Optimization of the Sources Structure of Financing the Implementation of Strategic Guidelines for Ensuring the Economic Security of Investment Activities of an Industrial Enterprise

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Abstract – The purpose of the research is to determine the optimal structure for financing the investment activities of industrial enterprises in the context of ensuring the economic security of such activities. In addition, the use of minimax strategies was substantiated in the direct selection of funding sources and the adoption of appropriate strategic decisions to minimize potential losses. Methodological approaches of strategic management for specifying the strategic guidelines for ensuring the economic security of the investment activities of an industrial enterprise were used to achieve the purpose. Optimization models have been developed on the basis of empirical studies at Ukrainian industrial enterprises and the survey conducted. The developed model for optimizing economic security based on minimizing losses in the formation of sources of financing investment activity allows enterprise management to make weighted strategic decisions and provides sufficient arguments for measures in the field of economic security.

Keywords – economic security, investment activity, strategic guidelines, funding sources optimization.

1. Introduction

Given the geopolitical changes of the last decade, security issues in various areas are becoming one of the highest priorities and are actively discussed at various levels. Globalization has impacted people and communities across the globe and has significantly influenced sustainable development. Fueled by fast-paced changes in technology and the increased mobility of goods, services, capital and labour, over the past decades globalization has greatly changed economies, societies and the natural environment and has made our world more interconnected than ever before [10].

Negative trends inherent in the economies of some countries in modern conditions are rapidly spreading and causing global crises that are extremely difficult to transfer for the countries with underdeveloped economies.

The paradox of twenty-first century globalization is that – despite an endless stream of discussion about its flexibility, efficiency and competitiveness – advanced and developing economies are becoming increasingly brittle, sluggish and fractured [13]. As Børge Brende said as the President of the World Economic Forum: «Geopolitical and geo-economic tensions are rising among the world's major powers. These tensions represent the most urgent global risks at present. The world is evolving into a period of divergence following a period of globalization that profoundly altered the global political economy. Reconfiguring the relations of deeply integrated countries is fraught with potential risks, and trade and investment relations among many of the world's powers were difficult during 2018» [11].

One of the important elements of the planetary economic system is security in its various manifestations, this also applies to the economic

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security of states, regions and individual enterprises. The economic security of the macro, meso and micro levels attracts the attention of both theoretical scientists and business leaders, since in the present conditions it is the key to the development of various economic systems. However, it is difficult to imagine any economic development without investment and effective investment management; therefore, studies of economic security of investment activities and the definition of strategic guidelines for ensuring such security are of particular relevance.

2. Review of previous studies

Experience in different areas of science and practice in solving problems of enterprise functioning and the economic reforms' success, including the field of economic security, has been accumulated in the economically developed countries of the world. So in recent years, such scientists as R. M. Gasca, A. J. Varela-Vaca [15], L. B. Cruz, D. M. Boehe, M. H. Ogasavara [3] developed a special technological control system for economic safety of the enterprise to provide optimal control over the security of business operations, formed the enterprise strategy based on corporate social responsibility, created separate mechanisms for improving the efficiency of enterprises. James McGann [8] conducted a quantitative and qualitative study of SIA think tanks, examining global and regional trends in his research. He presented a study on the evolution of security, as the researchers understand it, and assessed the future of security research and international relations with the possibility of a return to the traditional security orientation. Justification of discussions and problems in modern studies by foreign researchers in the field of security are presented in [12], [17].

Problems of economic security of economic entities and investment activities are also discussed in the works by Ukrainian scientists [6], [9] where the authors formed the conceptual foundations of economic security and security of investment activity, however, the modern transformation processes of the institutional environment in the conditions of external aggression and transformation of the fiscal sphere in particular are not taken into account. However, the applied aspects of the functioning of the elements of the economic security system in the field of investment management have been ignored by the scientific community, which determines the relevance of our study with the formation of not only theoretical but also applied aspects of the problem.

3. Methods

The functioning of most modern industrial enterprises shows the intensification of competition in the global dimension and the emergence of a significant number of intra-system threats and risks that negatively affect the economic security of such entities. This requires sound management decisions, especially in the area of strategic management. At the same time, taking into account the branching and differentiation of strategies developed at enterprises, functional strategies and strategic decisions aimed at solving highly specialized problems and aspects, including the provision of economic security of investment activity directly occupy a special place within the research. A classic approach to shaping functional strategies is developing them in accordance with the main priorities and goals of the enterprise overall development strategy.

In the ideal conditions for the strategies formation and implementation in accordance with their hierarchy in the enterprise, the triads of strategies related to investment activity, which "interact" within the system of enterprise management appear and they include the general strategy of enterprise development; strategy of the enterprise investment activity; strategy of providing the enterprise economic security. And if the first two strategies are thoroughly researched and detailed in various scientific sources [2], [4] the strategic aspects within the functioning of the system of economic security and its separate functional components require further scientific and methodological substantiation.

The expediency of forming such a strategy is also conditioned by the need for a clear vision of the sequence of its implementation and the general organization of the stakeholders interaction system, the substantiation of its resource support, the formation of the monitoring indicators' system of the implementation of such a strategy. The development of approaches to overcome resistance to change and opportunistic behavior of workers is of particular importance in this process, as they are forced to transform their traditional approaches to management and operational processes in accordance with the requirements and goals of the strategy, which does not always coincide with their interests and their vision of the enterprise development.

The formation of a strategy for ensuring the economic security of investment activity should include several options for organizing this process, since not all enterprises have a development strategy or individual functional strategies in general.

That is, there are at least three options for developing a strategy for ensuring the economic security of investment activity:

1. Subordination to the main objectives of the overall strategy; investment strategy; strategies for ensuring economic security;

2. Subordination to the main objectives of the investment strategy; strategies for ensuring economic security (if there are any);

3. Separation of the investigated strategy into a separate functional type, taking into account the absence of general strategic approaches to enterprise management.

It is also necessary to focus on the possible emergence of a conflict between the goals of different level strategies, since the goals of economic security will not always coincide with the goals of certain functional strategies. Profit maximization in short term (which is one of the main tasks for middle managers) in most cases will not be in line with an economic security strategy, and maximizing the return on investment usually involves a risk increase. At the same time, miscalculations in the field of investment management can lead to the most significant losses, since they are significant in terms of both value and time (as the risk of lost opportunity or benefit).

Also the subordination of the service (or department) of enterprise economic security is important, since it determines the efficiency and in many cases the compulsion of all developed measures in the field of economic security, including strategic ones. As noted in [6], the economic security service can be either a subsystem of the general enterprise management system, or have super-system characteristics (that is, be subject only to the owners or directors of the enterprise). Although the supersystem characteristics of the economic security service are typical for large industrial corporations, and the "SCM" and the Metinvest are striking examples of its functioning in Ukraine. For most enterprises, the economic security service, or the department with the appropriate authority, is a subsystem of the overall management system. Therefore, the formation of the investigated strategy and its integration into the overall strategy of enterprise development is an integral part of the implementation of managerial influence in the field of economic security and management system in general. The importance of managerial influence is caused by the fact that Ukrainian industrial enterprises practically do not invest in securities, that is, real investments with a relatively predictable economic effect prevail. This means that management can influence the final result of investment, since financial investments are more risky from the point of view of their management and the possibility of changing certain aspects of the external and internal environment. Accordingly, it is

the propensity of enterprise management to take risks that will determine the further opportunity to influence investment processes and ensure the economic security of a particular enterprise through the transformation of internal system processes and strategic management tools.

Most strategies require adequate financial support for their implementation, which determines the need and the search for effective tools for selecting sources of financing investment activity, their structural balancing in order to minimize the risks to the enterprise economic security and economic losses in general.

Consequently, enterprises usually have three types of financing sources of investment activity: in addition to own resources (own accumulated funds), these are borrowing and attracting. Each of the sources has its advantages and disadvantages; therefore, the enterprise management faces an extremely difficult task of choosing and balancing such sources in the formation processes of investment resources in order to minimize potential risks and economic losses.

The economic losses of enterprise, when forming sources of financing investment activity, are not caused by one, but by a number of various negative factors. That is, the loss is a consequence of the influence of some combination of such factors (causes). Let's denote the number of variants of combinations of potential causes of enterprise economic losses in the financing sources formation as N.

Let l_{kj} be estimation of losses for k-th type of the funding sources formation after the j-th option "worked out". Then we can consider the matrix of losses $\mathbf{L} = \left[l_{kj} \right]_{3 \times N}$ for further work aimed at minimizing these losses [16], [14]. This minimization involves the use of some combination of funding sources types, which use expects or predict the smallest losses. In particular, you can first define a cautious minimax strategy with probabilities for specified funding sources. Implementation of such a strategy is guaranteed to provide average losses no higher than a certain level [7], [16], [18].

Let us start with the evaluation of the elements of matrix of losses. Of course, such an assessment will only take place on the basis of expert judgments. Let us have K experts, each of which gives N assessments for each of the three types of funding sources. An r-th expert assessment for an element l_{kj} is an integer number $a_{kj}(r)$.

In our case, the assessment procedure for each expert is quite complicated, since the expert must provide $3N$ assessments in aggregate. Therefore, the

influence of various minor factors should be minimized. Therefore, experts are invited to provide estimates on a simplified scale:

1) the estimates must be integer numbers;
2) the assessment scale will not be long;
3) "0" estimate, which corresponds to the absence of losses, is mandatory (although such situations are rare);
4) the distance between "neighboring" estimates will be greater than one to strengthen the expert judgments categoricalness.

According to this list, the best option for the assessment scale is a range from 0 to 10 in step 2. So:

$$a_{kj}(r) \in \{0, 2, 4, 6, 8, 10\}, \quad r = \overline{1, K}, \quad k = \overline{1, 3}, \quad j = \overline{1, N}. \quad (1)$$

The general assessment of the element l_{kj} of the matrix of losses is then the arithmetic average (1):

$$l_{kj} = \frac{1}{K} \sum_{r=1}^{K} a_{kj}(r), \quad k = \overline{1, 3}, \quad j = \overline{1, N}. \quad (2)$$

In a matrix game with a matrix of losses $\mathbf{L} = \left[l_{kj} \right]_{3 \times N}$, which elements are determined by the formula (2) on the basis of expert assessments (1), there is always a minimax strategy (for the first player, since we operate with losses):

$$\mathbf{P} = \begin{bmatrix} p_{Vlas} & p_{Poz} & p_{Zal} \end{bmatrix}, \quad (3)$$

where the magnitudes p_{Vlas}, p_{Poz}, p_{Zal} are the probabilities of the funding sources formation, respectively, based on their own resources, borrowing, attracting, when [16], [18]:

$$p_{Vlas} + p_{Poz} + p_{Zal} = 1.$$

Probabilities (3) can be interpreted as fractions of the total amount necessary for the implementation of the enterprise action plan, including economic security. It is possible that one of these probabilities may be zero. This means that the appropriate type of financing source is super-risky (and minimax strategies in the economy aim at maximum caution in making economic decisions). It may even turn out that two of the probabilities in strategy (3) are zero. Then this strategy is called pure [16], although it usually does not constitute an effective way to form management decisions in complex economic systems [1], [18]. In particular, when profitable enterprises are operating only with one source of financing, there must be a certain non-zero probability of a

satisfactory state of the enterprise economic security. In the case of non-profitable ones, such a probability may be zero, but not for each of the three funding sources types.

Consequently, we can use the Bayes' theorem to adjust too careful minimax strategies (3) [1], [5], [14]. To do this, the K experts should evaluate three probable probabilities of a satisfactory state of the enterprise economic security (event A): probabilities $P(A|Vlas)$, $P(A|Poz)$, $P(A|Zal)$ after the formation of financing sources of investment activity on the basis of own resources, borrowing, attraction.

The scale of assessments in this case should be even narrower, since it is a very delicate magnitude (a huge set of direct and hidden factors affects the event A), and the number of experts, as a rule, is limited. The best option here is the scale of five assessments, including the impossibility (zero probability) and reliability (single probability) of the event A:

$$B = \{0, 0.25, 0.5, 0.75, 1\}. \quad (4)$$

Then the r-th expert forms corresponding estimates on the basis of the scale (4):

$$s_{Vlas}(r) \in B, \quad s_{Poz}(r) \in B, \quad s_{Zal}(r) \in B, \quad r = \overline{1, K}. \quad (5)$$

Further, the general estimates of the conditional probabilities of a satisfactory state of enterprise economic security are average arithmetic of corresponding estimates (5):

$$P(A|Vlas) = \frac{1}{K} \sum_{r=1}^{K} s_{Vlas}(r), \quad (6)$$

$$P(A|Poz) = \frac{1}{K} \sum_{r=1}^{K} s_{Poz}(r), \quad (7)$$

$$P(A|Zal) = \frac{1}{K} \sum_{r=1}^{K} s_{Zal}(r). \quad (8)$$

By the total probability theorem [5]:

$$P(A) = P(A|Vlas) \cdot p_{Vlas} + P(A|Poz) \cdot p_{Poz} + P(A|Zal) \cdot p_{Zal} \quad (9)$$

is an unconditional probability of a satisfactory state of the enterprise economic security. Now we can apply the Bayes' theorem for correction of minimal probabilities (which are actually the so-called hypotheses here). On this basis, the probability of the desired optimal strategy to minimize the losses of funding sources:

$$\mathbf{H} = \begin{bmatrix} h_{Vlas} & h_{Poz} & h_{Zal} \end{bmatrix} \quad (10)$$

is determined as follows [5]:

$$h_{Vlas} = P(Vlas \mid A) = \frac{P(A \mid Vlas) \cdot p_{Vlas}}{P(A)}, \quad (11)$$

$$h_{Poz} = P(Poz \mid A) = \frac{P(A \mid Poz) \cdot p_{Poz}}{P(A)}, \quad (12)$$

$$h_{Zal} = P(Zal \mid A) = \frac{P(A \mid Zal) \cdot p_{Zal}}{P(A)}, \quad (13)$$

where (11), (12), (13) are the optimal probabilities of the funding sources formation, respectively, based on their own resources, borrowing.

4. Results

The practical implementation of the above research methodology should be based on an appropriate list of the significant enterprise characteristics and the current state of economic security. Experts' evaluation should be conducted on the basis of information about the enterprise infrastructure. This information mainly concerns the significant characteristics of the enterprise and the current state of economic security:

1) organizational and legal form (state enterprise, public joint stock company, limited liability company, private enterprise);
2) financial state (profitable or loss-making);
3) presence of economic security department or a unit with appropriate powers in the field of investment activity security (whether or not);
4) management tendency to risk (whether or not);
5) credit history (positive or negative);
6) presence of state support or government orders (whether or not).

This list with the corresponding answers will be provided to experts, as these characteristics create the preconditions for the emergence of specific risks that cause the enterprise economic losses. However, the list of potential causes of economic losses in the funding sources formation does not depend on the enterprise infrastructure (as part of its economic security analysis).

From the point of view of economic security of the enterprise as a whole and its participation in investment activity in particular, the most influential reasons for the enterprise economic losses in

generating financing sources are the following:

1) increase in the cost of investment resources (need to pay interest, transaction costs);
2) enterprise raider capture;
3) loss of control over an enterprise (loss of a controlling shareholding) or loss of ability to manage an enterprise (if it is a non-equity company);
4) lack of working capital to carry out operating activities at the enterprise;
5) loss of controllability of enterprise organizational processes.

Now from the five types of risks presented, we compile $N = 2^5 = 32$ options for combining the potential causes of the company's economic losses in generating financing sources [1], [19]. The construction of the matrix of losses will be based on expert assessments in K questionnaires, where each expert will use the assessment scale in formula (1).

Let us consider the proposed model for optimizing economic security on the basis of minimizing the loss of the formation of sources of financing investment activities of an enterprise in action for the state-owned enterprise "Novator" (m. Khmelnytsky). On January 1, 2019, "Novator" is profitable, has a security department, and its management is not prone to risk. The credit history of this company is positive. In addition, the state-owned enterprise "Novator" is provided with state support.

38 experts were involved for the questionnaires examination. Thus, at first, the experts were informed on the following characteristics: state-owned enterprise, profitable, has a security department, the management is not risk-averse, positive credit history, has a state support. But in addition it was noted to the experts that the risk of raiding for state-owned enterprises is minimal. In other words, the experts proceeded from the fact that the impact of raider capture in the respective combinations of negative factors (options №9-16 and №25-32) is almost zero. This, of course, does not mean that these 16 variants of risk combinations have little effect on the loss estimates at the SOE "Novator".

After processing all 38 questionnaires, estimates were determined (2) and a matrix of losses was constructed $\mathbf{L}$. Figure 1. shows a fragment of this matrix. As you can see, the experts unanimously evaluated the first and last columns. However, in such a matrix game, the first player's minimax strategy is an arbitrary combination of three probabilities. In other words, any strategy here is cautious, including three pure strategies.

0	1.549	7.631	9.367	8.894	• • •	7.906	9.616	9.054	7.803	10
0	2.265	0.1326	2.114	7.634	• • •	9.679	9.758	9.291	9.086	10
0	1.711	0.1574	1.624	7.321	• • •	9.645	9.592	9.86	9.53	10

Figure 1. Fragments (first and last five columns) of the matrix of losses $\mathbf{L} = \left[l_{kj} \right]_{3 \times 32}$ *for SOE "Novator"*

It is clear that such a decision is unacceptable. Actually, it can be interpreted as the impossibility of solving the task of optimizing the enterprise economic security. Therefore, we exclude from consideration these "supposed" estimates in the form of the outside columns of the matrix of losses and consider the reduced one sized 3×30:

$$\mathbf{L}_{\text{redu}} = \begin{bmatrix} l_{12} & l_{13} & \cdots & l_{1,N-1} \\ l_{22} & l_{23} & \cdots & l_{2,N-1} \\ l_{32} & l_{33} & \cdots & l_{3,N-1} \end{bmatrix}. \tag{14}$$

Full matrix is shown in Figure 2.

```
1.549      7.631      9.367      8.894      9.278      9.468
2.265      0.1326     2.114      7.634      7.129      7.456
1.711      0.1574     1.624      7.321      7.299      7.727

   9.427      7.821      7.97      7.621      9.283      9.24
   7.934      7.687      7.714     9.277      9.903      9.151
   7.543      7.176      7.711     9.024      9.404      9.247

      9.485      9.356      9.934     0.06661     1.632      5.912
      9.775      9.838      9.12      7.491       9.052      9.689
      9.574      8.95       9.628     7.747       9.437      9.018

         5.417      9.536      9.331      9.631      9.322      1.616
         9.746      9.037      9.652      8.818      9.572      9.26
         9.624      9.297      9.191      9.523      9.085      9.23

            3.599      5.971      7.906      9.616      9.054      7.803
            9.188      9.31       9.679      9.758      9.291      9.086
            9.733      9.034      9.645      9.592      9.86       9.53
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Figure 2. Reduced matrix of losses (14), reflected in five 3×6 rows for convenience, for SOE "Novator" according to 38 experts' estimates

Minimax strategy (3) for a reduced matrix of losses in Figure 2.,

$$\mathbf{P} = \begin{bmatrix} 0.201 & 0.1367 & 0.6623 \end{bmatrix} \tag{15}$$

shows that for the SOE "Novator" in the most cautious direction of further actions would be attracting investments, grants, and also, under certain conditions, share participation. Does this really correspond to the rational formation of funding sources? To answer this question, the same 38 experts assessed the probability of a satisfactory state of the enterprise economic security. In the end, the probabilistic estimates (6) - (8) were the following:

$$P(A|Vlas) = 0.1993, \quad P(A|Poz) = 0.2987,$$
$$P(A|Zal) = 0.4586. \tag{16}$$

It is worth noting that the estimates (16) are somewhat similar to the probabilities in the minimax strategy (15). But, unlike the cautious behavior of

this strategy, where borrowing is less trusted (probability of 0.1367 versus 0.201 and 0.6623), the probabilistic assessment of the achievement of a satisfactory state of economic security for "Novator" only on the basis of borrowing is rather high. On the other hand, the probabilistic assessment of the attraction was reduced by almost 31%. At the same time, according to the judgments of experts, the probabilistic assessment of economic security based solely on its own resources has remained almost unchanged (about 0.2). However, we should remember that that the probabilities in any minimax strategy (3) differ in their "purpose" from the conditional probabilities $P(A|Vlas)$, $P(A|Poz)$, $P(A|Zal)$, since the latter are probabilities of achieving economic security, while the minimal probabilities indicate the shares of the total financial resources needed for this achievement.

Continuing its work with expert assessments, the unconditional probability (9) of a satisfactory state of economic security of the SOE "Novator", taking into account probabilities (16), is as follows:

$$P(A) = 0.1993 \cdot 0.201 + 0.2987 \cdot 0.1367 + 0.4586 \cdot 0.6623 = 0.3846.$$

Of course, the magnitude $P(A) = 0.3846$ is small, but this indicator plays a supporting role for determining the optimal strategy (10) for the formation of funding sources. Consequently, the desired optimal strategy (10) by formulas (11) - (13) has the following probabilities:

$$h_{Vlas} = P(Vlas \mid A) = \frac{0.1993 \cdot 0.201}{0.3846} = 0.1042,$$

$$h_{Poz} = P(Poz \mid A) = \frac{0.2987 \cdot 0.1367}{0.3846} = 0.1062,$$

$$h_{Zal} = P(Zal \mid A) = \frac{0.4586 \cdot 0.6623}{0.3846} = 0.7896,$$

that is, the strategy

$$\mathbf{H} = \begin{bmatrix} 0.1042 & 0.1062 & 0.7896 \end{bmatrix} \qquad (17)$$

is optimal in the sense of economic security of the SOE "Novator". At the same time, the strategy (17), if we compare it with the Minimax strategy (15), will further direct the "Novator" in the direction of attracting investments. According to our model, the loss of financing sources on the subsidiary "Novator" will be minimized, if the company adds about 10.5% of its own funds and 10.5% of its borrowings to the total amount. The remaining 79% of resources should be collected on the basis of attraction.

Let us now study an example for an enterprise without state support: LLC "ATEM" i PJSC "Chynbar". 26 experts participated in the evaluation for LLC "ATEM". They were informed about the relevant characteristics: a limited liability company, a loss-making, no security department, a risk-averse management, a positive credit history, no state support. As a result, the reduced matrix of losses for LLC "ATEM" (Figure 3.) was, at first glance, quite similar to the matrix in Figure 2. However, the averaged difference between these matrices is tangible and is about 14%.

```
2.12      7.457      7.307      7.408      7.366      7.945
1.524     0.5367     1.473      7.241      7.47       7.236
1.456     0.1199     1.903      7.175      7.742      7.147

      9.177     7.671     7.866     7.326     9.765     9.195
      7.408     7.521     7.145     9.446     9.589     9.563
      7.76      7.831     7.14      9.795     9.623     9.091

          9.681     9.147     9.565     0.3061    1.997     5.758
          9.397     9.028     8.829     7.34      9.65      8.948
          9.573     9.568     9.632     7.693     9.009     9.656

              5.488     9.187     9.306     9.432     9.407     2.285
              9.255     9.78      8.915     9.769     9.691     8.979
              9.864     9.101     9.789     8.939     9.39      9.682

                  3.783     5.859     7.925     9.295     9.054     7.903
                  9.168     9.364     9.548     9.33      9.99      9.526
                  9.263     9.271     9.409     8.858     8.915     9.759
```

Figure 3. Reduced matrix of losses (14), reflected in five 3×6 rows for convenience (similar to Fig. 2), for LLC "ATEM" according to 26 experts' estimates

Minimax strategy (3) for a reduced matrix of losses in Figure 3.,

$$\mathbf{P} = \begin{bmatrix} 0.0044 & 0.6387 & 0.3569 \end{bmatrix} \qquad (18)$$

shows that the most careless direction of further actions for LLC "ATEM" would be to work with its own funds. This is not surprising, since this LLC is unprofitable and does not have a security department. This is indicated by probabilistic estimates (6) - (8):

$$P(A \mid Vlas) = 0.1962, \quad P(A \mid Poz) = 0.5442,$$
$$P(A \mid Zal) = 0.2048. \qquad (19)$$

As we see from the estimates (19), experts have little faith about the success of the formation of sources of financing investment activities from their own funds. The probability of a satisfactory state of economic security is solely based on the attraction estimated and is low.

So we have:

$$P(A) = 0.1962 \cdot 0.0044 + 0.5442 \cdot 0.6387 + 0.2048 \cdot 0.3569 = 0.4216$$

by formula (9) taking into account probabilities (19) and strategy (18). So:

$$h_{Vlas} = P(Vlas \mid A) = \frac{0.1962 \cdot 0.0044}{0.4216} = 0.0021,$$

$$h_{Poz} = P(Poz \mid A) = \frac{0.5442 \cdot 0.6387}{0.4216} = 0.8246,$$

$$h_{Zal} = P(Zal \mid A) = \frac{0.2048 \cdot 0.3569}{0.4216} = 0.1734,$$

and the desired strategy:

$$\mathbf{H} = \begin{bmatrix} 0.0021 & 0.8246 & 0.1734 \end{bmatrix} \tag{20}$$

is optimal in the sense of economic security of LLC "ATEM". Thus, with sufficient accuracy for the practice, it can be considered that the economic security of this enterprise will be at an adequate level

when forming sources of investment financing by 82.5% of borrowings and 17.5% of attractions. It is not recommended to use its own resources (or use them in the least possible volumes).

31 experts participated in the evaluation for PJSC "Chynbar". Here, the experts took into account the following characteristics: a public joint stock company, profitable, no security department (but there is a person responsible for it), the management is not risk-averse, a positive credit history, no state support. Estimates of losses (Figure 4.) on average are different from the estimates in Fig. 2. (for another enterprise - SOE "Novator") by 11%.

```
2.24      7.175     7.536     7.038     7.883     7.546
1.992     0.1499    1.304     7.8       7.035     7.048
2.297     0.5029    2.13      7.151     7.054     7.773

    9.66      7.32      7.584     7.361     9.746     9.058
    7.027     7.072     6.999     9.128     9.442     9.34
    7.713     6.964     7.148     9.371     9.141     9.961

        9.341     9.826     9.161     0.1483    1.994     5.443
        9.056     9.485     9.103     7.592     9.187     8.948
        9.167     9.636     9.296     7.219     9.49      8.95

            5.179     8.937     9.072     9.707     9.043     2.241
            9.045     9.135     9.85      9.892     9.226     9.271
            9.599     8.878     9.305     9.59      9.412     9.075

                3.746     5.325     8.01      9.768     9.437     6.988
                9.541     9.759     9.055     9.097     9.735     9.288
                9.826     8.95      9.031     9.111     9.801     9.558
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Figure 4. Reduced matrix of losses (14), reflected in five 3×6 rows for convenience (similar to Fig. 2), PJSC "Chynbar" according to 31 experts' estimates

The corresponding minimax strategy (3) and probabilities according to formulas (6) - (9) and (11) - (13) for PJSC "Chynbar" are the following:

$$\mathbf{P} = \begin{bmatrix} 0.3209 & 0.1524 & 0.5268 \end{bmatrix},$$

$$P(A \mid Vlas) = 0.4394, \quad P(A \mid Poz) = 0.2933,$$

$$P(A \mid Zal) = 0.7019,$$

$$P(A) = 0.4394 \cdot 0.3209 + 0.2933 \cdot 0.1524 + 0.7019 \cdot 0.5268 = 0.5554,$$

$$\mathbf{H} = \begin{bmatrix} 0.2538 & 0.0804 & 0.6657 \end{bmatrix}.$$

Therefore, in this case, attraction (66.6%) is priority, whereas borrowing should be only 8% of the total. The share of own funds should make up 25.4%.

5. Conclusions

Optimization of the process of selecting sources of financing investment activity is one of the important elements of the effective functioning of the economic

security system of an enterprise. This statement is based on empirical studies of the activities of many Ukrainian industrial enterprises and the determination of strategic guidelines for ensuring their economic security (including the economic security of investment activities). Miscalculations in the selection of investment financing sources are rapidly transformed into financial problems for business entities, as their significance for the implementation of any projects is quite high. At the same time, the state of enterprise economic security significantly deteriorates with insufficient investment resources or inappropriate attraction use. The approach proposed in the article to optimize the structure of investment resources and the selection of financing sources based on the criterion of risk minimization is useful from both a theoretical and practical application point of view, and was implemented in Ukrainian enterprises. However, further studies of this issue have considerable prospects due to the constant transformations in the

fiscal sphere and the improvement of mechanisms for ensuring the economic security of industrial enterprises.

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