International Journal of Safety and Security Engineering
Vol. 11, No. 3, June, 2021, pp. 223-230
Journal homepage: http://iieta.org/journals/ijsse

Modeling the Process of Forming the Safety Potential of Engineering Enterprises

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https://doi.org/10.18280/ijsse.110302

Received: 5 May 2021
Accepted: 12 June 2021

Keywords:
safety potential, engineering enterprises, modelling, resources

ABSTRACT

The main purpose of the study is to form a methodological approach to modeling the process of forming a safety potential for engineering enterprises. The main method used was the method of multi-criteria assessment of alternatives and the matrix of paired comparisons. An assessment was made of alternative options for ensuring the security of the potential of engineering enterprises for different resource requirements. The study has certain limitations related to the fact that the data and enterprises that were used relate to the engineering ones of Eastern Europe. The results of calculating a rational option for ensuring the safety potential of engineering enterprises for different needs in material, financial, personnel and organizational resources by the method of multi-criteria assessment of alternatives can be used in the future to improve monitoring in practice. The main issues considered during the study were to determine the security potential of the engineering company, to determine the resources needed to ensure the security potential. This methodology allows through comparison of certain indicators or indicators, to determine which management decision is most appropriate to the existing situation. The value of the study lies in the formation of a scientific and practical approach to the formation of the safety potential of engineering enterprises, the use of which, in contrast to the existing ones, is based on the use of methods for multi-criteria assessment of alternatives and a matrix of paired comparisons for the advantage of options.

1. INTRODUCTION

The current activity of engineering enterprises in Eastern Europe is characterized not only by an increase in the negative impact of the external environment, but also by insufficient attention to the problem of ensuring business security by both owners and managers. The absence or insufficient effectiveness of the functioning of the security system does not allow to adequately respond to the action of external and internal threats, in the future not only slows down the development of the enterprise, but also leads to its destruction as a socio-economic system. Ensuring the necessary level of safety to achieve priority interests largely depends on the organization of the safety of the enterprise, which should be scientifically-organized, because, in contrast to the use of only gained experience, makes a more rational use of available resources to achieve the assigned tasks, plan and implement a set of protective measures for the appropriate adjustment of not only the security strategy, but also the development strategy of the enterprise. In modern conditions of functioning, when the state is limited in interference in the activities of business entities, the safety potential of an enterprise becomes one of the most important problems of their viability and development.

Taking into account the perfect generalizations and the above-stated own considerations of safety, danger, risk, threat and safety of activities, in our interpretation, safety potential is the aggregate ability to use available resources and opportunities to create safe conditions for development by reducing risks and countering internal and external threats.

We consider it expedient to single out individual components of safety potential:
the personnel of the enterprise in general, specialized and on-specialization units, between which the functions of ensuring the security of the enterprise are clearly distributed;
material, technical and financial resources that are necessary to ensure economic security at the enterprise;
a favorable organizational climate, which provides for the interaction of internal security actors and cooperation with external actors to achieve the goals of the security of the activity.

The next important aspect is the formation of the safety potential of engineering enterprises, which, in our opinion, is the process of identifying available resources and opportunities, their structuring and the formation of organizational forms for effective use in ensuring safety.

The formation of the safety potential of engineering enterprises should be carried out taking into account:

- Alternatives, that is, when performing a specific task in the field of ensuring economic security, possible options should be taken into account using all personnel, in specializations and specialized units, external actors, in particular law enforcement agencies and private security firms;
- Dynamism, that is, the inconstancy of the values of the available resources and capabilities;
- Combination in the use of various resources and capabilities, which makes the performance of certain tasks;
- Proportionality to the main parameters and indicators of enterprise development and the need for protection from the negative impact of the external environment and the need to strengthen control over internal processes;
- Efficiency, which consists primarily in reducing risks in decision-making through overcoming uncertainty, that is, preparing the necessary information ground, reducing losses from the implementation of internal and external threats through their timely identification, counteraction and elimination of consequences.

The main purpose of the study is to form a methodological approach to modeling the process of forming a safety potential for engineering enterprises.

2. LITERATURE REVIEW

Safety potential is the combined ability to use available resources and opportunities to create safe conditions for development through risk reduction and counteraction to internal and external threats. His research is only gaining momentum, and it is part of the scientific field of research in the field of enterprise security.

Basic theoretical provisions on security and features of security potential can be found in the works of Avanesova & Chuprin [1], Lielgaidina & Geipele [2] and Stankevičienė et al. [3].

Of course, when we talk about security, one cannot ignore the scientific contribution of one of the leaders in security research and their elements, namely Sylkin et al. [4], Sylkin et al. [5]. Its contribution is difficult to overestimate, as it conducts research in the field of security and security from almost all angles. This is through the prism of the crisis and its overcoming, it can be through the assessment of its level, both financial and economic. We have taken into account his experience and agree with his opinion that resources play a key role in unlocking the security potential of the enterprise.

In general, for all enterprises, it is increasingly possible to find scientific papers on the survival of enterprises and the prevention of banking (Wyrwicka & Mrugalska [6]; Akimova et al. [7]; Hvolkova et al. [8]).

Today, attention to engineering enterprises is extremely high. More and more scientists are trying to find an approach to ensuring the security of this type of enterprise. These include Eidenmüller & van Zwieten [9], Scacun & Voronova [10], Ginevičius [11], who have dealt with this issue. We also decided to pay our scientific attention to the security issues of engineering enterprises, because in our country, their leadership cannot realize their own potential and resources to protect their own business.

How resources should be used and how they can help protect the company and prevent its bankruptcy are the works of Schönfeld et al. [12], Yang et al. [13] and Eklund et al. [14]. We think that financial resources have a significant impact on how an enterprise can respond to other threats to its own security, but they can also help unleash its potential.

Szarucki [15] offers a model for choosing the solution of management problems in the enterprise, we are also supporters of the need to form a methodological approach that allows to choose between solutions. Variability determines the ability to ensure security, which is why our methodological approach offers several options for each group of resources.

Given the significant scientific contribution to the development of ways to ensure safety in engineering enterprises, to date, there is no methodological approach that would reveal the security potential of the enterprise and provide the desired variability for their management, through available resources.

In all of the above works, the process of ensuring safety and the formation of a safe potential was considered only from one side, without taking into account all the factors affecting safety. In addition, most of the works only list the factors of influence and decisions on ensuring safety at engineering enterprises, while the main idea of our article is precisely the mathematical substantiation of the formation of safety potential at engineering enterprises.

3. METHODOLOGY

The basis of our study uses methods of multi-criteria assessment of alternatives and a matrix of paired comparisons for the advantage of options, which allows to form alternative options for resource provision with the ability to choose among them the optimal one based on different needs for material, financial, personnel and organizational resources to maintain an appropriate level of security.

When developing management decisions, it is important to correctly assess the current situation and alternative solutions in order to choose the most effective solution that meets the goals of the organization. An organization, when making decisions, is guided by the goals that they strive to achieve. Each goal must meet a criterion by which the degree of goal achievement can be assessed. In the case of applying such methods, the dependence of the general usefulness of the alternative on the estimates for individual criteria is known in advance. Most often, the type of dependence is used, in which the numerical indicators of the importance of the criteria (that is, their specific weight) are determined, multiplied by the scores according to the criteria. This method is called the criterion score weighted sum method. Other direct methods include the decision tree method. By reviewing all the choices, alternative solutions are identified.

The pairwise comparison matrix consists in determining the advantages of the elements located in the left column over the elements located in the top row. In this case, a matrix is compiled, in the rows and columns of which the objects to be compared are arranged.

Also, it should be noted that the solution to the problem posed in our study is also based on the research of domestic scientists carried out in recent years at the micro and macro levels using the methods of system analysis.

The formation of the safety potential of engineering enterprises requires the use of certain resources: material and financial, personnel, organizational (Table 1). The availability of such resources makes it possible to form the safety potential of engineering enterprises. In addition, any measures should be formed on an alternative basis, that is, provide for several options for actions with a combination of needs and the use of

certain resources to achieve the required level of the safety potential of engineering enterprises.

The level of safety resources for the potential of engineering enterprises will be assessed according to the scale given below (Table 2). In order to simplify further determination of the advantages of some levels of baking of engineering enterprise with the corresponding resources over another, we identify the values of the level (Table 2) with the corresponding letter designations (Table 3).

To determine, on the basis of generalized opinions of experts, the weight of the level of ensuring the safety potential of the engineering enterprise with appropriate safety resources, a special scale of the relative importance of objects was used (Table 4).

To carry out the expert assessment, 20 experts were involved, who are specialists in the field of security at engineering enterprises. The survey was conducted using online communication and e-mail, taking into account the existing epidemic situation in the world. The main criterion for the selection of experts was a high level of professional awareness in this area, it turned out to be work experience in the field of security at an engineering enterprise for at least 5 years.

The entire survey process was carried out in accordance with the current ethical standards of statistical research. In the course of the study, the anonymity of the experts was preserved, and their answers had no effect on their subsequent work at the enterprise.

Table 1. Classification of resources necessary for the formation of the safety potential of engineering enterprises

Resources for the formation of the safety potential of the enterprise		
Material and financial	**Personnel**	**Organizational**
Dedicated in normal operation	With the help of specialized divisions of the enterprise	Activities developed within the enterprise
Due to redistribution from other areas of activity (within the enterprise)	By attracting workers from other divisions of the enterprise	By sharing information and experience with other organizations
Additional from reserve funds	It is necessary to additionally involve third-party workers and organizations	Provision of services by a third party security service

w_j	w_1	w_2	w_3
$\boldsymbol{w_1}$	1	4	5
$\boldsymbol{w_2}$	1/4	1	2
$\boldsymbol{w_3}$	1/5	1/2	1

Table 2. Scale for assessing the level of safety resources for the potential of engineering enterprises

Level	Assessment of the level of ensuring the safety of the potential of engineering enterprises
Minimum	Slows down (pauses the process)
Normal	makes it possible
Maximum	Gives the opportunity to speed up the process

Table 3. Designation of the levels of provision of material and financial w_j, personnel x_j and organizational y_j resources for the safety potential of engineering enterprise

№	Level of ensuring the safety of the potential of the engineering enterprises	Resources		
		$\boldsymbol{w_j}$	$\boldsymbol{x_j}$	$\boldsymbol{y_j}$
1	**Minimum**	w_1	x_1	y_1
2	**Normal**	w_2	x_2	y_2
3	**Maximum**	w_3	x_3	y_3

Table 4. A scale of the relative importance of the levels of provision of appropriate resources in relation to the safety potential of the engineering enterprise

Score, points	Explanation on the choice of assessment of the importance of the level of safety potential of the engineering enterprise
1	levels of resource provision are equivalent
2	one level of resource provision slightly predominates the other
3	one level of resource provision prevails another level
4	one level of resource provision is vastly superior to another
5	one level of resource provision absolutely prevails another level

4. RESULTS OF RESEARCH AND DISCUSSION

The results of comparing the levels of provision with resources for each of them will be presented further in the text of the work in the form of matrices of paired comparison. For a clear practical demonstration of the proposed methodological approach, data on the financial and economic activities of the engineering enterprise in Ukraine were taken (LLC "Electron").

This engineering enterprise operates on the territory of Poland and Ukraine. All the data that was provided for the study was provided by the persons of the safety department of

the company "Electron", and therefore we cannot provide the source of the data.

For two levels of resource provision, they are compared with each other depending on their degree of influence on the process of ensuring the safety potential of the engineering enterprise, we obtain an assessment of the importance, it is the corresponding element of the matrix in the position (w_j, w_m). According to the chosen method, the diagonal elements of the matrices are equal to one, and the lower part of the matrix is filled with inverse values.

Below there is a matrix of paired comparisons of the levels of provision of material and financial resources w_j of the safety potential of the engineering enterprise (Table 5).

Table 5. The results of comparing the levels of material and financial resources of the safety potential of the engineering enterprise

w_j	w_1	w_2	w_3
w_1	1	4	5
w_2	1/4	1	2
w_3	1/5	1/2	1

To establish the degree of consistency of numerical values of pairwise comparisons of safety potential levels of engineering enterprises, summarized in the matrix (Table 5), calculate the normalized priority vector of the matrix *En* (Table 6), the eigenvalue of the matrix λmax, consistency index IU and consistency ratio WU (Table 7).

Table 6. Components of the normalized vector of priorities of the matrix of pairwise comparisons of levels of providing material and financial resources of the safety potential of the engineering enterprise

w_j	w_1	w_2	w_3
E_n	0.683	0.199	0.116

The calculations were performed using a computer program.

The results of pairwise comparisons (Table 5) can be considered satisfactory, because $WU \leq 0.1$ (Table 7). Thus, we have a sufficient level of convergence of the comparison process and proper consistency of expert judgments regarding the weight values of the levels of material and financial resources of the safety potential of the the engineering enterprise.

Table 7. The results of determining the consistency of the matrix of pairwise comparisons of the levels of material and financial resources of the safety potential of the engineering enterprise

Indicator	The eigenvalue of the matrix, λ_{max}	Consistency index, *IU*	Consistency ratio, *WU*
Value	3.024	0.012	0.021

Further, just as the levels of providing material and financial resources for the safety potential of the engineering enterprise were compared, we compare the levels of providing the safety potential of the the engineering enterprise with personnel and organizational resources (Tables 8 and 9).

Table 8. The results of comparing the levels of personnel resources safety potential of the engineering enterprise

x_j	x_1	x_2	x_3
x_1	1	2	3
x_2	½	1	1
x_3	1/3	1	1
E_n	0.683	0.199	0.116

The table with the matrix of pairwise comparisons of the levels of personnel resources provision of the safety potential of the the engineering enterprise (Table 8) will be supplemented with a line with the results of calculations of the components of the normalized vector of the matrix priorities. We establish the degree of consistency of numerical values of pairwise comparisons of levels of safety potential of the engineering enterprise, which are summarized in the matrix (Table 8), calculate the eigenvalue of the matrix λmax, consistency index *IU* and consistency ratio *WU* (Table 9).

Table 9. The results of determining the consistency of the matrix of pairwise comparisons of the levels of personnel safety potential of the engineering enterprise

Indicator	The eigenvalue of the matrix, λ_{max}	Consistency index, *IU*	Consistency ratio, *WU*
Value	3.018	0.009	0.016

The results of pairwise comparisons (Table 9) are satisfactory. We have a sufficient level of convergence of the comparison process and proper consistency of expert judgments ($WU \leq 0.1$).

In the following table (Table 10) we have summarize the data on the comparison of the levels of organizational resources of the safety potential of the engineering enterprise and determine the components of the normalized vector of priorities of the same matrix.

Table 10. The results of comparing the levels of organizational resources of the safety potential of the engineering enterprise

y_j	y_1	y_2	y_3
y_1	1	3	4
y_2	1/3	1	2
y_3	¼	1/2	1
E_n	0.625	0.238	0.136

We consider the results of paired comparisons (Table 11) to be satisfactory because we have a sufficient level of convergence of the comparison process and proper consistency of expert judgments ($WU \leq 0.1$).

Table 11. The results of determining the consistency of the matrix of pairwise comparisons of the levels of organizational resources of the safety potential of the engineering enterprise

Indicator	**The eigenvalue of the matrix, λ_{max}**	**Consistency index, *IU***	**Consistency ratio, *WU***
Value	3.018	0.009	0.016

Applying the method of pairwise comparisons by the predominance of options, we determine the possibility of optimal resource provision of the safety potential of the engineering enterprise. To do this, we evaluate the alternatives of providing the relevant resources of the safety potential of the engineering enterprise (Table 12) at the levels defined above (Table 1).

Table 12. Material and financial resources are needed to ensure the safety potential of the engineering enterprise

№	Resources	Marking
1	allocated in the normal mode of operation ($_{MFR1}$)	*A*
2	due to redistribution from other areas of activity (within the enterprise) ($_{MFR2}$)	*B*
3	additional from reserve funds ($_{MFR3}$)	*C*

In order to determine the utility function of certain resources to ensure the safety potential of the engineering enterprise, we compare these types of resources, taking into account the appropriate levels of their provision. The results of comparisons, which are presented in the form of tables (Tables 13, 15 and 17), will be supplemented with a line with the results of calculations of the usefulness of these resources.

Table 13. The results of the comparison of material and financial resources at the minimum level of ensuring the safety potential of the engineering enterprise

Low Level	*A*	*B*	*C*
A	1	1/2	¼
B	2	1	1/3
C	4	3	1
E_n	0.136	0.238	0.625

The consistency of the evaluation results is established by the priority vectors λmax, the *IU* consistency index and the *WU* consistency ratio (Tables 14, 16 and 18).

Table 14. The level of consistency of the results of the comparison of material and financial resources at the minimum level of ensuring the safety potential of the engineering enterprise

Indicator	The eigenvalue of the matrix, λ_{max}	Consistency index, *IU*	Consistency ratio, *WU*
Value	3.018	0.009	0.016

The results of the comparison of material and financial resources at the normal level of providing them with the safety potential of the engineering enterprise are shown in Table 15.

Table 15. The results of comparison of material and financial resources at the normal level of providing them with the safety potential of the engineering enterprise

Normal Level	*A*	*B*	*C*
A	1	1/2	1/3
B	2	1	½
C	3	2	1
***E**n*	0.163	0.296	0.539

The level of consistency of the results of the comparison of material and financial resources at the normal level of ensuring the safety potential of the engineering enterprise is shown in Table 16.

Table 16. The level of consistency of the results of the comparison of material and financial resources at the normal level of ensuring the safety potential of the engineering enterprise

Indicator	**The eigenvalue of the matrix, λ_{max}**	**Consistency index, *IU***	**Consistency ratio, *WU***
Value	3.009	0.005	0.008

Table 17. The results of comparing material and financial resources with the maximum level of ensuring the safety potential of the engineering enterprise

Maximum Level	***A***	***B***	***C***
A	1	1/2	1/2
B	2	1	1/2
C	2	2	1
E_n	0.195	0.310	0.493

The level of consistency of the comparison results (Tables 14, 16 and 18) is considered satisfactory, because we have a sufficient level of convergence of the comparison process and proper consistency of expert judgments (WU ≤ 0.1).

Table 18. The level of consistency of the results of comparison of material and financial resources at the maximum level of ensuring the safety potential of the the engineering enterprise

Indicator	**The eigenvalue of the matrix, λ_{max}**	**Consistency index, *IU***	**Consistency ratio, *WU***
Value	3.054	0.027	0.046

The results of calculations of utility functions of types of material and financial resources at different levels of providing them with the safety potential of the engineering enterprise (Tables 13, 15 and 17) to simplify further calculations are summarized in one table (Table 19).

Table 19. The usefulness of the types of material and financial resources for the safety potential of the engineering enterprise at various levels of their safety potential of the engineering enterprise

U_{MFRij}	u_{MFRi1}	u_{MFRi2}	u_{MFRi3}
u_{MFR1j}	0.136	0.238	0.625
u_{MFR2j}	0.163	0.296	0.539
u_{MFR3j}	0.195	0.310	0.493

The components of the normalized vector of priorities of the matrix of pairwise comparisons of levels of material and financial resources security of the engineering enterprise (Table 6) allowed to determine the specified weights of s*i* types of material and financial resources at different levels of safety potential of the engineering enterprise.

In our case, there are three options for the values of the utility function of the U_{MFRi} material and financial resources at

different levels of providing them safety potential of the engineering enterprise (1):

$$U_{MFR1}=s_{MFR1}u_{MFR11}+s_{MFR2}u_{MFR21}+s_{MFR3}u_{MFR31},$$
$$U_{MFR2}=s_{MFR1}u_{MФР12}+s_{MFR2}u_{MFR22}+s_{MFR3}u_{MFR32}, \quad (1)$$
$$U_{MFR3}=s_{MFR1}u_{MФР13}+s_{MFR2}u_{MFR23}+s_{MFR3}u_{MFR33}.$$

Substituting into the system of Eq. (1) the obtained values of the weights of the types of material and financial resources at various levels of their safety potential of the engineering enterprise and the usefulness of resources for various levels of safety potential of engineering enterprise, we obtain the following results (2):

$$U_{MFR1}=0,683\times0,136+0,199\times0,163+0,116\times0,195=0,148,$$
$$U_{MFR2}=0,683\times0,238+0,199\times0,296+0,116\times0,310=0,257, \quad (2)$$
$$U_{MFR3}=0,683\times0,625+0,199\times0,539+0,116\times0,493=0,591.$$

The above results are listed in Table 20.

The results show that the greatest effect in ensuring the safety potential of the engineering enterprise for different needs in material and financial resources is achieved by the alternative U_{MFR3} (ensuring the safety potential of the engineering enterprise by attracting additional resources from reserve funds of the LLC "Electron"), for which the utility function is maximum (Table 20).

Table 20. The value of the utility function of material and financial resources for different levels of providing them with the safety potential of the engineering enterprise

U_{MFRi}	U_{MFR1}	U_{MFR2}	U_{MFR3}
Value	0.148	0.257	0.591

Similar calculations were made for personnel and organizational resources. To find the value of the utility functions of the types of personnel resources at different levels of providing them with the safety potential of the engineering enterprise (Table 21), we also made a matrix of pairwise comparisons

Table 21. Personnel resources are needed to ensure the safety potential of the engineering enterprise

№	Resources
1	by the specialized divisions of the enterprise ($_{PER1}$)
2	by attracting employees from other divisions of the enterprise ($_{PER2}$)
3	it is necessary to additionally involve third-party workers and organizations ($_{PER3}$)

Without reflecting these calculations (as has already been shown in the tables above), we obtained the value of the utility function of personnel resources for different levels of safety of the engineering enterprise (Table 22).

Table 22. The value of the utility function personnel resources for different levels of providing them with the safety potential of the engineering enterprise

U_{PERi}	U_{PER1}	U_{PER2}	U_{PER3}
Value	0.143	0.245	0.607

The calculations (Table 22) show that the maximum effect in ensuring the safety potential of the engineering enterprise for different needs in personnel resources is achieved by alternatives U_{PER3} (ensuring the safety potential of the LLC "Electron" is due to additional involvement of third parties and organizations) is the maximum.

To find the value of the utility functions of the types of organizational resources at different levels of providing them with the safety potential of the engineering enterprise (Table 23), we also made a matrix of pairwise comparisons.

Table 23. Organizational resources are needed to ensure the safety potential of the engineering enterprise

№	Resources
1	activities developed within the enterprise ($_{ORG1}$)
2	by sharing information and experience with other organizations ($_{ORG\ 2}$)
3	provision of services by a third party safety service ($_{ORG\ 3}$)

Without demonstration of similar calculations, the results are shown in Table 24.

Table 24. The value of the utility function organizational resources for different levels of providing them with the safety potential of the engineering enterprise

U_{ORGi}	U_{ORG1}	U_{ORG2}	U_{ORG3}
Value	0.621	0.251	0.125

The obtained results (Table 24) prove that the maximum effect in ensuring the safety potential of the engineering enterprise for different needs in organizational resources is achieved by alternative U_{ORG1} (ensuring the safety potential of LLC "Electron" occurs through measures developed within the enterprise), for which the utility function is maximum.

Discussing the results of our study, we can note that it makes its scientific contribution to the development of solving problems of economic security in engineering enterprises. When, for example, Bublyk et al. [16] and Luebcke [17] analyze what factors may affect the very system of economic security of engineering enterprises, we seek to propose an approach that will determine which and how to use existing enterprise resources in order to maximize its own safety potential.

Organizational resources are very popular among the scientific community when it comes to researching business safety in the enterprise. Thus, Khalina et al. [18] and Hbur et al. [7] considers safety in engineering enterprises through the prism of organizational resources. In our methodological approach, we propose to consider not only through organizational resources but also through material, financial and personnel.

Unfortunately, today there are few scientific studies that focus on the resources of enterprises as its basis for safety and capacity building as such. For example, Shynkar et al. [19] and Ianioglo & Polajeva [20] propose to assess security through a certain set of indicators, however, in our opinion, it is the assessment of resources and reveals the safety potential of the enterprise.

5. CONCLUSIONS

A scientific and practical approach to the formation of the safety potential of engineering enterprises has been

substantiated, which provides, taking into account the alternative, dynamism, combination of use, proportionality and efficiency, to identify available resources and opportunities, their structuring and the formation of organizational forms for effective use in the field of safety activities. The choice of the most rational option for resource security using the method of multi-criteria assessment of alternatives for different needs in material, financial, personnel and organizational resources to achieve the tasks set for security subjects is proposed.

So, as a result of the study, a scientific and practical approach to the formation of the safety potential of engineering enterprises was proposed, the use of which, in contrast to the existing ones, based on the use of methods for multi-criteria assessment of alternatives and a matrix of paired comparisons for the advantage of options, allows to form alternative options for resource provision with the possibility the choice of the optimal among them based on the different needs for material, financial, personnel and organizational resources to maintain an appropriate level of security.

The presented assessment method is only a methodological basis for the presentation of data. The main method of our research is the use of a matrix of pairwise comparisons. Usually this methodology is not new, and is represented in many mathematical studies. But for economics and security management, this method is new and relevant for use and further development. Therefore, our article has scientific value, which lies in the application of new methods in the field of resource management and the application of new methods of safety management.

The study has certain limitations related to the fact that the data and enterprises that were used relate to the engineering ones of Eastern Europe.With the following adaptation and experimental verification, this methodology can be used at the industrial enterprises of other countries of the world.

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