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THE CHOICE OF THE MODEL OF DIAGNOSTIC THE PROBABILITY OF BANKRUPTCY OF THE ENTERPRISE ON THE BASIS OF ADDITIVE CONVOLUTION IN THE CONTEXT OF ASSESSMENT ITS SANITATION CAPACITY

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Key words:

sanitation, sanitation capacity, sanitation potential, financial management of sanitation capacity, models of diagnostic the probability of bankruptcy, crisis, multicriteria choice, additive convolution.

In the article the essence of the concept of “crisis” is revealed. Researchers’ scientific works are analyzed and the most thorough interpretation of such economic category as “enterprise sanitation” is determined: a set of consistent, interrelated measures of financial and economic, production and technical, organizational and social nature aimed at bringing the business entity out of crisis and recovery or achieving its profitability and competitiveness in the long term. The purpose of the enterprise sanitation is highlighted. It is noted that the main criterion for deciding of the sanitation or liquidation of the enterprise is its sanitation capacity and this definition is described. The general preconditions of sanitation capacity are indicated. A broader view of the preconditions for the sanitation capacity of the enterprise is presented, according to which they are divided into legal, general and economic, resource, financial and economic. It is established that successful sanitation of the enterprise is not possible without effective management of sanitation capacity. Two approaches to the interpretation of the concept are indicated. The structural and logical scheme of the process of managing the sanitation capacity of the enterprise is proposed, which is focused on timely diagnostic of the level of sanitation capacity of the enterprise, identification of strategic gaps between existing and desired levels and development of a program of measures to improve sanitation capacity, using the appropriate sanitation strategy and appropriate tools for its recovery. It is determined that the assessment of sanitation capacity is an effective tool to determine the insolvency of the enterprise and its ability not only to overcome the crisis, to determine the factors that led to lower levels of its individual elements, but also to prevent crises. It is noted that the diagnostic of the probability of bankruptcy of the enterprise has a significant impact on the assessment of sanitation capacity. A multicriteria choice of models of diagnostic the probability of bankruptcy of domestic enterprises on the basis of additive convolution is made.

ВИБІР МОДЕЛІ ДІАГНОСТИКИ ЙМОВІРНОСТІ БАНКРУТСТВА ПІДПРИЄМСТВА НА ОСНОВІ АДТИВНОЇ ЗГОРТКИ В КОНТЕКСТІ ОЦІНКИ ЙОГО САНАЦІЙНОЇ СПРОМОЖНОСТІ

Череп О.Г., Рєпка К.Р.*Запорізький національний університет**Україна, 69063, м. Запоріжжя, просп. Соборний, 74***Ключові слова:**

санация, санаційна спроможність, санаційний потенціал, фінансове управління санаційною спроможністю, моделі діагностики ймовірності банкрутства, криза, багатокритеріальний вибір, адитивна згортка.

У статті розкрито сутність поняття «криза». Проаналізовано наукові роботи дослідників та визначено найбільш ґрунтовне тлумачення такої економічної категорії як «санация підприємства». Висвітлено мету проведення санації підприємства. Зазначено, що головним критерієм прийняття рішення щодо санації чи ліквідації підприємства є його санаційна спроможність та охарактеризовано дане визначення. Вказано загальні передумови санаційної спроможності. Також представлено більш розширений погляд на передумови санаційної спроможності підприємства, відповідно до якого вони поділяються нормативно-правові, загальноекономічні, ресурсні та фінансово-економічні.

Встановлено, що вдале проведення санації підприємства не можливе без ефективного управління санаційною спроможністю. Зазначено два підходи до трактування поняття. Запропоновано структурно-логічну схему процесу управління санаційною спроможністю підприємства, яка орієнтована на здійснення своєчасної діагностики рівня санаційної спроможності підприємства, виявлення стратегічних розривів між наявним і бажаним рівнями та розробці програми заходів з метою підвищення санаційної спроможності, використовуючи при цьому відповідну санаційну стратегію та відповідні інструменти її відновлення. Визначено, що оцінка санаційної спроможності є дієвим інструментом, за допомогою якого можна визначити стан неплатоспроможності підприємства та його здатність не лише подолати кризу, визначити фактори впливу, що призвели до зниження рівня його окремих елементів, а й запобігати настанню кризових явищ. Відзначено, що неабиякий вплив на оцінку санаційної спроможності має діагностика ймовірності банкрутства підприємства. Здійснено багатокритеріальний вибір моделей діагностики ймовірності банкрутства вітчизняних підприємств на основі адитивної згортки.

Statement of the problem

Modern market conditions have not only caused negative changes in the Ukrainian economy, but also led to the fact that most domestic enterprises have become insolvent and unprofitable, there has been an increase in their debt dependence, deterioration of key financial performance. One of the most important guarantees of profitable activity of the enterprise is timely detection of crisis tendencies and their operative elimination without harm to the business entity. In such conditions, the issues of the effectiveness of the sanitation of the enterprise and the study of its sanitation capacity become actual.

Analysis of recent studies and publications

The following domestic scientists paid considerable attention in their scientific achievements to the theoretical aspects of sanitation and the management of the sanitation capacity of the enterprise: O. Bilousova [1], O. Bulovych [2], L. Verbitska [3], A. Danylenko [1], V. Zymovets. [1], N. Karvatska [4], I. Kushnir [3], O. Lisnichuk [5], N. Pigul [6], A. Romanyuk [3], O. Romanovich [7], L. Svistun [7], V. Semenets [6], O. Tereshchenko [8], A. Cherep [9, 10], O. Cherep [11] and others. As for foreign scientists, E. Altman [12], M. Golder [13], J. Conan [13], G. Springgate [14], J. Taffler and D. Chesser [15] were engaged in the development of models of diagnostic the probability of bankruptcy.

Highlighting previously unsolved parts of the general problem to which this article is devoted

In the scientific space, much of the research is currently devoted to the development and analysis of a large number of models of diagnostic the probability of bankruptcy. In the conditions of such diversity, it is quite difficult for enterprises to choose the model of diagnostic they need, which would take into account the specifics of their activities, industry or type of national economy. Therefore, it is important is study the choice of models of diagnostic the probability of bankruptcy on the basis of additive convolution, taking into account the criteria inherent in the functioning of domestic enterprises.

Objectives of the article

The purpose of the article is a choice of models of diagnostic the probability of bankruptcy of domestic enterprises on the basis of additive convolution.

The main material of the research

The current unstable state of Ukraine's economy has a negative impact on the work of many domestic enterprises. In the conditions of sharp fluctuations of political, social, economic processes, growing competition the number of insolvent enterprises which are in a crisis situation increases.

The crisis contributes to the fact that most companies do not have enough of their own financial resources, have difficulty in borrowing, accumulate significant amounts of accounts payable, which leads to a deterioration of their solvency or even bankruptcy [7, p. 1295].

The crisis should be understood as a complex, integrated in many aspects characteristics of the enterprise in a given period, which reflects its degree of own and borrowed resources, working capital for timely settlement of liabilities and effective economic activity in the future [3, p. 251].

In many developed countries, sanitation of the enterprise is an integral part of enterprise crisis management.

Nowadays, many researchers dedicate their research to the essence of sanitation. After analyzing their work, we came to the conclusion that the most thorough interpretation of this concept was proposed by Professor A.M. Podderogin: «sanitation is a set of consistent, interconnected measures of financial and economic, production and technical, organizational and social nature, aimed at bringing the business entity out of crisis and restoring or achieving its profitability and competitiveness in the long term» [6, p. 360–361].

The purpose of enterprise sanitation is to eliminate or prevent the threat of bankruptcy, ensure the most efficient use of potential in order to adapt to new business conditions and create preconditions for restoring competitiveness in the long term [4, p. 8].

The main criterion for deciding of the sanitation or liquidation of the enterprise is its sanitation capacity.

The modern scientific literature presents different points of view of scientists on the interpretation of the concept of “sanitation capacity”. However, the study of domestic economic literature has shown that in Ukraine the variability of approaches to understanding sanitation capacity is significantly limited, and most researchers in their works refer to the definition of O. Tereshchenko [5, p. 17].

Thus, the sanitation capacity is the presence of an enterprise that is in financial crisis, financial, organizational, technical and legal capabilities that determine its ability to successfully conduct financial sanitation [8, p. 75–76].

The sanitation capacity of the enterprise acts as a kind of “economic immunity” of the business entity and creates

the preconditions for its survival in a changing external environment.

The general prerequisites for sanitation capacity include the company's effective sanitation concept and potential for future successful activity, namely: stable market positions, real opportunities to increase sales, competitive advantages of production and human resources [9, p. 187–188; 2, p. 174].

A more expanded view of the prerequisites for the sanitation capacity of the enterprise is presented in the work of A. Cherep and O. Romanenko. The authors systematized four groups of prerequisites that can make the company capable for sanitation: normative and legal, general economic, resource, financial and economic [10, p. 106].

Successful sanitation of the enterprise is not possible without effective management of sanitation capacity. At one point, it is a separate component of the overall management system of the business entity, the formation of which is influenced by factors of both external and internal environment, as well as the industry orientation of the enterprise.

If we consider the management of sanitation capacity on the other hand, it is a repetitive process that results from the interconnection of certain management functions, namely: monitoring, planning, design, implementation and control.

Summarizing the theoretical material on the nature and components of such concepts as sanitation and sanitation capacity of the enterprise, taking into account the results of substantiation of their methodological support, scientists have proposed such a structural and logical scheme of the process of managing the sanitation capacity of the enterprise, which is shown in fig. 1 [5, p. 39].

The structural and logical scheme of the process of managing the sanitation capacity of the enterprise reflects a set of financial, organizational and economic tools through which the regulation of economic processes and relations in the overall management system of the enterprise.

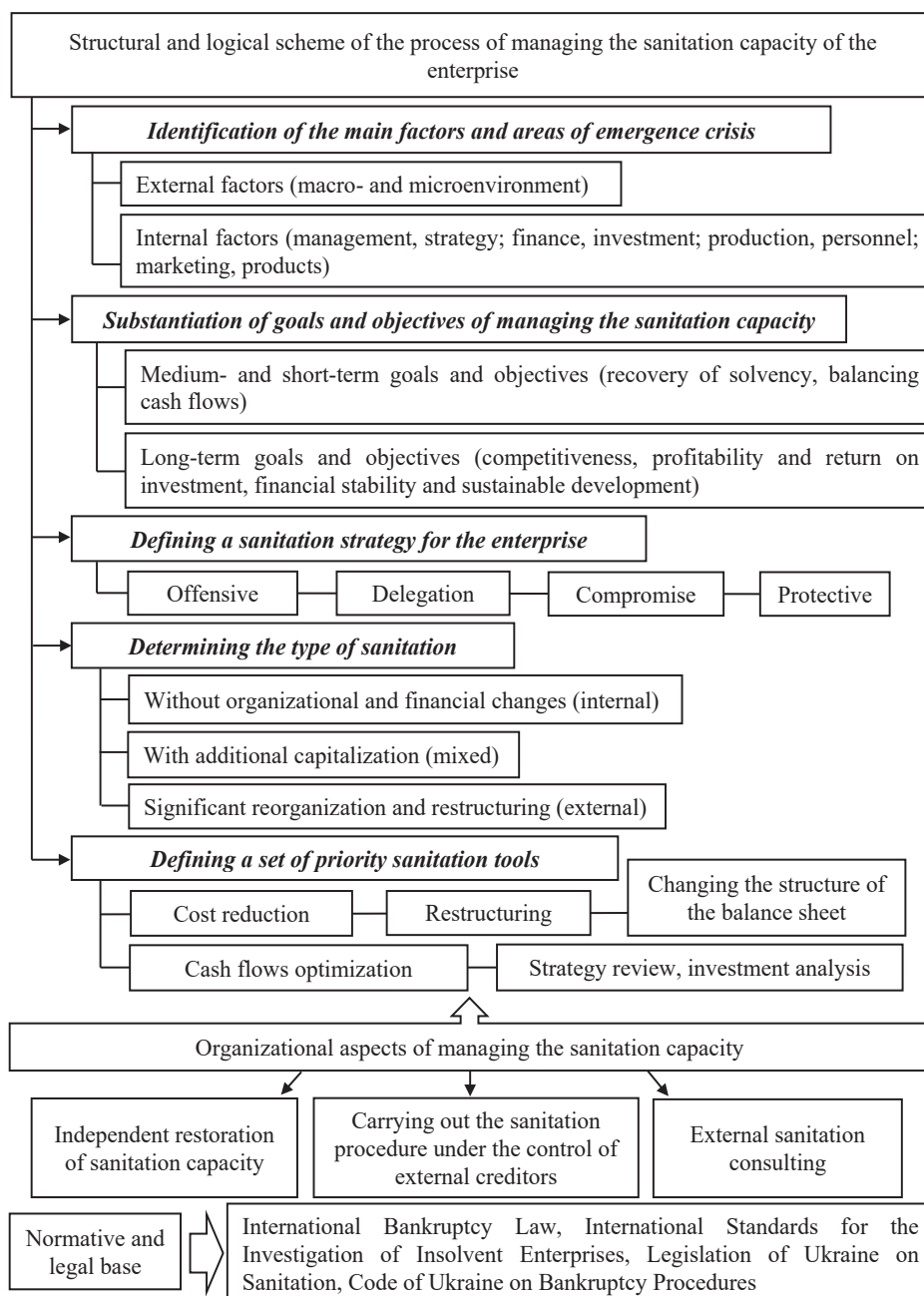


Fig. 1 – Structural and logical scheme of the process of managing the sanitation capacity of the enterprise

Source: developed by the authors based on [5]

This scheme is focused on the timely diagnostic of the level of sanitation capacity of the enterprise (not only actual but also prospective or forecast), identifying strategic gaps between existing and desired (normative or established by management) levels and developing a program of measures to improve sanitation capacity, using this appropriate sanitation strategy and appropriate tools to restore sanitation capacity [5, p. 39].

Assessment of sanitation capacity is an effective tool to determine the insolvency of the enterprise and its ability not only to overcome the crisis, to identify the factors that led to a decrease its individual elements, but also to prevent crises. Assessing the level of sanitation capacity, the company's management will be able to make effective and efficient management decisions either to implement sanitation measures and determine the optimal strategic directions of sanitation of the enterprise, or to eliminate it [11, p. 74].

In our opinion, the diagnostic of the probability of bankruptcy of the enterprise has a significant impact on the assessment of sanitation capacity. Currently, there are a large number of diagnostic models developed by both domestic and foreign scientists. All of them were created taking into account the peculiarities of the country of origin of their authors.

In such a variety, domestic enterprises may have difficulty in choosing the most reliable diagnostic model and one that takes into account the specifics of the enterprise and the type of national economy. That is, in other words, the chosen model must be adapted to the Ukrainian market.

Therefore, to improve the assessment of the sanitation capacity of the enterprise, we propose to make a multi-criteria choice of models of diagnostic the probability of bankruptcy on the basis of additive convolution.

The first step in multi-criteria choice is to identify the alternatives from which the best option will be chosen. In our case, such alternatives are models of diagnostic the probability of bankruptcy of the enterprise, namely: a_1 – five-factor model of Altman; a_2 – model of Springgate; a_3 – model of Taffler and Tishaw; a_4 – model of Lis; a_5 – model of Conan and Golder; a_6 – model of Fulmer; a_7 – model of Tereshchenko.

The criteria according to which the model will be chosen include: c_1 – the possibility of application to different types of national economies; c_2 – the possibility of application to all organizational and legal forms of enterprise activity; c_3 – taking into account the size of the enterprise; c_4 – taking into account the field of activity of the enterprise; c_5 – model reliability; c_6 – simplicity of model calculation.

The second step aims to determine the membership functions of the evaluation of alternatives by criteria, ie the satisfaction of the models with the selected criteria (tab. 1).

Table 1 – The membership functions of the evaluation of alternatives by criteria

Satisfaction	0	1	0
Very low (VL)	0	0	0
Low (L)	0	0,2	0,4
High (H)	0,6	0,8	1
Very high (VH)	0,8	1	1

Source: developed by the authors

The third step is manifested in determining linguistic assessments of the relative importance of the criteria (tab. 2).

Table 2 – Linguistic assessments of the relative importance of the criteria

Importance	0	1	0
Important enough (IE)	0,3	0,5	0,7
Important (I)	0,5	0,7	0,9
Very important (VI)	0,8	1	1

Source: developed by the authors

According to the fourth step, it is necessary to assess the satisfaction of alternatives to the criteria (tab. 3).

Table 3 – Assessment of the satisfaction of alternatives to the criteria

Criterion	Assessment of alternatives							Importance
	a_1	a_2	a_3	a_4	a_5	a_6	a_7	
c_1	L	VL	L	VL	VL	VL	H	VI
c_2	VL	VL	VL	VL	L	VL	H	VI
c_3	VH	L	VL	L	L	VL	L	IE
c_4	VH	H	VL	L	VL	VL	H	I
c_5	VH	H	H	H	L	VL	H	VI
c_6	VL	H	VH	H	L	VL	L	IE

Source: developed by the authors

The fifth step is characterized by determining the vertex and limits of the fuzzy number of each alternative by multiplying the corresponding value of the membership functions of the evaluation of alternatives by criteria and the corresponding value of linguistic estimates of the relative importance of criteria based on tab. 3 (tab. 4).

Table 4 – Determining of the vertex and limits of the fuzzy number of each alternative

Criterion	0						
	Alternative						
	a_1	a_2	a_3	a_4	a_5	a_6	a_7
c_1	0	0	0	0	0	0	0,48
c_2	0	0	0	0	0	0	0,48
c_3	0,24	0	0	0	0	0	0
c_4	0,4	0,3	0	0	0	0	0,3
c_5	0,64	0,48	0,48	0,48	0	0	0,48
c_6	0	0,18	0,24	0,18	0	0	0
Sum	1,28	0,96	0,72	0,66	0	0	1,74
Criterion	1						
	Alternative						
	a_1	a_2	a_3	a_4	a_5	a_6	a_7
c_1	0,2	0	0,2	0	0	0	0,8
c_2	0	0	0	0	0,2	0	0,8
c_3	0,5	0,1	0	0,1	0,1	0	0,1
c_4	0,7	0,56	0	0,14	0	0	0,56
c_5	1	0,8	0,8	0,8	0,2	0	0,8
c_6	0	0,4	0,5	0,4	0,1	0	0,1
Sum	2,4	1,86	1,5	1,44	0,6	0	3,16

End of Table 4

Criterion	0						
	Alternative						
	a_1	a_2	a_3	a_4	a_5	a_6	a_7
c ₁	0,4	0	0,4	0	0	0	1
c ₂	0	0	0	0	0,4	0	1
c ₃	0,7	0,28	0	0,28	0,28	0	0,28
c ₄	0,9	0,9	0	0,36	0	0	0,9
c ₅	1	1	1	1	0,4	0	1
c ₆	0	0,7	0,7	0,7	0,28	0	0,28
Sum	3	2,88	2,1	2,34	1,36	0	4,46

Source: developed by the authors

As a result, we obtained the following membership functions of weighted estimates of alternatives: R1 = {0/1.28; 1/2.4; 0/3}; R2 = {0/0.96; 1/1.86; 0/2.88}; R3 = {0/0.72; 1/1.5; 0/2.1}; R4 = {0/0.66; 1/1.44; 0/2.34}; R5 = {0/0; 1/0.6; 0/1.36}; R6 = {0/0; 1/0; 0/0}; R7 = {0/1.74; 1/3.16; 0/4.46}.

Based on the membership functions of weighted estimates of alternatives, a graph of alternatives is constructed (fig. 2).

Ranking of alternatives using the obtained weighted estimates can be carried out on the basis of their fuzzy composition, according to which the alternative is considered the best, that has the biggest number.

The priority of each alternative is determined by choosing the minimum among the points of intersection of the right limits of the corresponding fuzzy number with the limits of fuzzy numbers representing weighted estimates of the alternatives located to the right of the numerical axis. It is assumed that the right limit of the area of determining

of fuzzy numbers corresponds to the best estimates, and the left – the worst.

Thus, we obtained the following estimates of the benefits of alternatives: a₁ – 0.62; a₂ – 0.44; a₃ – 0.18; a₄ – 0.23; a₅ – 0.02; a₆ – 0; a₇ – 1.

According to the calculations, the best model of diagnostic the probability of bankruptcy of domestic enterprises is the model of Tereshchenko, and the worst – the model of Fulmer.

Conclusions

In today's reality, many domestic enterprises suffer from crisis trends, which are reflected in the insolvency of the entity, lack of liquid working capital, low financial stability, the presence of receivables and payables, reduced competitiveness and etc. The continued operation of the enterprise in such conditions can lead to undesirable consequences, in particular, its bankruptcy. It is possible to prevent this only by timely sanitation, the main guarantee of which is the presence of the enterprise's sanitation capacity, which determines its ability to recover. It is possible to assess whether a company is capable of sanitation by calculating financial ratios, but we must also not forget about the diagnostic of the probability of bankruptcy, which, in our opinion, should be done in the context of assessing the sanitation capacity. In the modern scientific space, there are a large number of models of diagnostic the probability of bankruptcy, which complicates the choice of the most acceptable for the company. Therefore, we propose to make this choice on the basis of additive convolution, analyzing different types of models for a certain set of criteria. This approach will take into account the specifics of the enterprise, its industry focus, type of national economy and will provide the most accurate and reliable results.

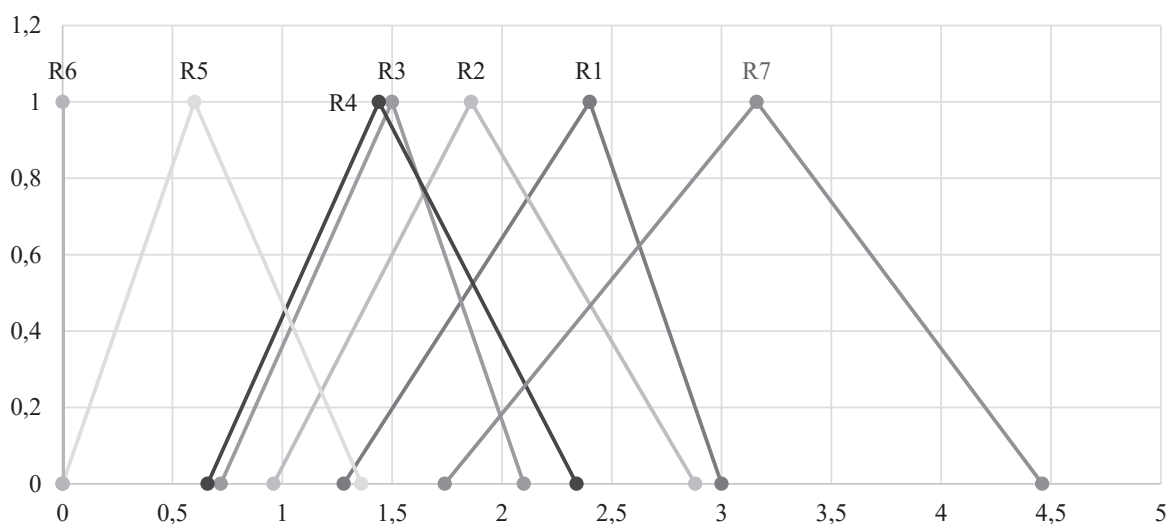


Fig. 2 – A graph of alternatives

Source: developed by the authors

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