International Journal of Sustainable Development and Planning
Vol. 18, No. 10, October, 2023, pp. 3327-3332
Journal homepage: http://iieta.org/journals/ijsdp

Scenario Modeling for Sustainable Development in Dynamic Environments

Borys Pohrishchuk[1*], Mariya Bardadym[2], Maksym Kovalskyi[3], Iryna Martusenko[4], Viacheslav Rogov[5]

[1] The Vinnytsia Educational and Research Institute of Economics, West Ukrainian National University, Vinnytsia 21000, Ukraine
[2] Department of Accountancy, Taxation and Management of Financial and Economic Security, Dnipro State Agricultural and Economic University, Dnipro 71000, Ukraine
[3] Central-Western Interregional Department, Ministry of Justice, Khmelnytskyi 11000, Ukraine
[4] Department of Economics, Accounting and Taxation, Vinnytsia Educational and Scientific Institute of Economics, West Ukrainian National University, Vinnytsia 21000, Ukraine
[5] Department of Intellectual Digital Economy, Admiral Makarov National University of Shipbuilding, Mykolayiv 54000, Ukraine

Corresponding Author Email: b.pogrishchuk@wunu.edu.ua

https://doi.org/10.18280/ijsdp.181032

Received: 11 July 2023
Revised: 18 September 2023
Accepted: 23 September 2023
Available online: 31 October 2023

Keywords:
sustainable development, adaptation, scenario, environment, modeling

ABSTRACT

Today, conditions are characterized by high dynamics of changes in the external environment, which has a significant impact on ensuring sustainable development. The main purpose of the article is to model the choice of a scenario to ensure the achievement of sustainable development in a dynamic environment. The object of the study is the activity of specific socio-economic systems in the framework of sustainable development. The method of analysis of hierarchies formed the basis of the methodology of the article. As a result of the study, the article proposes a scientific and practical approach to determining the nature of adaptation procedures, which, in contrast to the existing ones, based on the nature of changes in the external environment and the application of the hierarchy analysis method, involves the choice of a static or dynamic type of adaptation, which determines the content of adaptation procedures for ensuring sustainable development. The main results of the study are revealed in the approach proposed by the authors when choosing a scenario for ensuring sustainable development. Certain limitations influence the results in such a way that possible scenarios will not be effective for other regions. The prospects for further research will aim at expanded facilities through the selection of more sustainable development activities. That is, in the future, we will consider ensuring sustainable development not only of the country, but also of an entire set of countries, such as the EU, for example.

1. INTRODUCTION

In the modern conditions of sustainable development, it becomes obvious that any socio-economic system must constantly adjust its activities to survive and maintain competitiveness, taking into account the requirements of the external environment. This necessity arises because changes in environmental factors can create an imbalance between the socio-economic system and its environment, prompting a need for adaptation. As such, these systems must possess the capacity to make adequate and timely changes, which can often be achieved through restructuring.

Adaptation of the socio-economic system to the effects of the external environment involves the introduction of a significant number of changes in the activities of the socio-economic system; the number, nature, scale of changes and the resources needed to maintain these changes, with a significant intensity of the action of environmental factors, can be quite diverse. In this case, the determination of the nature of all changes introduced into the activity of the socio-economic system, their localization, interconnection, and, most importantly, the organization of control over the introduction of changes turn into a cumbersome and time-consuming job. The adaptation of the socio-economic system becomes uncontrollable, and therefore unmanageable. Omitting even seemingly insignificant changes in internal systems and departments can reduce the effectiveness of the adaptation process. Adaptation itself in the context of sustainable development is by far the most common category in the context of practical and theoretical research. In this sense, adaptation is used in the case when we are not talking about any specific area and its problems, but about the entire system of sustainable development. Adaptation as a mechanism of gradual economic and social shifts and restructuring enables the system to maintain the right direction and pace of sustainable development, regardless of the level and activity of the influence of external and internal factors. In addition, the adaptation system within the framework of sustainable development must be implemented with the full formation of a mechanism for economic and social response. At the same time, all adaptations must have limitations and not threaten a radical change in the functioning of the socio-economic system. Detailing our research, we chose a separate type of socio-economic system - the enterprise.

To achieve effective adaptation in the framework of sustainable development, it should be understood that it is systemic, covering all areas of the enterprise and subordinate units. The ability of an enterprise to adapt depends on the ability to reduce the risk in the enterprise from a negative change in certain factors in the external environment. The risk reflects the degree (degree) of deviation from the goals, the desired (expected) result, as well as the degree of failure, taking into account the influence of controllable and uncontrollable factors, direct and feedback concerning the control object in the framework of sustainable development.

The importance of studying the adaptation of socio-economic systems lies in the very phenomenon of the emergence of new changes in the dynamics of the external environment. It is constantly changing and new challenges are emerging that need to be adapted to our sustainable development strategy. Thus, the research question arises: What is the most optimal scenario for ensuring sustainable development under such environmental conditions? The scientific task is to determine adaptation scenarios for such socio-economic systems as enterprises in the framework of ensuring optimal sustainable development.

2. LITERATURE REVIEW

In the scientific and practical literature [1, 2], it is noted that the current stage of sustainable development of market relations requires enterprises to take active steps aimed at finding ways and mechanisms to adapt to a dynamic and unstable market environment. The toughening and sophistication of competition at all levels of management, the acceleration of scientific and technological progress, and the informatization of society encourage enterprises to quickly and timely adapt to changes in the external environment The implementation of this type of adaptation allows the enterprise to reach a new level of efficiency and competitiveness in the production of products, mastering new production paths and management paradigms, as well as introducing new types of environmental technologies.

Adaptation cannot be interpreted only as the adaptation of a particular system to changing conditions. In general, this is a complex phenomenon, accommodating the variety of conditions to which the system can adapt; and the ability to survive, that is, the strength of the system, which consists in maintaining certain stable characteristics during the restructuring; and directly the process of adaptation (adaptation) [3, 4].

Summarizing the information obtained from the studied literature sources [5, 6], we can conclude that the phenomenon of adaptation in conditions of sustainable development should be considered a complex and permanent process of evolution and development of the structure and activity of socio-economic systems, which occurs due to the need for standardized activities under different external and internal conditions. Understanding this process is only possible through a full and comprehensive study of it, including the analysis of key trends, principles, and functions of this processor. In the context of our study, a detailed analysis of the adaptation process in the sustainable development system will allow us to formulate the most effective ways to optimize the enterprise's activities, subject to changes in the external environment. The search for ways to adapt enterprises is the direction of development in various areas of their functioning, which ensures economic growth and efficient functioning in a competitive environment. Today, industrial enterprises need organizational restructuring to turn production complexes into flexible structures with a wide range of commercial products that can quickly adapt to changes in the external environment.

In the scientific literatures [7, 8], it is noted that for successful operation, modern enterprises must be reformed, and qualitatively change the methods and forms of response to external factors, that is, adapt to market requirements. The adaptation of enterprises is a factor in increasing competitiveness and the ability to operate effectively and create conditions for survival in the market. However, in the current conditions, the question of using innovative tools and new approaches to doing business also arises. Companies must actively attract and use these progressive approaches not only to maintain their existing positions but above all to acquire competitive advantages and take a leading position in the market. Therefore, innovation is vital for enterprises that set themselves the goals of successful long-term sustainable development. Therefore, the issues of combining the adaptation of enterprises to external conditions the introduction of innovative business methods, and the use of the potential of innovative entrepreneurship are extremely relevant in today's economic conditions, especially in Ukraine.

As noted in the literatures [9, 10], the essence of adaptation in the context of sustainable development is a controlled continuous process of adapting an enterprise to the goals, objectives, and conditions of sustainable development, aimed at maintaining a sufficient level of business sustainability in its evolutionary phases of the life cycle on the trajectory of sustainable development, which is set by the innovation strategy. enterprises. Ensuring the sustainability of the enterprise in this case should be considered a functional purpose of the enterprise adaptation process. Adaptation of the company is provided through a holistic system of adaptive reactions of the company (in response to the likely changes in the conditions of operation and sustainable development), which are formed through the mechanisms of adaptive management. Consequently, the adaptation of the enterprise to sustainable development allows you to effectively acquire new knowledge, skills, abilities, and technologies and timely introduce certain innovations in the enterprise.

Summarizing the review of the literature, it should be noted that there are some gaps in previous studies in the current body of knowledge, among which the following should be highlighted:

1. Modeling gap. Low research activity on the use of modern modeling methods.
2. Gap in the scenario approach. Most of the literature considers one or at most two scenarios for sustainable development. The ability to choose remains less active.

To fill these gaps, we propose a new method for choosing a sustainable development scenario.

Thus, after analyzing the literature, we concluded that within the framework of our study, we will fulfill the following scientific task: we will determine adaptation scenarios for such socio-economic systems as enterprises in the framework of ensuring optimal sustainable development.

3. METHODOLOGY

This section should clarify the key features of the methods of the article that form the research methodology. In the

process of making managerial decisions to ensure sustainable development, it usually becomes necessary to give unambiguous assessments of events and phenomena that have a complex socio-economic nature. This, in turn, requires the use of methods that allow ranking the objects of assessment by importance. To solve such problems, the method of analysis of hierarchies developed by T. Saaty is used, which is widely used by researchers and practitioners in solving economic problems [11-13].

The method of analyzing hierarchies consists of creating a specific model that includes hierarchical relationships. When constructing, it is possible to determine the values of the sums of elements of each column of square inversely symmetric matrices. Ultimately, a detailed check of the consistency of the results obtained occurs. In addition, the use of this method is accompanied by an expert assessment for the most adequate information content of the model. All generated expert conclusions are formed and systematized per the scale of the relative importance of the following objects (Table 1). This method can be conveniently used to build possible scenarios for the future and make managerial decisions to ensure sustainable development.

Table 1. The scale of the relative importance of the objects of comparison in the framework of our study

Grade	Explanation of the Choice of Grade
1	Objects of comparison are equivalent
2	One object is not significantly higher than the other
3	One object dominates another object
4	One object is significantly larger than the other
5	One object absolutely dominates the other

For better understanding, this can be thought of as a certain kind of comparison: the minimally important object in this is a unit, while the most important object consists of a certain number of such units. Carrying out such paired comparisons allows us to obtain the most accurate characterizing features of objects. A simple qualitative comparison of the levels of importance of sustainable development objects is less informative and useful for research.

Mostly, the tasks to be solved within the framework of ensuring sustainable development are multi-criteria and may contain factors of different dimensions: funds, demand for products, payback period, profit, probable risk, or be dimensionless: subjective qualities or social processes, aesthetic or spiritual nature. The intuition or practical experience of a person is not enough to solve, therefore it is necessary to apply mathematical methods. These are real conditions of uncertainty, where semi-structured and unstructured problems arise, which are solved with the help of stochastic programming, correlation-regression analysis, game theory, and the method of analyzing hierarchies.

The methodology involves the use of several methods, however, the main one is the hierarchy analysis method. The method was applied analyzing the hierarchies that are used and solving problems of ensuring sustainable development. The idea is that the selected objects are evenly compared with each other. A key feature of the method that was used in the context of our study is that the comparison examined objects that in practice do not have clear numerical estimates. That is, paired comparisons allow us to obtain more accurate characteristics of objects.

4. RESULTS OF RESEARCH

To begin with, let's present a group of changes in the external environment that have influenced and determined the sustainable development of German industrial enterprises:

SG. Structural transformations in the national economy (decrease in the number of large and medium-sized enterprises, loss of human resources).

MA. Military acts (loss of the Russian market. Non-loading of production capacities. Deterioration of financial performance. Growth in domestic demand for defense products).

GP. Strengthening globalization processes and a sustainable development strategy (growth in imports of high-tech products with the displacement of German manufacturers).

CV. COVID-19 (deceleration of economic processes. Growth in demand for medical equipment).

TA. Technological advancement (innovative passivity with increasing backlog).

As depicted in Figure 1, the ultimate goal or apex of the hierarchy is defined as the "type of adaptation". The second level consists of criteria - "Changes in the external environment that have influenced and determine the sustainable development of enterprises." At the third level, we see adaptation options, that is, "Types of adaptation" (SA - statistical adaptation scenario; DA - dynamic adaptation scenario), which are alternative scenarios for the development of the situation (Figure 1).

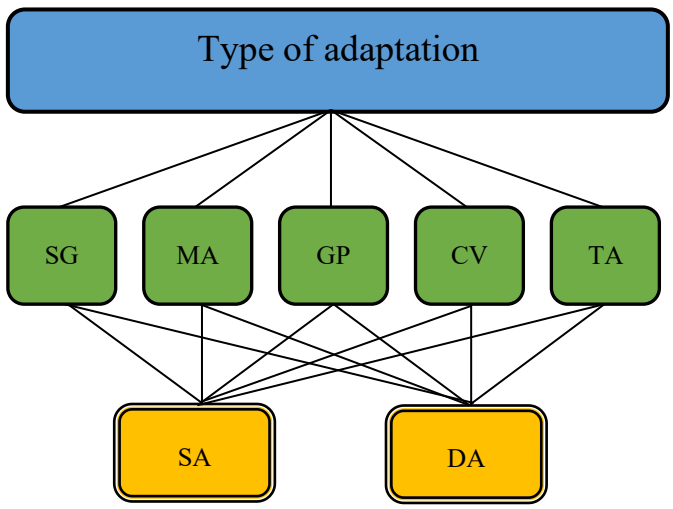

Figure 1. Hierarchy of the task of choosing the type of adaptation for German industrial enterprises

Now let's evaluate alternative scenarios. Let's define n, which in our case will mean the number of criteria at the same level. In our case, the five main changes in the external environment that influenced and determined the sustainable development of German industrial enterprises, it is necessary to make ten comparisons of different pairs of changes. The corresponding equality must be observed when comparing (1):

$$(n*(n-1))/2 \quad (1)$$

Calculations were made using the listing computer program. It should be noted that the sums of the elements of the matrix columns characterize the ordering of priorities (in other words, their significance relative to the process under study), and the eigenvalue is a measure of the consistency of estimates.

Let us explain the calculation results given in Table 2. The largest eigenvalue of the matrix $k_{max} = 5.131$. It is known that the consistency of a square inverse symmetric matrix is equivalent to the requirement that its maximum eigenvalue kmax be equal to n, so we define the matrix consistency coefficient: $(k_{max} – n) / (n – 1)$. In our case, CI=0.032.

Consistency factor, comparable to a random consistency factor, WI matrix of the same size. WI values were determined in due time by T. Saaty (for n=5, WI=1.12). The ratio of CI to WI for a matrix of the same order is the matrix inconsistency level CR=CI/WI. In our case, CR=0.029.

The applied method allows for a certain level of inconsistency in the matrix of even comparisons. The relative inconsistency should be no more than 10%.

w_i represents the elements of the columns of the pairwise comparison matrix according to the data in Table 2.

Next, we put alternative scenarios which, also have its own "n", but in order to avoid confusion, we denote the number of alternatives, that is, five comparisons of pairs of alternative scenarios, we denote as m, but equality (1) acts similarly for them.

Thus, the basis of this type is a kind of comparison: the minimally important object is a unit, and the most important object consists of a certain number of such units. Carrying out such paired comparisons allows us to obtain the most accurate signs of characterizing objects. A simple qualitative comparison of the levels of importance of sustainable development objects is less informative and useful for research. Matrices of pairwise comparisons of parameters under various changes in the external environment that have influenced and determined the sustainable development of German industrial enterprises are presented in Table 3. We do not provide data on the levels of consistency of the matrices of pairwise comparisons, because all of them are within the normal range ($CR \leq 0.1$) and confirm the correctness of the estimates obtained.

It has already been noted above that the values of the largest eigenvalue, kmax, the consistency coefficient, CI, and the level of inconsistency, CR for each of the matrices are within the normal range.

The choice of a strategy for creating an adaptive-oriented system for ensuring sustainable development (synthesis of priorities) U_i is carried out according to the formula (2):

$$U_j=\sum_{i=1}^{n} w_i\, u_{ij}; j = 1, \dots m \quad (2)$$

where, w_i is the priority of the i-th level of environmental changes that have influenced and determined the sustainable development of German industrial enterprises (i = 1,…, 5);

u_{ij} is the relative weight of each type of adaptation (j = 1, 2) according to the i-th level of environmental changes (i = 1,…, 5).

According to (2), there are the following options for calculating priority values for all alternative scenarios U_1 and U_2 (Table 4).

Table 2. Pairwise comparison matrix of environmental changes affecting the sustainable development of german industrial enterprises

k_n/k_n	SG	MA	GP	CV	TA
SG	1.0	1.0/2.0	1.0/3.0	3.0	2.0
MA	2.0	1.0	1.0/2.0	3.0	4.0
GP	3.0	2.0	1.0	4.0	5.0
CV	1.0/3.0	1.0/3.0	1/4	1.0	2.0
TA	1.0/2.0	1.0/4.0	1.0/5.0	1.0/2.0	1.0
w_i	w_1	w_2	w_3	w_4	w_5
S_j	0.160	0.264	0.418	0.090	0.066
w_i	k_{max}		CI		CR
The Results	5.131		0.032		0.029

Table 3. Matrix of pairwise comparisons of the parameters of each sustainable development scenario

u_{1j}	u_{11}	u_{12}	u_{2j}	u_{21}	u_{22}	u_{3j}	u_{31}	u_{32}	u_{4j}	u_{41}	u_{42}	u_{5j}	u_{51}	u_{52}
S_j	0.75	0.25	S_j	0.83	0.16	S_j	0.333	0.666	S_j	0.5	0.5	S_j	0.8	0.2
SG	**SA**	**DA**	**MA**	**SA**	**DA**	**GP**	**SA**	**DA**	**CV**	**SA**	**TA**	**SG**	**SA**	**DA**
SA	1	3	**SA**	1	5	**SA**	1	1/2	**SA**	1	1	**SA**	1	4
DA	1/3	1	**DA**	1/5	1	**DA**	2	1	**DA**	1	1	**DA**	1/4	1

Table 4. Choosing a strategy for creating an adaptive-oriented system for ensuring sustainable development

Scenario	Calculations
U_1	$w_1u_{11} + w_2u_{21} + w_3u_{31} + w_4u_{41} + w_5u_{51}$
U_2	$w_1u_{12} + w_2u_{22} + w_3u_{32} + w_4u_{42} + w_5u_{52}$
U_1	0.160 × 0.750 + 0.264 × 0.833 + 0.418 × 0.333 + 0.0 90 × 0.500 + 0.066 × 0.800 = 0.577
U_2	0.160 × 0.250 + 0.264 × 0.166 + 0.418 × 0.666 + 0.0 90 × 0.500 +0.066 × 0.200 = 0.422

The results obtained allow us to state that the most acceptable type of adaptation for German industrial enterprises is the dynamic type of adaptation in the framework of sustainable development.

Dynamic adaptation is used at the time of a significant increase in danger through the implementation of one or more threats through the rapid development of a program based on the need not to be limited not only by the internal environment but also by changing the nature of the impact on the subjects of the external environment, in particular through lobbying corporate interests.

5. DISCUSSIONS

In discussing our own results, our goal is to compare our article with similar ones.

When discussing our results, we should compare them with the previous ones. For example, some scientists have

developed [14-17] the technology of forming a system for ensuring sustainable development, which is a step-by-step sequence of performing interrelated actions to provide qualities for a particular enterprise that will provide the necessary flexibility in the implementation of sustainable activities. Unlike the policy traditionally used in German enterprises, the developed technology regulates paying due attention to the issue of preliminary creation of a sustainable development strategy to support the effectiveness of security actors in responding to changes in the operating environment, in particular through the implementation of an adaptation strategy.

Other scientists [18-21] as a result represent that the key conditions for the modern activity of an enterprise are the uncertainty of the market, the behavior of owners and competitors, and legislative decisions of public authorities. The enterprise exists and develops in an active external and internal environment, adapting to its changes. The complexity and instability of the environment require the enterprise not to improve the forms and methods of management, but to radically change the principles of creating management and production systems.

In the studies of other scientists, it was established [22-25] that effective sustainable development of enterprises in conditions of a high level of dynamism of the external environment and the emergence of new impact factors is possible only if the potential of the enterprise is created and constantly maintained, which will be determined by the constancy of relationships and effective interaction between business and processes. Mandatory consideration of the synergistic effect from the interaction of all business elements allows not only an economical approach to the use of resources but also to improve the mechanism of adaptive strategic management, to substantiate the vectors of sustainable development.

We can highlight the similarities and differences between our research results and those of others. The similarities include:

1. Agreement with the view that ensuring sustainable development should be variable.

2. Agreement with the idea of the importance of sustainable development for socio-economic systems such as the enterprise.

Along with this, the differences are as follows:

1. A different approach to achieving sustainable development through scenario building.

2. A different vision of sustainable development due to countering new environmental challenges.

Discussing the results of the study, we should note that the modeling was based on: the results of the study of the current conditions of the functioning of German industrial enterprises; and theoretically substantiated the content of two types of adaptation, that is, "static" and "dynamic"; familiarization with the results of applying the method of analysis of hierarchies for modeling socio-economic processes at the enterprise level, including sustainable development. The results of the implementation of the developed scientific and practical approach of determining the nature of adaptation procedures showed that the most acceptable for German industrial enterprises is "dynamic". In the conditions of an individual enterprise, the results of modeling may vary under the actual conditions of the sustainable development strategy, but the formed scientific and practical approach clearly defines the parameters of sustainable development.

6. CONCLUSIONS

To summarize, it should be noted that today the problem is not only in ensuring sustainable development but also in which version of the scenario for ensuring it should be chosen for certain socio-economic systems. We chose enterprises as an open socio-economic system and proposed several possible scenarios for their sustainable development. Modeling involves some calculations that contributed to this choice.

The scientific novelty of the results obtained provides for the proposed scientific and practical approach to determining the nature of adaptation procedures in the framework of sustainable development, which, unlike the existing ones, based on the nature of changes in the external environment of the functioning of German industrial enterprises of a certain type of activity and the application of the hierarchy analysis method, involves the choice of static or dynamic type of adaptation, which determines the content of adaptation procedures concerning the enterprise management system, the implementation of which allows the systematic improvement of the sustainable development strategy.

The study has a limitation in the form of selecting only German enterprises within the framework of our article. In addition, it was narrowed exclusively to one type of activity - industrial. Certain limitations influence the results in such a way that possible scenarios will not be effective for other regions. The prospects for further research will aim at expanded facilities through the selection of more sustainable development activities. That is, in the future, we will consider ensuring sustainable development not only of the country but also of an entire set of countries, such as the EU, for example.

In the future, the following research question opens: What scenario for the sustainable development of socio-economic systems is possible at the international level of their cooperation at the level of all EU countries?

REFERENCES

[1] Noga, G. (2018). Problems of adapting enterprises in the strategy implementation process. Case of Poland. Business, Management and Economics Engineering, 16: 222-238. https://doi.org/10.3846/bme.2018.6261

[2] Salamatov, A., Gordeeva, D., Agapov, A. (2021). Sociocultural dynamics of sustainable development: Formation of human potential in the process of integrated ecological and economic training. International Journal of Environmental Impacts, 4(1): 62-76. https://doi.org/10.2495/EI-V4-N1-62-76

[3] Ahearne, M., Lam, S.K., Kraus, F. (2014). Performance impact of middle managers' adaptive strategy implementation: The role of social capital. Strategic Management Journal, 35(1): 68-87. https://doi.org/10.1002/smj.2086

[4] Kryshtanovych, M., Antonova, L., Filippova, V., Dombrovska, S., Pidlisna, T. (2022). Influence of COVID-19 on the functional device of state governance of economic growth of countries in the context of ensuring security. International Journal of Safety and Security Engineering, 12(2): 193-199. https://doi.org/10.18280/ijsse.120207

[5] Kryshtanovych, S., Kornieieva, T., Malinovska, O., Sokolik, L., Bortnikova, M. (2022). SMART management of sustainable development of the region in

the context of globalization. International Journal of Sustainable Development and Planning, 17(6): 1765-1772. https://doi.org/10.18280/ijsdp.170610

[6] Cobbinah, P.B., Erdiaw-Kwasie, M.O., Amoateng, P. (2015). Rethinking sustainable development within the framework of poverty and urbanisation in developing countries. Environmental Development, 13: 18-32. https://doi.org/10.1016/j.envdev.2014.11.001

[7] Raharjo, K. (2019). The role of green management in creating sustainability performance on the small and medium enterprises. Management of Environmental Quality: An International Journal, 30(3): 557-577. https://doi.org/10.1108/MEQ-03-2018-0053

[8] Rainaldi, M. (2023). Digital optimization of public assets for enhanced resilience to socioeconomic and environmental disruptions. International Journal of Environmental Impacts, 6(3): 129-134. https://doi.org/10.18280/ijei.060305

[9] Sylkin, O., Kryshtanovych, M., Zachepa, A., Bilous, S., Krasko, A. (2019). Modeling the process of applying anti-crisis management in the system of ensuring financial security of the enterprise. Business: Theory and Practice, 20: 446-455. https://doi.org/10.3846/btp.2019.41

[10] Grati R., Boukadi K., Abdallah H.B. (2017). A decision-making adaptation approach based on fuzzy logic systems for composite SaaS. Ingénierie des Systèmes d'Information, 22(4): 77-106. https://doi.org/10.3166/ISI.22.4.77-106

[11] Yashiro, H., Hayashin, T. (2021). Analysis on impact of compact city progress on seismic risk fluctuation. International Journal of Environmental Impacts, 4(1): 25-35. https://doi.org/10.2495/EI-V4-N1-25-35

[12] Zemlickienė, V. (2018). Adaptation set of factors for assessing the commercial potential of technologies in different technology manufacturing branches. Business, Management and Economics Engineering, 16: 206-221. https://doi.org/10.3846/bme.2018.5402

[13] Kryshtanovych, M., Akimova, L., Akimov, O., Kubiniy, N., Marhitich, V. (2021). Modeling the process of forming the safety potential of engineering enterprises. International Journal of Safety and Security Engineering, 11(3): 223-230. https://doi.org/10.18280/ijsse.110302

[14] Bazyliuk, V., Shtangret, A., Sylkin, O., Bezpalko, I. (2019). Comparison of institutional dynamics of regional development publishing and printing activities in Ukraine: Methodological and practical aspects. Business: Theory and Practice, 20: 116-122. https://doi.org/10.3846/btp.2019.11

[15] Rushchyshyn, N., Medynska, T., Nikonenko, U., Kostak, Z., Ivanova, R. (2021). Regulatory and legal component in ensuring state's financial security. Business: Theory and Practice, 22(2): 232-240. https://doi.org/10.3846/btp.2021.13580

[16] Shakhatreh, H. (2023). Payment of Canal dues by carriers carrying out international overseas transportation – A case of legal discrimination. Studia Iuridica Lublinensia, 32(1): 251-273. https://doi.org/10.17951/sil.2023.32.1.251-273

[17] Al Azzam, F. (2019). The adequacy of the international cooperation means for combating cybercrime and ways to modernize it. JANUS.NET e-journal of International Relations, 10(1). https://doi.org/10.26619/1647-7251.10.1.5

[18] Ozerov, A., Philippe, P., Gribonval, Bimbot, F. (2007). Choice and adaptation of statistical models for single channel singing voice separation. Traitement du Signal, 24(3): 211-224.

[19] Chapman, E., Rogers, L., Kay, A. (2021). Toward just and sustainable cities: Identifying key areas for urban, peri-urban and rural sustainability collaborative initiatives. International Journal of Environmental Impacts, 4(1): 36-48. https://doi.org/10.2495/EI-V4-N1-36-48

[20] Srivastava, A.K., Sushil (2014). Modelling drivers of adapt for effective strategy execution. The Learning Organisation, 21(6): 369-391. https://doi.org/10.1108/TLO-08-2013-0038

[21] Nikonenko, U., Hanushchyn, S., Boikivska, G., Andriichuk, Y., Kokhan, V. (2020). Influence of world commodity prices on the dynamics of income of exporting countries of natural resources under globalization. Business: Theory and Practice, 21(1): 440-451. https://doi.org/10.3846/btp.2020.12202

[22] Saleh, A.J., Alazzam, F.A.F., K.K.A.R., Zavalna, Zh. (2020). Legal aspects of the management of cryptocurrency assets in the national security system. Journal of Security and Sustainability Issues, 10(1): 235-247. https://doi.org/10.9770/jssi.2020.10.1(17)

[23] Sylkin, O., Krupa, O., Borutska, Y., Todoshchuk, A., Zhurba, I. (2023). Exploring the impact of international tourism on regional sustainable development: A methodological approach for enhancing effectiveness. International Journal of Sustainable Development and Planning, 18(7): 2089-2096. https://doi.org/10.18280/ijsdp.180711

[24] Alazzam, F.A.F., Saleh A., Aldou Kh. (2020). Impact of pandemic COVID-19 on the legal regulation of world trade activity using the example of the medical supplies. Wiadomości Lekarskie, 23(7): 1521-1527. https://doi.org/10.36740/WLek202007139

[25] Sylkin, O., Shtangret, A., Ogirko, O., Melnikov, A. (2018). Assessing the financial security of the engineering enterprises as preconditions of application of anti-crisis management: Practical aspect. Business and Economic Horizons, 14(4): 926-940. https://doi.org/10.15208/beh.2018.63