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JUSTIFICATION OF RISKS IN THE SYSTEM OF ECONOMIC SECURITY OF THE ENTERPRISE AND MEANS OF THEIR LEVELING

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Formulation of the problem. The creation of a competitive enterprise in the conditions of integration processes taking place in modern society is one of those tasks that involve not only the creation of competitive products but also the development of such economic methods that allow the enterprise to compete in the appropriate market environment. The processes of clustering of enterprises in the regions of Ukraine are aimed at using their advantages, namely sectoral, territorial location, effective management, availability of specialists and institutions for their training and advanced training, social infrastructure, etc. The purpose of the clustering of enterprises in the regions of Ukraine can be considered the combination of social, economic, and environmental components in the sustainable development of the territory, the optimization of production processes, the creation of conditions for the effective use of the available potential, the increase in the number of jobs, as well as the improvement of the quality of life of the population.

Analysis of recent research and publications. Several works of domestic and foreign scientists are devoted to issues of formation and development of clustering of the socio-economic space. Among the scientists who devoted their research to the methodology, mechanism, and justification of the risks of enterprise clustering, we can name domestic and foreign authors, among them I. Budko [1], L. Vasilieva [2], I. Degtyareva [3], M. Porter [4], V. Fedorenko [5], V. Khristianovsky, V Shcherbina [6], and many other domestic and foreign scientists. The authors published the results of scientific research, in which organizational principles for the creation of clusters were proposed, scientific-methodical approaches to the formation of clusters and their state regulation, well-founded principles, conditions, and perspectives of their functioning and many other important issues were considered.

The existence of a variety of views on the formation and functioning of the processes of clustering of the socio-economic space both in regions and in the country as a whole requires unification and improvement to ensure the effectiveness of these processes. Therefore, the search for the most effective form of integration of business entities both at the state level and in each region is a very timely and relevant task.

Goal. The purpose of the study is to substantiate risks in the economic security system of enterprises in the conditions of integration processes.

Research materials and methods. The clustering of enterprises takes place under the influence of various risks, the occurrence of which is due to certain features, limitations, and requirements for the course of this process. The consequences of risks are the emergence or strengthening of negative trends in the clustering of enterprises both at the level of regions and at the level of individual clusters. Justification of risks and understanding the consequences of their impact will allow us to propose a mechanism for their neutralization and prevention. Therefore, there is a need to study the risks of clustering enterprises in the regions of Ukraine under the conditions of integration processes.

It should be noted that risk is an integral characteristic of any socioeconomic system. In modern science, risk is understood as the probability of the occurrence of undesirable events. Risk is defined as a combination of the probability and possible amount of damage, or loss of resources, caused by a hazard. Taking into account possible negative phenomena and processes creates the basis for the effective functioning of clusters. There is also an approach where risk is understood as the probability of not achieving the set goals.

According to the approach proposed by M. Porter, a cluster is a "geographically concentrated group of interdependent companies, specialized suppliers, service providers, firms in relevant industries, as well as organizations related to their activities (universities, standardization agencies, etc.), in certain areas that compete, but at the same time work together" [4]. In the general sense, a cluster is considered a set of individual elements that form a single whole to ensure the implementation of specific functions. The combination of these elements creates a synergistic effect, that is, their interaction functions more efficiently than each of the elements separately.

When considering the risks, the direction, and the strength of their influence on the activity of the cluster, it is important to pay attention to the fact that they largely depend on the field of business activity.

The task of substantiating the risks of enterprise clustering is to establish the force of their action and the direction of influence, as well as to identify existing and possible factors of danger, and to determine methods of their neutralization. The consequences of risks are the emergence or strengthening of negative trends in the processes of creation and functioning of clusters.

Attention should be paid to the existence of such a category as a measure of risk, which turns out to be a generally accepted classification feature that determines the degree of uncertainty, the degree of possible losses. The mathematical toolkit of probability theory is used for risk assessment, namely standard deviation, variance, mathematical expectation, and coefficient of variation. It has been proven that the smaller the value of the standard deviation and the coefficient of variation for the main parameters, the lower the risk.

Research results. Considering the process of emergence and the impact of risks on the clustering of enterprises, it should be noted the presence of external and internal risks. In this context, internal risks represent interaction that occurs directly within the cluster itself. Internal risks should include such negative phenomena and processes, the likelihood of which is caused by existing contradictions in the enterprise itself. The following phenomena and processes can be cited as examples of this type of cluster functioning risks. First of all, these are the risks of the first group, the basis of which is The second group of internal risks should include contradictions that arise within the cluster (transportation, sales, supply, personnel, management, etc.). The risks of this group also include production and commercial ones, which are caused by several changes in the field of production and circulation (high level of wear and tear of equipment, accidents, low level of organization of production processes, qualifications of workers, and other reasons).

It should be noted that the direction and force of action of internal risks are closely related to the conditions of the interaction of enterprises in the process of financial and economic activity (economic relations, features of vertical and horizontal integration of adjacent industries, type of enterprise activity, as well as the specifics of the cluster organization and stage of the life cycle cluster and others). It is also advisable to pay attention to the risks that arise based on the ongoing integration processes.

It is advisable to consider external risks as risks of the impact of the macro-environment, the effect of which is to worsen the general conditions of the cluster's functioning. The emergence of these risks is provoked by general economic trends that have developed in society. In modern science, an approach is proposed, according to which two groups of external risks of enterprise clustering are distinguished [6; 7].

The first group includes risks related to the management of the regional economy. The risks arising at the level of management of the regional economy are considered to be the following. Namely, the excess of costs for ensuring cluster development over benefits; ineffective activity of the created clusters; unjustified preferences for clustering participants; lack of a real increase in the level of socio-economic development of the territory, etc. [7]. The peculiarity of the impact of these risks is that they create a complex effect. In the event of their occurrence, there is a threat not only to the business entities themselves but also to the overall socio-economic space of the respective territories.

The second group includes risks associated with the functioning of individual cluster structures of the enterprise. According to this approach, special attention is paid to industry risks, that is, the probability of company losses as a result of changes in the economic state of the industry [3], as well as regional risks associated with the features of the socio-economic space of the corresponding territory.

Thus, it can be argued that in the process of creating and functioning a cluster, a system of risks arises, which affects the activities of enterprises, thereby generating the systemic risk of enterprise clustering.

It is important from the point of view of assessing the influence of external and internal risks on the clustering of enterprises in the region that they can influence both indirectly and directly. In turn, this provides a basis for distinguishing direct and indirect risks of influence. It is advisable to consider the effect of direct risks as an influence on processes and phenomena, in the case of which quantitative changes occur in indicators of the clustering efficiency of enterprises in the region. The impact of indirect risks consists of negative changes in quality indicators that characterize this process.

Understanding the essence of the risk of enterprise clustering in the context of integration processes is

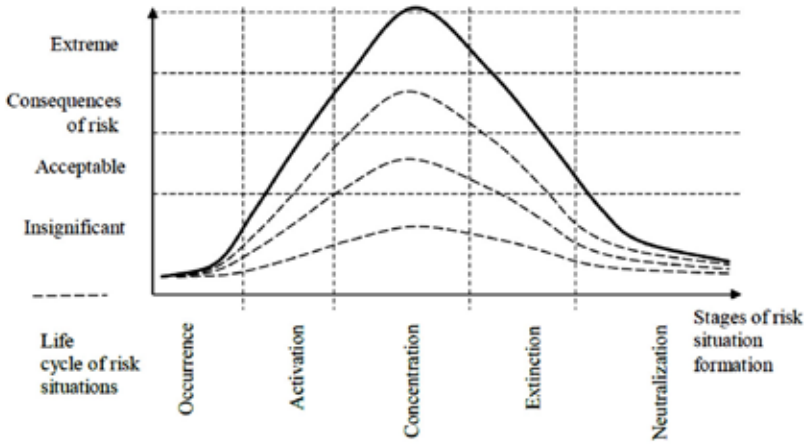

Fig. 1. Stages of the life cycle of risk situations and the consequences of their influence on the clustering of enterprises in the context of integration processes

Source: constructed by the authors

facilitated by a detailed study of its life cycle, which allows for determining the stages of its formation, and the vector of development, assessing the degree of change and possible consequences of the impact. This awareness affects the justification of the choice of the appropriate management strategy, the creation of target programs, and health measures, which are aimed at overcoming negative trends in the formation and functioning of the cluster. Thus, it is advisable to consider the impact of risk on the clustering of enterprises in the conditions of integration processes through its life cycle (Fig. 1) [8].

Correspondence of the stages of risk development to the consequences of its influence on the clustering of enterprises in the conditions of integration processes forms the risk life cycle. In the life cycle, it is advisable to distinguish the following interrelated stages: emergence, activation, concentration, extinction, and neutralization. The risk, during the passage of certain stages, changes its strength, which is expressed in the change of pressure on the object of influence, with the help of which it is possible to judge the possible consequences on the formation and functioning of the cluster. Based on the results of researching the scientific literature, it has been proven that conventional units or a qualitative scale are usually used to assess the impact of risk.

Risk graduation takes place based on the proposed scale of correspondence of its degree to the consequences of its action. In modern science, there are many methods of quantifying the degree of risk. These include indices calculated by the Haner Institute (risk is graded on a scale from 0 to 25 conditional units), expert scale based on the Haner model (from 0 to 100 conditional units), "Prince model" (from –125 to + 125), BERI indices (from 0 to 100), etc. The criteria by which the degrees of risk are distributed in the reproduction of regional society's vital activities are introduced based on scientific research in the field of risk assessment by the following scientists: T. Bachkai, D. Messina, V. Rudasheska, K. Tarasova. The risk level scale that can be used in its integral assessment is presented in Table 1.

Table 1

The scale of compliance of the integrated risk assessment to the level of its influence on the clustering of enterprises in the conditions of integration processes

Gradation of risk	The probability of an undesirable result (amount of risk)	Strength of action and direction of risk impact
Practically absent	from 0 – to 0,1	Weak
Low	from 0,1 – to 0,3	
Permissible	from 0,3 – to 0,4	Moderate
Perceptible	from 0,4 – to 0,6	
Critical	from 0,6 – to 0,8	Big
Disastrous	from 0,8 – to 1,0	Maximum

Source: compiled by the authors

The procedure for measuring, taking into account, and managing the risks observed during the clustering of enterprises should be carried out based on the identification and assessment of all components of their impact (Fig. 2).

Thus, the expediency of the implementation of the algorithm lies in the ability of business entities to implement a justified risk management policy when clustering enterprises in the context of integration processes. The developed matrix of risks allows for illustrating their influence on the processes of clustering of enterprises in the conditions of integration processes (Table 2). Note that the list of risks given in the table is quite conditional. It can be expanded or specified following the situation under investigation.

Source: compiled by the authors

Important, from the point of view of risk neutralization, is the long period of their effects. Therefore, to eliminate the negative consequences of exposure, an appropriate period is required, which consists of two components:

$$N_r = t_r + t_e, \quad (1)$$

where *N*r – is the risk neutralization period,

*t*r – is the risk period,

*t*e – is the term for overcoming the consequences of the risk.

Each of the selected risks (economic, political, managerial, and industry) can exist both separately and in combination with others. The cumulative result of the interaction of these risks can be determined in a certain way. The assessment of the synergistic effect consists in determining the speed, strength, and direction of the interaction of risks affecting the formation and functioning of the cluster.

$$S_e = f(E_A, E_B, E_C, E_D), \quad (2)$$

where S_e – is the total result of the interaction of existing risks;

$f(E_A, ..., E_D)$ – risk interaction function;

E_A – is the result of economic risk;

E_B – is the result of political risk;

E_C – is the result of managing risk;

E_D – is the result of industry risk.

The synergistic effect of the interaction of existing risks can be presented in the form of a weighted average indicator:

$$\overline{R} = \frac{\sum_{i=1}^{N} (\omega_i \cdot x_i)}{\sum_{i=1}^{N} \omega_i}, \quad (3)$$

where – integrated assessment of the interaction of risks;

ω_i – the specific weight of the indicator (risk);

x_i – is an indicator characterizing the degree of risk;

N – is the number of considered risks.

It is worth noting that if it is meant that the sum of weights is equal to 1 (), then the formula looks like this:

$$\overline{R} = \sum_{i=1}^{N} (\omega_i \cdot x_i), \quad (4)$$

If we mark the previously defined risks of influence as economic – x_1, political – x_2, management – x_3, industry – x_4, the formula takes the form:

$$\overline{R} = \sum_{i=1}^{4} (\omega_i \cdot x_i) = \omega_1 x_1 + \omega_2 x_2 + \omega_3 x_3 + \omega_4 x_4 . \quad (5)$$

The combination of speed, the force of action, and the direction of impact of the listed risks can increase the total result of their interaction and in some cases, on the contrary, reduce the impact due to their neutralization by each other.

Conclusions. The task of identifying risks is to establish the force of their action and the direction of influence, as well as to identify existing and possible factors of danger and

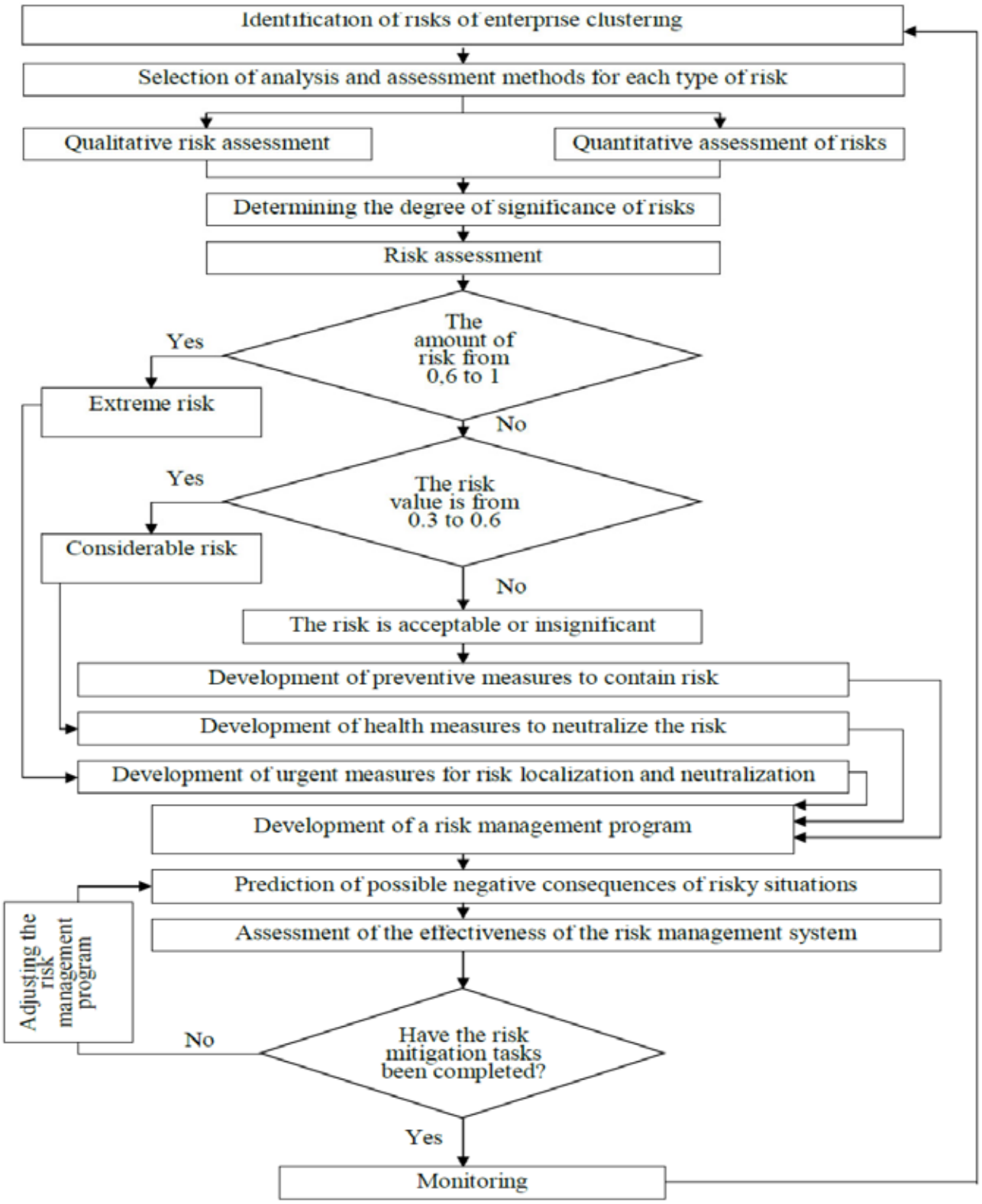

Fig. 2. Algorithm of the process of managing risk situations in the conditions of enterprise clustering

Source: constructed by the authors

Table 2

The matrix of the influence of risks on the processes of clustering of enterprises in the conditions of integration processes

Risks of impact on enterprise clustering processes	Cluster life cycle				
	Agglomeration (а)	An emerging cluster (ф)	A growing cluster (р)	Formed cluster (сф)	Transformation (т)
Economical (A)	Aa	Aф	Ap	Aсф	Aт
Political (B)	Ba	Bф	Bp	Bсф	Bт
Management (C)	Ca	Cф	Cp	Ссф	Cт
Industry (D)	Da	Dф	Dp	Dсф	Dт

justify the methods of their neutralization. Understanding the essence of risk affects the justification of choosing an appropriate management strategy, the creation of regional programs, and health measures aimed at overcoming negative trends in the processes of enterprise clustering in the context of integration processes.

The article substantiates that risk situations have a life cycle, depending on the stages of which corresponding types of consequences arise (insignificant, acceptable, significant, extreme). Correspondence of the stages of risk development to the consequences of its impact from the life cycle of the risk. The proposed life cycle of the risk situation made it possible to build matrices of correspondence of the degree of risk exposure to the significance of the consequences and impact of risks, as well as to develop a methodology for calculating the synergy effect from the interaction of existing risks.

The risk, during the passage of certain stages, changes its strength, which is expressed in the change of pressure on the object of influence, with the help of which it is possible to judge the possible consequences in the processes of clustering of enterprises in the conditions of integration processes.

BIBLIOGRAPHY:

1. Будько І. Р. Кластеризація як механізм інноваційного розвитку вищого навчального закладу. *Державне управління: удосконалення та розвиток*. URL: http://www.dy.nayka.com.ua/?op=1&z=1026 (дата звернення: 22.12.2019).
2. Васільєва Л. М. Кластеризація як інструмент модернізації регіональної економіки. *Вісник Дніпропетровського державного аграрно-економічного університету*. 2015. № 1 (35). С. 172–175.
3. Дегтярьова І. О. Наукові та практичні аспекти застосування кластерного підходу в управлінні конкурентоспроможністю регіонів України. *Державне управління: теорія та практика*. 2011. №1. URL: http://academy.gov.ua/ej/ej13/txts/Degtyaryova.pdf (дата звернення: 01.12.2019).
4. Портер М. Стратегія конкуренції: методика аналізу галузей і діяльності конкурентів. Київ, 1998. 390 с.
5. Федоренко В. Г., Тугай А. М., Гойко А. Ф., Джабейло В. Б. Концепція кластерної політики в Україні. *Економіка та держава*. 2008. № 11. С. 5–15.
6. Христиановский В. В., Щербина В. П. Економічний ризик та методи його вимірювання. Донецьк, 2000. 197 с.
7. Бойченко Е. Б. Відтворення продуктивних сил в контексті розвитку регіонального соціуму: питання теорії, практики, діагностики. Київ, 2015. 372 с.

REFERENCES:

1. Budko, I.R. (2016). Klasteryzatsiia iak mekhanizm innovatsijnoho rozvytku vyschoho navchalnoho zakladu [Clustering as a mechanism of innovative development of higher education]. *Derzhavne upravlinnia: udoskonalennia ta rozvytok – Public administration: improvement and development*. URL: http://www.dy.nayka.com.ua/?op=1&z=1026 [in Ukrainian].
2. Vasilieva, L.M. (2015). Klasteryzatsiia iak instrument modernizatsii rehionalnoi ekonomiky [Clustering as a tool for modernization of the regional economy]. *Visnyk Dnipropetrovskoho derzhavnoho ahrarno-ekonomichnoho universytetu – Bulletin of the Dnipropetrovsk State Agrarian and Economic University*, 1, 172–175 [in Ukrainian].
3. Dehtiarova, I.O. (2011). Naukovi ta praktychni aspekty zastosuvannia klasternoho pidkhodu v upravlinni konkurentospromozhnistiu rehioniv Ukrainy [Scientific and practical aspects of applying the cluster approach in managing the competitiveness of the regions of Ukraine]. *Derzhavne upravlinnia: teoriia ta praktyka – Public administration: theory and practice, 1*. URL: http://http://academy.gov.ua/ej/ej13/txts/Degtyaryova.pdf [in Ukrainian].
4. Porter, M. (1993). *Stratehiia konkurentsii: metodyka analizu haluzej i diialnosti konkurentiv [Competition strategy: methods of analysis of industries and competitors].* Kyiv: Osnovy [in Ukrainian].
5. Fedorenko, V.H., Tuhaj, A.M., Hojko, A.F., & Dzhabeylo V.B. (2008). Kontseptsiia klasternoi polityky v Ukraini [The concept of cluster policy in Ukraine]. *Ekonomika ta derzhava – Economy and the state*, 11, 5–15 [in Ukrainian].
6. Khrystyanovskyj, V.V., & Scherbyna, V.P. (2000). *Ekonomycheskyj rysk y metody eho yzmerenyia [Economic risk and methods for measuring it].* Donetsk: DonNU [in Ukrainian].
7. Bojchenko, E.B. (2015). *Vidtvorennia produktyvnykh syl v konteksti rozvytku rehional'noho sotsiumu: pytannia teorii, praktyky, diahnostyky [Reproduction of productive forces in the context of the development of regional society: issues of theory, practice, diagnosis].* Kyiv: Khaj Tek Pres [in Ukrainian].

Бояркіна Л.В., Бойченко Е.Б. Обґрунтування ризиків у системі економічної безпеки підприємства та засобів їх нівелювання

Метою статті є обґрунтування ризиків в системи економічної безпеки підприємств в умовах інтеграційних процесів. **Матеріали та методи.** Наслідками дії

ризиків є виникнення або посилення негативних тенденцій у кластеризації підприємств як на рівні регіонів так і на рівні окремих кластерів. Обґрунтування ризиків та розуміння наслідків їх впливу, дозволять запропонувати механізм їх нейтралізації та попередження. Ризик визначається як поєднання ймовірності та можливої величини збитку, втрати ресурсів, завданого небезпекою. Врахування можливих негативних явищ і процесів створюють підґрунтя для ефективного функціонування кластерів. Завданням обґрунтування ризиків кластеризації підприємств є встановлення сили їх дії та напряму впливу, а також виявлення існуючих та можливих чинників небезпеки, визначення методів їх нейтралізації. **Результати.** Наслідками дії ризиків є поява або посилення негативних тенденцій у процесах створення та функціонування кластерів. Для оцінки ризику використовується математичний інструментарій теорії ймовірностей, а саме стандартне відхилення, дисперсія, математичне очікування, коефіцієнт варіації. Напрям та сила дії внутрішніх ризиків мають тісний зв'язок з умовами взаємодії підприємств в процесі фінансово-господарської діяльності. Розумінню сутності ризику кластеризації підприємств в умовах інтеграційних процесів сприяє детальне опрацювання його життєвого циклу, що дозволяє визначити стадії його формування, вектор розвитку, оцінити ступінь зміни та можливі наслідки впливу. Відповідність стадій розвитку ризику до наслідків його впливу на кластеризацію підприємств в умовах інтеграційних процесів формує життєвий цикл ризику. У життєвому циклі доцільно виділити такі взаємопов'язані стадії: виникнення, активізація, концентрація, згасання, нейтралізація. Ризик, під час проходження визначених стадій, змінює свою силу, яка виражається у зміні тиску на об'єкт впливу, за допомогою якої можна судити про можливі наслідки на формування та функціонування кластеру. **Висновок.** Обґрунтовано, що ризикові ситуації мають життєвий цикл, залежно від стадій якого виникають відповідні види наслідків (незначні, допустимі, значні, екстремальні). Відповідність стадій розвитку ризику до наслідків його впливу формують життєвий цикл ризику. Запропонований життєвий цикл ризикової ситуації дав змогу побудувати матриці відповідності ступеню впливу ризику до значущості наслідків і впливу ризиків, а також розробити методику розрахунку ефекту синергії від взаємодії існуючих ризиків.

Ключові слова: економічна безпека, ризик, життєвий цикл ризику, шкала рівня ризику, алгоритм процесу управління ризиковими ситуаціями

Boiarkina L.V., Boichenko E.B. Justification of risks in the system of economic security of the enterprise and means of their leveling

The purpose of the article is to justify risks in the economic security system of enterprises in the context of integration processes. **Research materials and methods.** The consequences of risks are the emergence or strengthening of negative trends in the clustering of enterprises both at the level of regions and at the level of individual clusters. Justification of risks and understanding the consequences of their impact will allow us to propose a mechanism for their neutralization and prevention. Risk is defined as a combination of the probability and possible amount of damage, or loss of resources, caused by a hazard. Taking into account possible negative phenomena and processes creates the basis for the effective functioning of clusters. The task of substantiating the risks of enterprise clustering is to establish the force of their action and the direction of influence, as well as to identify existing and possible factors of danger, and to determine methods of their neutralization. **Results.** The consequences of risks are the emergence or strengthening of negative trends in the processes of creation and functioning of clusters. The mathematical toolkit of probability theory is used for risk assessment, namely standard deviation, variance, mathematical expectation, and coefficient of variation. The direction and strength of internal risks are closely related to the conditions of the interaction of enterprises in the process of financial and economic activity. Understanding the essence of the risk of enterprise clustering in the context of integration processes is facilitated by a detailed study of its life cycle, which allows for determining the stages of its formation, and the vector of development, assessing the degree of change and possible consequences of the impact. Correspondence of the stages of risk development to the consequences of its influence on the clustering of enterprises in the conditions of integration processes forms the risk life cycle. In the life cycle, it is advisable to distinguish the following interrelated stages: emergence, activation, concentration, extinction, and neutralization. The risk, during the passage of certain stages, changes its strength, which is expressed in the change of pressure on the object of influence, with the help of which it is possible to judge the possible consequences on the formation and functioning of the cluster. **Conclusions.** The article substantiates that risk situations have a life cycle, depending on the stages of which corresponding types of consequences arise (insignificant, acceptable, significant, extreme). Correspondence of the stages of risk development to the consequences of its impact from the life cycle of the risk. The proposed life cycle of the risk situation made it possible to build matrices of correspondence of the degree of risk exposure to the significance of the consequences and impact of risks, as well as to develop a methodology for calculating the synergy effect from the interaction of existing risks.

Key words: economic security, risk, risk life cycle, risk level scale, risk management process algorithm.