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Innovative Development as Determinant of Corporate Economic Security

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Abstract: The current challenges of globalization provide business entities of various economic systems with multifaceted opportunities, while creating new threats to economic security. These and other challenges require enterprises to pay attention to innovation, and improve their economic security. The study substantiates the importance of innovative development as a determinant of corporate economic security. The main purpose is to assess the innovative development state of enterprises, and evaluate its impact on economic security based on the available information and analytical support. To achieve the set goal, the authors proposed an assessment approach for corporate economic security based on the innovative component, and developed a monitoring algorithm for the factors affecting corporate development. The systemic approach was employed to consider the innovative component as a subsystem of corporate economic security, and to measure its impact on corporate development. In this way, the innovative component of corporate economic security could be calculated comprehensively. The methodology takes account of the systemic approach, as well as methodical support for the analysis of components, which is based on rating evaluations, systematic expert evaluations, and ranking scales. Industrial enterprises that pay special attention to innovative development were selected to test the proposed methodical support. In addition, the Harrington scale was adapted to establish the level of corporate economic security. Based on the calculations, it was determined that the studied enterprises have an average and below average level of economic security due to component innovation. Overall, this research presents a suitable algorithm for assessing the level of corporate economic security.

Keywords: Innovative development; Economic security; Enterprises; Economic development; Monitoring

1. Introduction

The activities of business entities are directly affected by the turbulence of external and internal environments, as well as the present threats and risks. In this case, these entities must find new tools and mechanisms to improve their economic security. Corporate economic security is a multifaceted concept. Firstly, a set of measures must be in place to assure the stable functioning and development of the enterprise. Secondly, economic security is a subsystem of the corporate system. Thirdly, economic security determines the state of corporate development, and characterizes the availability of corporate resources. Fourthly, the enterprises must be protected from possible threats and risks. As a result, corporate economic security is and will remain relevant for a long time.

Many academic economists have explored corporate economic security from various aspects, but many problems remain relevant. For example, innovative development and corporate economic security are important in the military conflict in Ukraine. The post-war economy of Ukraine should focus on restoring its potential via

innovative progress in all spheres of social life. It is already necessary for the country to develop measures that contribute to the innovative corporate development, and increase their level of economic security. To identify the risks against corporate economic security, it is advisable to assess the state of the resource base according to the relevant components.

Determining the impact on the level of economic security of individual components makes it possible to improve the threat assessment procedure, and to optimize the neutralization or reduction measures for the risks. Some of these measures include organizing activities related to threat prevention, assessing internal and external threats and impactors, making decisions on how to manage the identified threats, and forecasting the development of the economic security system. In the post-war period, Ukraine must pursue the innovative recovery of the economy as a component of corporate economic security, and monitor the state of corporate economic security as a whole.

This study aims to assess the innovative corporate development and its impact on economic security based on the available information and analytical support. The systemic approach was employed, along with the methodical support for the analysis of components. The following techniques were involved, including rating evaluations, systematic expert evaluations, and ranking scales. To this end, the authors created a methodological support for assessing corporate economic security based on innovative components, and put forward a monitoring algorithm for the factors affecting corporate development and corporate economic security.

The research proves the expediency of using a systematic approach to assess corporate economic security, in the light of the relevant components and indices, the available information, and analytical support. The authors justified the methodological support for analyzing the components of corporate economic security, which involves rating evaluations, systematic expert evaluations, and ranking scales. The influence of the innovative component on corporate economic security provides an important reference for properly evaluating and managing innovative development, a premise of a secure corporate economy.

2. Literature Review

Many scientific publications are devoted to the problem of innovative corporate development, especially in the context of economic security. The most representative works include Arefieva et al. (2021), Gontareva et al. (2022), Illiashenko et al. (2021), Kompanets et al. (2022), Korytko et al. (2021), Mironova et al. (2022), Mishchuk et al. (2020), Onyshchenko et al. (2020), Rushchyshyn et al. (2022), Solodovnik et al. (2021), Tulchynska et al. (2021), Viknianska et al. (2021), Vovk et al. (2021), Yermak & Bugaenko (2016), Zalutska et al. (2021) and other.

Mishchuk et al. (2020) summarized the theoretical and methodological foundations of shaping corporate competitiveness in terms of innovative development and corporate economic security, and suggested taking account of modern challenges in formulating rational policies for innovative corporate development. Kompanets et al. (2022) proved the practicality of a simulation model for right and duty distribution of corporate personnel in the management system of innovative development, and developed measures for personnel development. These measures are expected to facilitate enterprises to implement innovative activities efficiently and effectively in highly competitive environments. Rushchyshyn et al. (2022) tried to clearly determine the promising options for providing resources to the management of innovative corporate development. To fulfil the related tasks, these scientists included a set of management bodies, divisions and executors, and developed a set of methods that contribute to management. Their recommendations are perfectly in line with today's changing conditions of innovative corporate development.

Gontareva et al. (2022) improved the existing theories and methods regarding the application of the system-functional approach to manage the innovative development of construction enterprises, and developed a methodological toolkit for using that approach in this field. Mironova et al. (2022) proposed a method to determine the strategic directions of innovative development of three Polish industrial enterprises. Their method models the selection between strategies that stimulate the innovative development of industrial enterprises. The results show that the matrix of strategies should be based on the diagnosis of the aggregate potential of industrial enterprises, and its implementation in the innovation sphere. Onyshchenko et al. (2020) developed an econometric model for innovative corporate development in the construction industry, and demonstrated that the model contributes to the rationality and efficiency of investing and take into account the interests of the customer, investor and creditor. The methodologies developed by the above authors enable enterprises to determine strategic directions, and to choose the most effective and rational strategy, in view of the peculiarities of corporate activities.

Illiashenko et al. (2021) set out the theoretical and methodological principles for quantifying the prerequisites for implementing the strategic directions of innovative development of industrial enterprises. These scientists defined and systematized the external and internal prerequisites of catching up, and anticipating innovative development. The external prerequisites were evaluated by the relative values of the Global Innovation Index. Korytko et al. (2021) developed a method for formulating and selecting the innovative development strategy in the context of digitalization, making corporate innovative development more effective. Solodovnik et al. (2021) fully considered the peculiarities of foreign economic activities related to innovative corporate development,

evaluated the planned work quality of foreign economic activities, and devised an algorithm for the programmatic selection of innovative development directions.

After reviewing the scientific works on corporate economic security, it is possible to conclude that more scientific research is needed to substantiate the importance of innovative development as a determinant of the corporate economic security. The previous works mainly focus on the methodological support for analyzing and assessing corporate economic security, and clarifying the development directions. A more through study is wanted to highlight the importance of innovative development to economic security in the post-war period.

3. Methodology

In modern times, the economic security of enterprises should be assessed by new methods, given the current processes and states of corporate economic development. Today, Ukraine is engaged in a military conflict, which threatens the corporate economic security. Large strategic enterprises of the country have mostly been destroyed. Some have been paralyzed and thus unable to carry out required activities. Against this backdrop, it is advisable to assess the economic security of the enterprises and sectors that are currently operational. To restore the economy of Ukraine, an important measure is to introduce innovative developments in social life. The innovative aspect is a priority for ensuring the economic security at corporate and state levels. The economic security of innovative enterprises needs to be compared with similar indices in the sectors of the economy. The comparative results could provide a reference for modeling and forecasting the state of corporate economic security, using a generalized integrated index of economic security.

Today, there are many methodological approaches to assess the components of corporate economic security. One of the most popular approaches is grounded on the importance of each component. Some researchers utilized a matrix composed of elements, which characterize the indices of corporate quality and their degree of influence. In the matrix, the row elements (i=1...n) are the quality indices of the economic entity, while the column elements (j=1...m) are the scores of the entity. That is, each sample consists of m economic entities, where a_{ij} is an index of the score of the j-th entity.

The innovative development should be evaluated comprehensively with the aid of aggregate criteria, which contain the weighed functional components of corporate economic security. The weight coefficients are calculated by comparing the level of threat to economic security and the effectiveness of the countermeasures. In modern practice, the components of cooperate economic security are mostly determined based on weights. Thus, an integrated qualitative index R_{ES}^{1} can be created for the economic security of the j-th enterprise:

$$R_{ES}^{1} = \sum_{i=1}^{n} K_i \alpha_{ij} \quad j = 1.m \tag{1}$$

where, k_i is the weight coefficient of the importance of the i-th component; α_{ij} is the score of the j-th enterprise by the i-th component; n – the number of components of corporate economic security.

To ensure calculation accuracy, the indices can be normalized by:

$$\sum_{i}^{n} k_i = 1 \tag{2}$$

The next approach to assess the components of corporate economic security is to define an overall criterion based on a score, in view of the highest quantitative score of the integrated index. The enterprise with the greatest total score receives the highest rating. The integrated index can be calculated by:

$$R_{ES\,j}^{2} = \frac{1}{\sqrt{n}} \sqrt{\sum_{i=1}^{n} \alpha_{ij}^{2}},\ J = 1..., m \tag{3}$$

where, α_{ij} is the score of the j-th enterprise by the i-th functional component.

This approach focuses on the components with the more dominant quantitative scores, and singles out the components that characterize a positive trend. The disadvantage of the approach is that it overlooks the qualitative components of the elements. In fact, the trend of some of these components are negatively correlated with the quantitative components. For each component i=1,…, m, the following method can be adopted based on the component weight:

$$R_{ES}^{3} = \sqrt{\sum_{i=1}^{n} K_i \alpha_{ij}^{2}}.\ j = 1.m \tag{4}$$

where, k_i is the weight of the corresponding index, j=1, … n; $\sum_i^n k_i = 1$.

By this approach, one can consider the advantages of each component. Even a weight is calculated based on expert assessment, the relative importance of each index is taken into account. The disadvantage of this approach is as follows: only the aggregate criterion of corporate economic security is considered, without giving consideration to the level of each index. If there are many small values, the overall quantitative value will be affected.

There is another approach that assesses economic security based on the weight of each element:

$$R_{ES}^4 = \frac{1}{2}\sqrt{\sum_{i=1}^n K_i(1+\alpha_{ij}),\ \ j=1,...,m} \tag{5}$$

The problem with this method is that small quantitative indices are overshadowed by the large ones.

To determine the corporate economic security by components, the geometric mean of all components needs to be employed. Then, the level of economic security could be examined from two aspects. In the first aspect, the mean index is determined based on the linear form of communication between the components of the economic security system:

$$R_{ES}^5 = n\left(\sqrt[n]{\Pi_{i=1}^{ni} K_i}\,\alpha_{ij}\right),\ j=1,...,m \tag{6}$$

Through the multiplicative approach, the criterion for determining corporate economic security by components can be written as:

$$R_{ES}^6 = \frac{n}{2}\left(\sqrt[n]{\Pi_{i=1}^{n} K_i(1+\alpha_{ij})}\right).\ j=1,...,m \tag{7}$$

where, R_{ES}^6 is an integrated quantitative index of the functioning of the j-th enterprise, j=1, …m; k_i is the weight coefficient of the index of the corresponding component, i=1…n.

Considering the geometric mean, the critical limit of the integrated index of economic security of innovative enterprises can be obtained by:

$$R_{ES}^7 = \frac{1}{2}\prod_{i=1}^{n}(1+\alpha_{ij})^{K_i}.\ j=1...,m \tag{8}$$

where, K_i is the weight coefficient of the corresponding criterion of the index, which characterizes the risk of error in determining the complex integrated index of corporate economic security, $i = 1\ldots n$.

Note that the weight coefficients must be normalized, too.

Considering the need to match the weight coefficients $k_i(k_i \geq 0), i = 1 \ldots n$ we have:

$$\sum_{i=1}^n k_i = 1 \tag{9}$$

In this way, the corporate economic security could be calculated more accurately. There are both strengths and weaknesses of assessing the economic security by components. The main weakness is the difficulty in weighing the components of corporate economic security. To assess corporate economic security more thoroughly by components, expert assessment is the preferred method. This approach can establish the coefficients of significance of each component, making it easier to determine the level of corporate economic security.

The assessment of corporate economic security by components can be thoroughly determined by the following approaches:

The first approach compares the generalized indices of the economic security of the target enterprise against those of the reference enterprise. The index quality is measured by the distance between the actual and normative values of the indices. The second approach compares the actual and normative values of the aggregated index, which characterizes the level of corporate economic security. The first approach is easier to implement than the second approach.

By analogy, the components of corporate economic security can be assessed one by one. Then, the difference between the reference value and the actual value can be calculated based on the selected components of corporate economic security:

$$D(A_i.A_0) = \sqrt{\sum_{j=1}^{n} (\alpha_{ij} - \alpha_{0j})^2} \tag{10}$$

where, $D(A_i.A_0)$ is the integral difference between the target enterprise and the reference enterprise in economic security; α_{ij} is the value of the *j-th* index for the *i-th* enterprise; α_{0j} is the value of the *j-th* index for the reference enterprise.

The normative value of an index or that of a component for corporate economic security is calculated through expert assessment. Thus, the aggregated index of the corresponding component $D(A_i.A_0)$ characterizes the deviation of corporate economic security from the normative level. If $D(A_i.A_0) = 0$, then the enterprise has reached the optimal economic security. If the index value moves downward, then the corporate economic security deteriorates. This approach can assess the economic security of each enterprise, or evaluate the level of regional and macro-level enterprises.

For most enterprises today, the innovative component is a key impactor on the level of economic security. This impactor must be fully considered to find the proper direction for corporate development, and to assure the economic security of the enterprise. Currently, there is not yet a unified and universal for assessing corporate economic security by components. It is more and more relevant to determine the impact of innovative corporate development on the condition of the enterprise. Thus, this study intends to expand the indices of innovative influence.

Currently, corporate activities are threatened substantially by military aggression and other crises around the world. To disclose how an innovative component impacts the overall economic security, it is important to study the impact of indices on various components at both the macro and micro levels. In general, the state of indices that characterize individual components reflects the level of corporate economic security. The application of econometric modeling makes it possible to more accurately consider the influence of factors on the resulting features, and to change the corporate development strategy in a timely manner.

To substantiate the influence of factors on corporate economic security, a systematic approach should be adopted to consider all the functional components of the relevant indices. The following steps are taken to measure the impact of the innovative component on corporate economic security:

Step 1. Define the functional components.

Step 2. Establish the significance of each component through expert assessment.

Step 3. Substantiate indices, and establish their thresholds.

Step 4. Calculate index values, compare the values with normative values, and determine corporate economic security by components.

Under the stabilizing effect, each index (*Si*) can be calculated by:

$$Si = \frac{I_n}{M_n} \cdot k_m \tag{11}$$

where, I_n is the index of economic security; M_n is the component of an economic security index; k_m is the correction coefficient. Under the destabilizing effect, the index can be calculated by:

$$Si = \frac{M_n}{I_n} \cdot k_m \tag{12}$$

The mean corporate economic security can be calculated by components by:

$$P_I = P_I = \frac{\sum_{i=1}^{n} S_i}{n} \tag{13}$$

where, n is the number of indices; S_i is the mean of the indices. The economic security by components can be calculated, depending on the priority of impactors:

$$L_{es} = \sum_{i=1}^{m} P_i \cdot q_i \tag{14}$$

where, L_{es} is the economic security based on the priority of components; q_i is the weight coefficient of each component.

The proposed method can be utilized flexibly, for the index system varies with the goal of analysis and diagnosis. The innovative component of corporate economic security can be characterized by the following indices: the growth rate of the proportion of investment in the acquisition of new basic production assets, the growth rate of the costs of technological innovations, the growth rate of software costs, and the growth rate of informatization cost. These indices can be solved for each enterprise.

4. Results

The above methodical support needs to be adopted to properly calculate the impact of innovative corporate development on economic security. As shown in Figure 1, the corporate innovation activities in Ukraine in 2020 decreased, compared to that in 2018 and 2019. This trend stems from the COVID restrictions. The fall of corporate innovation can be characterized by indices like the share of new types of products, the rate of increase in the number of innovatively active enterprises, the share of enterprises that implement innovations, etc.

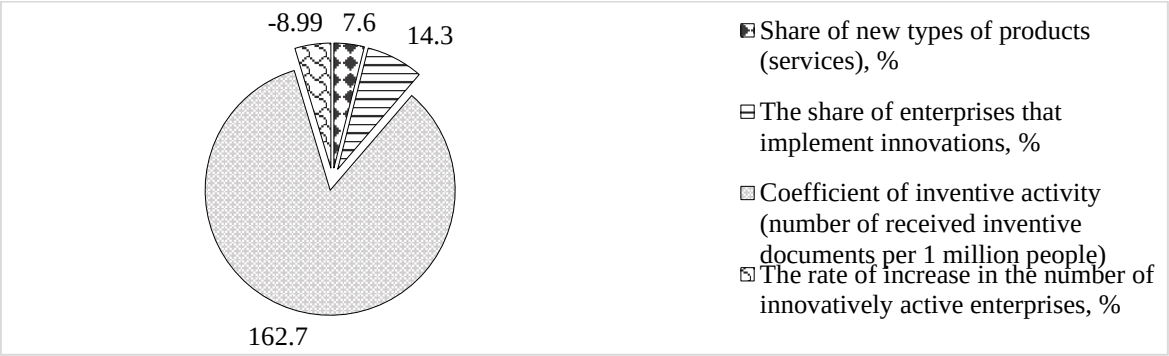

Figure 1. Trend of innovative component of the economic security of Ukraine in 2018-2020
Source: compiled by the authors based on statistical data (Solodovnik et al., 2021)

To compute the innovative component of corporate economic security, the authors established the normative values of corporate economic security using the Harrington scale (Table 1). The Harrington scale makes it possible to establish thresholds for corporate innovative activity. The universality of the scale allows one to adjust the normative values depending on the assessment needs.

Table 1. Classification of levels of economic security by innovative component, using the Harrington scale

Interval	Linguistic assessment of security level
1,0-0,81	High
0,80-0,64	Above average
0,63-0,38	Average
0,37-0,21	Below average
0,20-0,00	Low

Source: Compiled by the authors using the Harrington scale

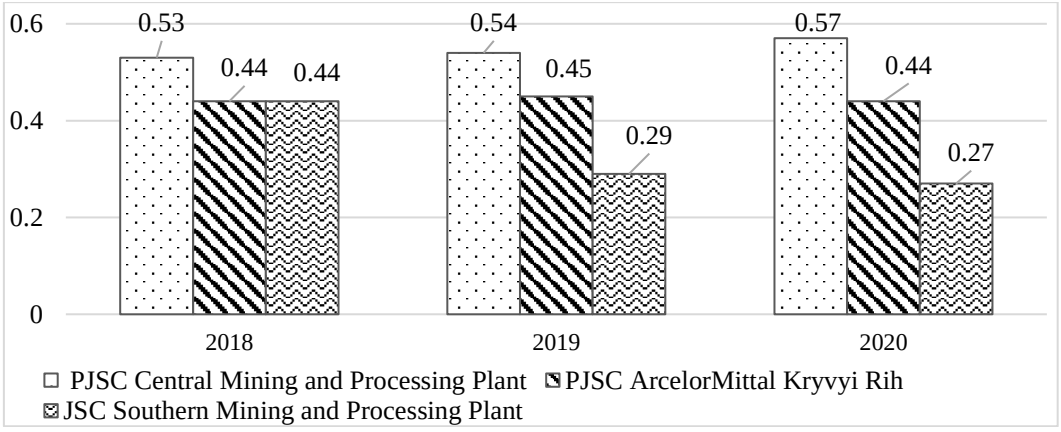

Figure 2. Economic security by the innovative component of enterprises for 2018-2020
Source: Built by the authors based on the results of calculations (Vovk et al., 2021)

Industrial enterprises that pay great attention to innovative development were selected for analysis. All these enterprises are leaders in their field. The relevant indices were calculated based on the official information of these enterprises in 2018-2020. The results show that, in the study period, none of the enterprises reached a high level of economic security in terms of the innovative component. In terms of the innovative component, the highest level of economic security was achieved by PJSC Central Mining and Processing Plant (0.57 in 2020). This level of economic security corresponds to the average. The lowest level of economic security belonged to the JSC Southern Mining and Processing Plant (0.27 in 2020), which is below the average. In 2020, the economic security of PJSC ArcelorMittal Kryvyi Rih corresponded to the average (0.44) (Figure 2). This calls for appropriate measures to bolster their innovative activity and enhance economic security for all these enterprises.

To improve corporate economic security by increasing innovative activity, it is necessary to determine the main stages of management (Figure 3). The effectiveness of corporate innovative activity depends on the type of resources utilized throughout the lifecycle of the enterprise.

At the stage of growth, the use of material resources plays an important role, for they directly take part in material production. Personnel resources directly bear on the implementation of management decisions and control, and thus contribute to corporate development. Financial resources assure the maintenance of the production and sale of products.

At the stage of decline, priority is given to the use of financial resources. This is because effective use of financial resources helps to accumulate assets to support corporate activities, or to determine the market value during restructuring or sales. Each enterprise has the above resources, but not all enterprises manage them effectively, which affects their activity and development.

This study measures the influence of the innovative component on corporate economic security, making it possible to form an appropriate algorithm to identify and assess the threats to innovative corporate development. To properly decide on innovative corporate development, and to assure economic security, it is important to monitor all sorts of threats, assess the state of resources, evaluate the corporate economic security, and make relevant forecasts. These are the preliminary steps to assess the influence of threats and risks on corporate development, to judge the dependence of economic security on the innovative development, and to assess economic security by components. On this basis, the management can correct decisions regarding the innovative corporate development, and to ensure economic security. Next, analytical assessment could be carried out by the presented algorithm (Figure 3). Then, it is possible to make effective management decisions on the innovative corporate development and its economic security.

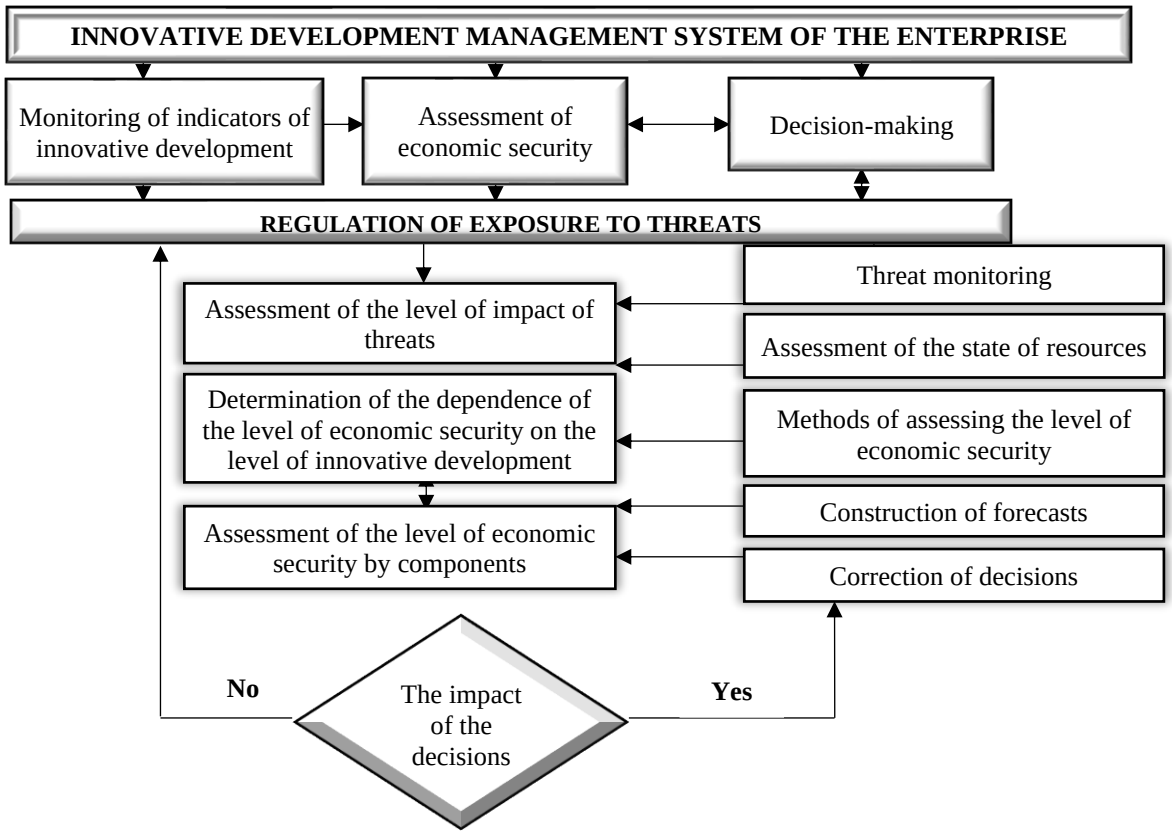

Figure 3. Workflow of the proposed algorithm
Source: Suggested by the authors

After going through the steps in Figure 3, an enterprise would be able to make timely response to the risks that may arise during corporate innovation. Innovative corporate development requires the investment of many resources, which can be attracted by the enterprise independently or with the help of the state. A favorable investment climate is crucial to attract investments and promote innovative development, and thus ensure corporate economic security.

5. Conclusions

This study delves into the application of various approaches to assess corporate economic security, and singles out the methodological support for the analysis of components, which is based on rating assessments, systematic expert assessments, and ranking scales. It was established that the most widely used methodology is the systematic approach, which takes into account the relevant components and indices for assessing corporate economic security, as well as the available information and analytical support. The most unified approach is to calculate weight coefficients, solve reference values, and compare them with the normative values.

The work analyzes the methodological support for assessing the impact of innovative corporate development over economic security. The most expedient and effective method was determined for evaluating the components of corporate activities. The research results show that expert evaluations are the most common applicable approach, according to the available information and analytical support. For large enterprises that have significant information and analytical support, it is necessary to effectively use econometric modeling for greater validity of the decisions made.

The research results also lie in the practical plane: the management efficiency of the economic security system can be improved by monitoring the innovative component of the corporate economic security. It is suggested to use the Harrington scale to establish the normative values of the security. To manage corporate development and enhance economic security, it is necessary to identify and assess the threats to innovative corporate development, and determine the motivational measures to boost innovative activity. Under the premise of ensuring economic security, the management of the innovative corporate development must be grounded on the correct assessment of the impact of threats, the right determination of how much economic security depends on the innovative development, and the sound assessment of economic security by components. The monitoring and the analysis of monitoring results would increase the effectiveness of management decisions regarding innovative corporate development and ensuring its economic security.

In future research, the authors would try to improve the assessment of the innovative corporate development, and the measurement of its influence over economic security, taking account of econometric methods of process modeling and forecast maps.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare no conflict of interest.

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