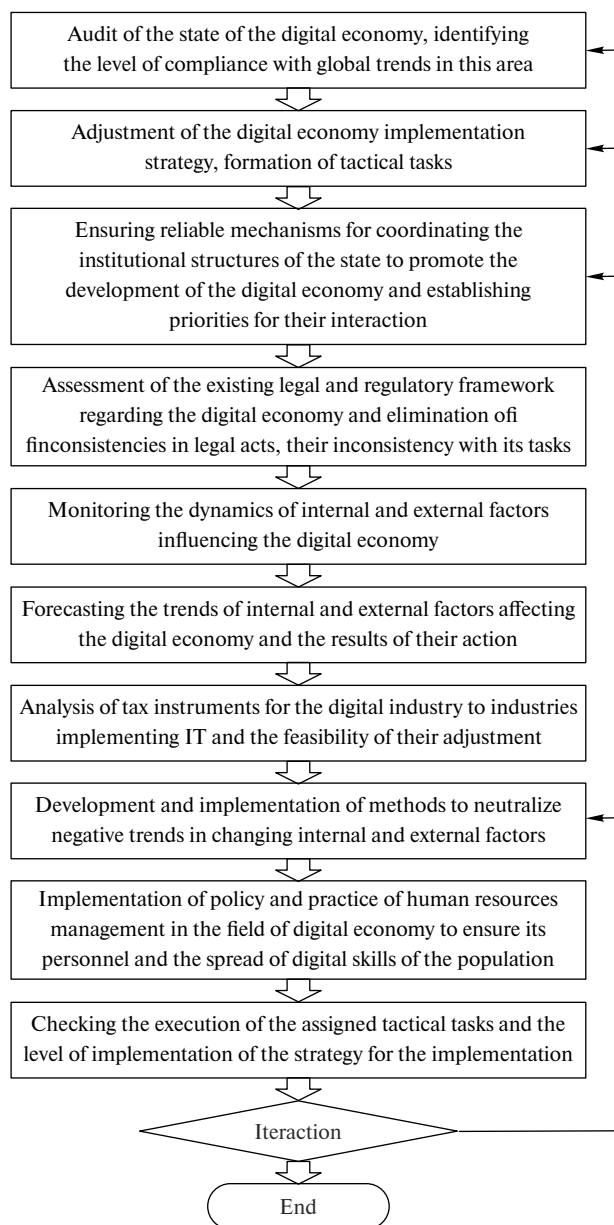


Fig. Algorithm for the implementation of the methodology of assessment of external and internal factors of influence on the development of the digital economy and management of this influence

of the country's competitiveness. Therefore, it is recommended to use institutional management tools to increase investments in digital technologies for industry, agriculture and other areas of economic activity. Concrete management tools have been proposed, in particular, changes in the amount of budgetary funding for the training of IT specialists in certain areas, the introduction of institutional support at the international level for the protection of the intellectual rights of Ukrainian IT developers, an increase in the effectiveness of regulatory support for producers and consumers of the IT sphere, tax benefits and favorable taxation regimes, etc. Since the system of factors affecting the digital economy is complex and multi-level, the methodology for evaluating factors, managing them, and adapting the economy and society to their changes requires the implementation of an appropriate level of algorithmization. For this purpose, an appropriate algorithm for the implementation of the methodology of assessment of external and internal factors of influence on the development of the digital economy and management of this influence has been developed.

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Методологія оцінки впливу зовнішніх і внутрішніх факторів на розвиток цифрової економіки

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Мета. Розробити математичну модель і запропонувати алгоритм для аналізу та оцінки впливів на цифрову економіку й формування методу вибору факторів зовнішнього та внутрішнього впливу, що потребують заходів інституційного управління.

Методика. Використані спеціальні й загальні методи наукового пізнання: математичні методи – для розроблення моделі оцінки впливів на цифрову економіку й вибору заходів інституційного управління; методи аналітичного дослідження – для виокремлення груп факторів; метод аналізу й синтезу – при визначенні найбільш вагомих факторів і груп впливу, розробленні алгоритму управління.

Результати. Виявлені фактори впливу на напрями інвестування у цифрові технології для масового й корпоративного споживача та значну різницю в обсягах фінансування за ними. Вказано на можливість зменшення рівня конкурентоспроможності країни через невідповідність інвестування у цифрові технології для корпоративного сектору. Рекомендовані заходи управління для збільшення інвестицій у цифрові технології саме для корпоративного сектору.

Наукова новизна. Розроблені математична модель і алгоритм для аналізу та оцінки впливів на цифрову економіку й формування методу вибору факторів впливу, що потребують заходів управління. За використання математичної моделі проаналізована сфера інвестування в розвиток цифрової економіки й розроблені пропозиції управління цією сферою.

Практична значимість. Створені математична модель для аналізу та оцінки впливів на цифрову економіку та алгоритм моніторингу, аналізу й управління впливами можуть бути реалізовані для наукових і практичних цілей.

Ключові слова: методологія, цифрова економіка, фактори впливу, зовнішній і внутрішній вплив, алгоритм

The manuscript was submitted 24.11.22.