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FINANCIAL AND ECONOMIC NARRATIVES FOR EVALUATION OF INNOVATIVE POTENTIAL OF ENTERPRISES

Purpose. Development of a methodological approach to the assessment of the enterprise innovation strategy and its modeling.

Methodology. During the research, we used general and special methods: systematization – for generalization of theoretical bases, comparative analysis and synthesis in order to clarify concepts, formal-logistical – for the formation of a methodological approach, graphic-analytical method – for visual presentation of research results; empirical research – for the study of innovation potential, simulation and multiple regression modeling – for the formation of strategic guidelines.

Findings. The methodical approach of assessment of the enterprises innovative potential was grounded and the initiative model of choosing the strategy of enterprises was created, which allows analyzing quantitative indicators of structural elements of potential, assessing the level of development of each component. In the course of the research a methodical approach to assessing the intellectual potential of industrial enterprises has been developed.

Originality. In contrast to the existing ones, this methodological approach provides: a comprehensive assessment of the innovation potential of industrial enterprises; econometric models for determining the components of the innovation potential of enterprises; the model of innovation strategy selection, which is an informational and analytical tool for working out the variants of strategies and development orients. It is proved that the implementation of the developed methodological approach will allow adopting an effective innovative strategy of enterprise development taking into account financial and economic narratives.

Practical value. The results of the research can be used by practitioners, scientists, government officials (the Ministry of Economic Development and its structural divisions, local self-government bodies in the field of economics) for the development and implementation of innovation strategies, as well as for the development of managerial decisions in the field of innovation, increasing the value added, capitalization and level of competitiveness.

Keywords: *innovation, strategy, innovative potential, enterprise, simulation model, financial and economic narratives*

Introduction. An important competitive advantage of the enterprises in present-day conditions is their innovative susceptibility, which determines the ability to respond in a timely manner to constant changes in the external environment, to introduce new products and technologies. Such opportunities are determined by the enterprises' innovative potential (EIP). Of great importance is the process of evaluating the innovative potential of an industrial enterprise and analyzing its components on the basis of financial and economic narratives. Based on the evaluation of the state of innovative potential of an industrial enterprise, it is possible to determine a further strategy for its innovative development and carry out operational management of innovative activities to ensure the possibility of the enterprise switching to the production of competitive products, significantly increasing its stability against changes in the external environment [1]. The higher the level of innovative potential is, the more successfully the enterprise is able to overcome possible crisis situations, strengthen its competitive position in the market, and ensure high profit in the long term [2].

Literature review. Present-day economics literature pays great attention to the issues of the enterprise's innovative development, increasing the efficiency of their innovative activities, managing innovative processes at the enterprise, the problems of the formation and development of innovative potential. These problems are considered in sufficient detail in the works by many scientific economists.

The research [3, 4] considers the practical aspects of the concept of "innovative potential", while the author notes that innovation begins with an analysis of existing potential in order to use it efficiently.

Innovative potential is considered from the point of view of improving management [5, 6], since the main condition for economic development is not only the creation and increase of potential, but also more efficient use of existing potential, as well as ensuring its growth in those sectors of the economy that can provide socio-economic outcome [7, 8].

Innovative potential is considered from the standpoint of readiness for the implementation of innovative activities [9, 10], that is, for the implementation of innovative activities, a certain amount of innovative potential of the company is required, which determines the choice of the innovative path development.

From the standpoint of the availability of resources and the possibilities of their use, the innovative potential is a combination of resources necessary for the implementation of innovative activities at the enterprise [11, 12], thus, ensuring the untimely development of the enterprise, and their successful implementation helps to overcome the development of crisis phenomena [13, 14].

An important innovative resource of the enterprise is the staff, whose innovative potential is based on the ability of employees to produce and effectively implement both their own and third-party's new ideas and projects [15, 16].

As for the innovativeness of the business entity, it is interpreted mainly from the standpoint of the role that innovation plays in the activities of a particular enterprise, as it, in particular [17, 18]. Thus, innovation is a property of the enterprise that characterizes the measure use of innovations in its economic activity. In this case, as noted in the works [15, 19], this measure can be described by various indicators.

Innovation potential is a complex and multidimensional concept that requires evaluation to use a significant number of different indicators. Determining the optimal number of indicators to avoid data redundancy or lack of information, determining the criteria for each indicator is an important problem in ensuring the evaluation of the innovative potential of the enterprise.

However, the subject of the work is associated with the reasoning of the methodological approach to evaluation of innovative potential based on financial and economic narratives and does not have a methodological justification. The authors' approach to solving this problem is given in the article.

Unsolved aspects of the problem. The scientific achievements of these scientists are undoubtedly important for the formation of the theoretical foundations for assessing the innovation potential and modeling the innovation strategy of the enterprise. However, the issues of the process of assessing the innovation potential and modeling the innovation strategy of enterprises remain open. Methodological tools for modeling the innovation strategy of the enterprise need to be improved.

The purpose of the article is development of a methodical approach to assessing the innovation strategy and modeling the innovation strategy of the enterprise.

Methods. For the implementation of efficient management of innovation, a real evaluation of the level of the enterprise's innovative potential on the basis of financial and economic narratives at a given moment and evaluation of its dynamics in order to further development is necessary.

The purpose of the evaluation of innovative potential is the ability to select and implement an innovative strategy of the enterprise, which helps to strengthen its position in the market. The assessment of the level of the enterprise innovation potential will allow:

- adequately assessing the possibility and its readiness for innovation activities;
- analyzing and predicting development trends, as well as identifying its strengths and weaknesses;
- making recommendations on strategy formation and mechanisms of its implementation.

The stages of a methodological approach to evaluating the enterprises innovative potential are shown in Fig. 1.

This methodological approach is the basis for evaluating the enterprises innovative potential and can help increase the efficiency of the evaluation procedure for this. At the initial stage, the formation of a system of indicators characterizing the components of the enterprises' innovative potential on the basis of financial and economic narratives is important. The formation of a system of indicators characterizing the enterprises' innovative potential is carried out on the basis of the expert method.

The factors influencing the investment potential in the context of the personnel component include: the share of scientific and technical personnel in the total number of employ-

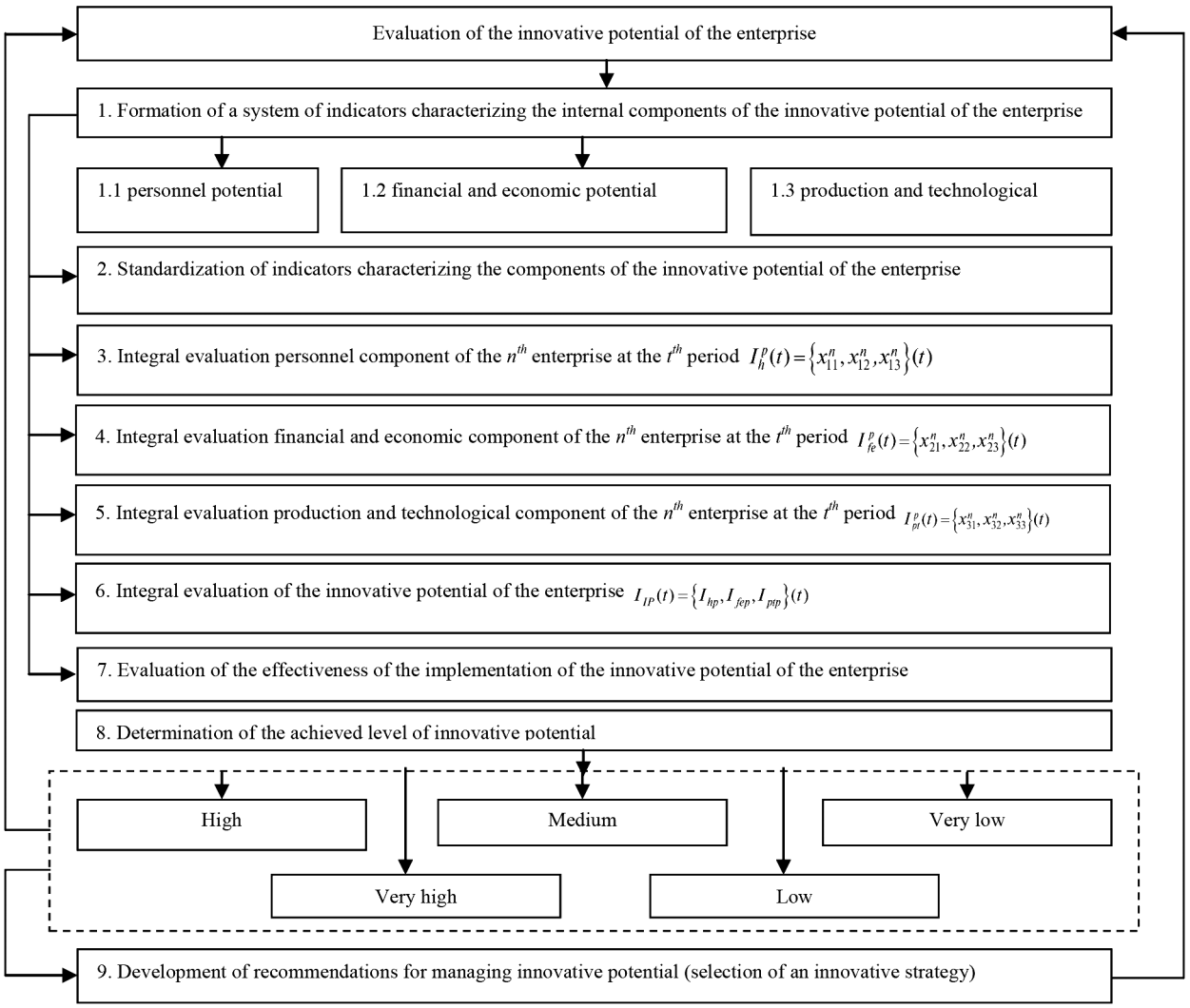

Fig. 1. Stages of a methodical approach to an estimation of innovative potential of the industrial enterprise on the basis of financial and economic narratives

ees of the enterprise (X_1); the degree of provision of the enterprise with intellectual property (X_2); the profitability (loss) ratio per employee (X_3).

The factors influencing the investment potential, in the context of financial and economic components include: the provision of equity (X_1); coefficients: autonomy (X_2), equity flexibility (X_3), the concentration of debt capital (X_4).

The factors influencing the investment potential in the context of production and technological components include: availability of fixed assets (X_1), profit from operations (X_2); costs of technological innovation (X_3); profitability (loss) of sales (X_4); profitability (loss) of assets on profit from ordinary activities (X_5).

For a more accurate and unambiguous interpretation of the assessment results and comparison with each other, the indicators of innovation potential of enterprises should be rated. The change of rated values is carried out in the interval [0; 1]. In this case, the value of the indicator equal to "1" means that the enterprise is the leader with respect to this characteristic, if the value is close to "0", there is no innovative activity in this area.

At the following stages of assessing the innovative potential of the enterprise, the assessment of human resources, financial-economic and industrial-technological components is done, the definition and justification of the main directions for their improvement are carried out. For this purpose, it is advisable to use multiple regression modeling (Table 1).

In order to analyze the obtained values of the evaluation indicators and determine the level of the enterprise's innovative potential, it is necessary to introduce some boundaries and evaluation criteria. Comparison of evaluation indicators is possible only if they are brought to a comparable form, which is achieved by applying criteria values. This allows you to compare the levels of various indicators and greatly simplifies the analysis of the evaluation results.

In order to solve this problem, one should use the desirability function developed by [18], which has the form

$$d = \frac{1}{e}\sqrt[y]{e},$$

where e is the base of the natural logarithm; y is the value of an indicator characterizing the differences in the levels of innovation activity (the y values vary from –2 to +5).

Function d is in the interval [0; 1] and is used as a dimensionless scale for evaluation the level of innovative activity. Each actual value of the desirability function is given a specific economic meaning, which is associated with the level of innovative activity of the studied object.

The interpretation of the integral indicator of the innovative potential of health is beyond Harrington's [18] modified modal scale, which is shown in Table 2.

Table 1

Correspondence of the level of the integral indicator of the enterprise's innovation potential based on the modified Harrington scale

Type of model	Criteria of model
1. The model of integrated evaluation of production and technological component of the innovative potential	
$I_{ptp} = -0.111 + 0.276X_1 + 0.541X_2 + 0.338X_3 + 0.211X_4 + 0.245X_5$, (1) where X_1 – provision of main assets; X_2 – profit from operating activities; X_3 – the cost of technological innovation; X_4 – profitability (negative profitability) of sales; X_5 – the profitability (negative profitability) of assets beyond the profit of the sound business	$F = 50.16$; $R = 0.974$; $R^2 = 0.87$; t – criterion of Student: for an intercept – 2.024; X_1 – 3.340; X_2 – 7.699; X_3 – 3.757; X_4 – 2.319; X_5 – 2.856
2. The model of integrated evaluation of financial and component of the enterprise's innovation potential	
$I_{fep} = 0.135 + 0.237X_1 + 0.450X_2 + 0.251X_3 + 0.170X_4$, where X_1 – equity capital; X_2 – autonomy coefficient; X_3 – coefficient of maneuverability of their own capital; X_4 – coefficient of concentration of loan capital	$F = 66.99$; $R = 0.937$; $R^2 = 0.878$; t – criterion of Student: for an intercept – 2.083; X_1 – 4.569; X_2 – 4.027; X_3 – 2.24; X_4 –2.253
3. The model of integrated evaluation of personnel component of the enterprise's innovation potential	
$I_{hp} = 0.397 + 0.438X_1 + 0.188X_2 + 0.099X_3$, where X_1 – the proportion of scientific and technical personnel in the total number of all personnel of the enterprise; X_2 – degree of provision of the enterprise with intellectual property; X_3 – coefficient of profitability (negative profitability) per one worker	$F = 62.89$; $R = 0.926$; $R^2 = 0.845$; t – criterion of Student: for an intercept – 13.144; X_1 – 10.301; X_2 – 2.102; X_3 – 2.084
4. Model of integral evaluation of the enterprise's innovative potential	
$I_{IP} = 0.157 + 0.218X_1 + 0.239X_2 + 0.363X_3$	$F = 8.80$; $R = 0.926$; $R^2 = 0.845$; t – criterion of Student: for an intercept – 2.015; X_1 – 3.967; X_2 – 3.490; X_3 – 4.149

Table 2

Interpretation of the integrated indicator of innovation potential of the enterprise on the basis of the modified Harrington scale

Quality evaluation	Evaluation intervals	Content
Very low	0–0.2	Poor state of innovation potential. Solid action is required to change the development strategy of the enterprise. Lack of opportunities for innovation. The company may be classified as insolvent
Low	0.2–0.37	The minimum acceptable level of innovation potential. Conforms to the ultimate level of competitiveness; urgent investments in the development of components of innovative potential are required
Medium	0.37–0.63	Good state of innovative potential. The company has significant opportunities for innovation and is actively using them
High	0.63–0.8	Satisfactory state of innovation potential. The company has the average capacity for innovation. Development of innovative potential and activation of its use are required
Very high	0.8–1.0	Excellent state of innovation potential. The company has the maximum potential for innovation and uses them effectively. The company is at the level of the world leader in its industry

A characteristic feature of the methodological approach to evaluating the innovative potential of industrial enterprises is to determine the optimal innovative strategy based on ranking the values of the level of the enterprise f innovative potential. At this stage, an interpretation of the value of the rejected integrated indicator of innovative potential is carried out. Intervals of significance (IP) are formed on the basis of the method of statistical grouping with regular intervals (Table 3).

The "stomp on the spot"strategy is characterized by the fact that enterprises at the same time use the innovations (food, technology, management) of other organizations that have been released to the market with some improvements and modernizations. These enterprises have high production and technological potential and fairly strong market positions. At the same time, innovations developed and mastered both by large enterprises and small innovative organizations can be taken as a basis.

The strategy of minor modifications is characterized by the need to conduct their own R&D for the subsequent more accurate selection of licenses for purchase.

The follower strategy (imitation) characterizes the reaction to ongoing and possible changes in the external environment through continuous technological innovation. A strategy in which a new technology or product is acquired from other enterprises.

The strategy of following the leader (defensive) includes innovative development of a reactionary nature – a reaction to changes in the external environment, in particular to the innovations of competitors. This strategy is aimed at maintaining market positions. It is used by enterprises with strong market and technological positions that are not pioneers in launching certain innovations on the market. This strategy is used by enterprises which are stronger in marketing than in R&D.

The leader's strategy (offensive, pioneering) is characterized by constant development of technological innovations. It is characterized by a large number of innovative products offered for implementation. It is characteristic of a manufacturer that focuses on a wide range of consumers and is fairly confident in the high level of competitiveness of products in the future.

One of the most effective methods for choosing innovative strategies is simulation.

The parameters of the simulation model are presented in Table 4.

Based on the components and parameters described above, in the course of the study, a general outline of the model for evaluation the innovative potential of an industrial enterprise was formed, which is presented in Fig. 2**.**

Results. Using the obtained data, we will make a chart showing the production and technological component of industrial enterprises (1 – PJSC FTFKRAZ; 2 – JSC AC BOGDAN MOTORS; 3 – PJSC Boryspil Avtoplant; 4 – JSC CHERKASSY BUS; 5 – PJSC "Chasivoyarski Buses" Plant; 6 – PJSC "Chernihiv Automobile Plant" in 2020 (Fig. 3).

Table 3

The level of innovation potential and the type of innovation strategy of the industrial enterprise

Quantitative assessment of the innovative potential of the enterprise	Level of assessment of the innovative potential of the enterprise	Type of innovative strategy of the enterprise
0–0.2	Very low	"Stomp on the spot" strategy
0.2–0.37	Low	Strategy of minor modifications
0.37–0.63	Medium	Follower strategy (Imitation)
0.63–0.8	High	Leader follow strategy (Defensive)
0.8–1.0	Very high	Leader strategy (offensive, pioneering)

Table 4

Parameters of a simulation model for the formation of innovative strategies of the industrial enterprise

Parameters	Description
Incoming parameters:	
I	Information on the external and internal environment
Qi	Quality information
Qui	Quantitative Information
S	Structured Information
Ap	Assessment period
Internal parameters:	
$\{F_{ip}\}$	Factors characterizing innovative potential
$\{F_{ic}\}$	Internal context factors
$\{Pi\}$	Investment Potential Evaluation Indicators
$\{Ki\}$	The weight coefficient of the i^{th} indicator
$\{I^i_j\}$	The integral value of the components of innovative potential
IP	Integral value of the innovative potential of the enterprise
Output data	
Output result 1	Level of innovative potential (by components)
Output result 2	Level of innovative potential (integral value)

The graph clearly demonstrates the level of the production and technological component of the innovative potential, allows you to develop measures to influence specific components in order to increase the overall level of the enterprise innovative potential. Using the data obtained, we will make a chart showing the financial component of an industrial enterprise in 2019 (Fig. 4).

The graph clearly demonstrates the level of the financial component of the innovative potential; it allows you to develop measures to influence specific components in order to increase the overall level of innovative potential of the enterprise. Using the obtained data, we make a chart showing the personnel component of industrial enterprises in 2020 (Fig. 5).

The chart clearly demonstrates the level of personnel component of innovative potential; it allows you to develop measures to influence specific components in order to increase the overall level of innovative potential of the enterprise.

Using the obtained data, we make a chart showing the innovative potential of industrial enterprises in 2020 (Fig. 6).

The chart clearly demonstrates the level of innovative potential; it allows you to develop measures to influence specific components in order to increase the overall level of innovative potential of the enterprise.

The generalized results of the evaluation of innovative activity of industrial enterprises in the region are given in Table 5.

In 2020 the enterprises have an average level of innovation potential. It indicates that they have significant opportunities for innovation activity and actively uses them. One of the directions of improvement of innovative activity at the enterprise is a rational choice of innovative projects.

Software development of the simulation model of formation of innovation strategies of the industrial enterprise was

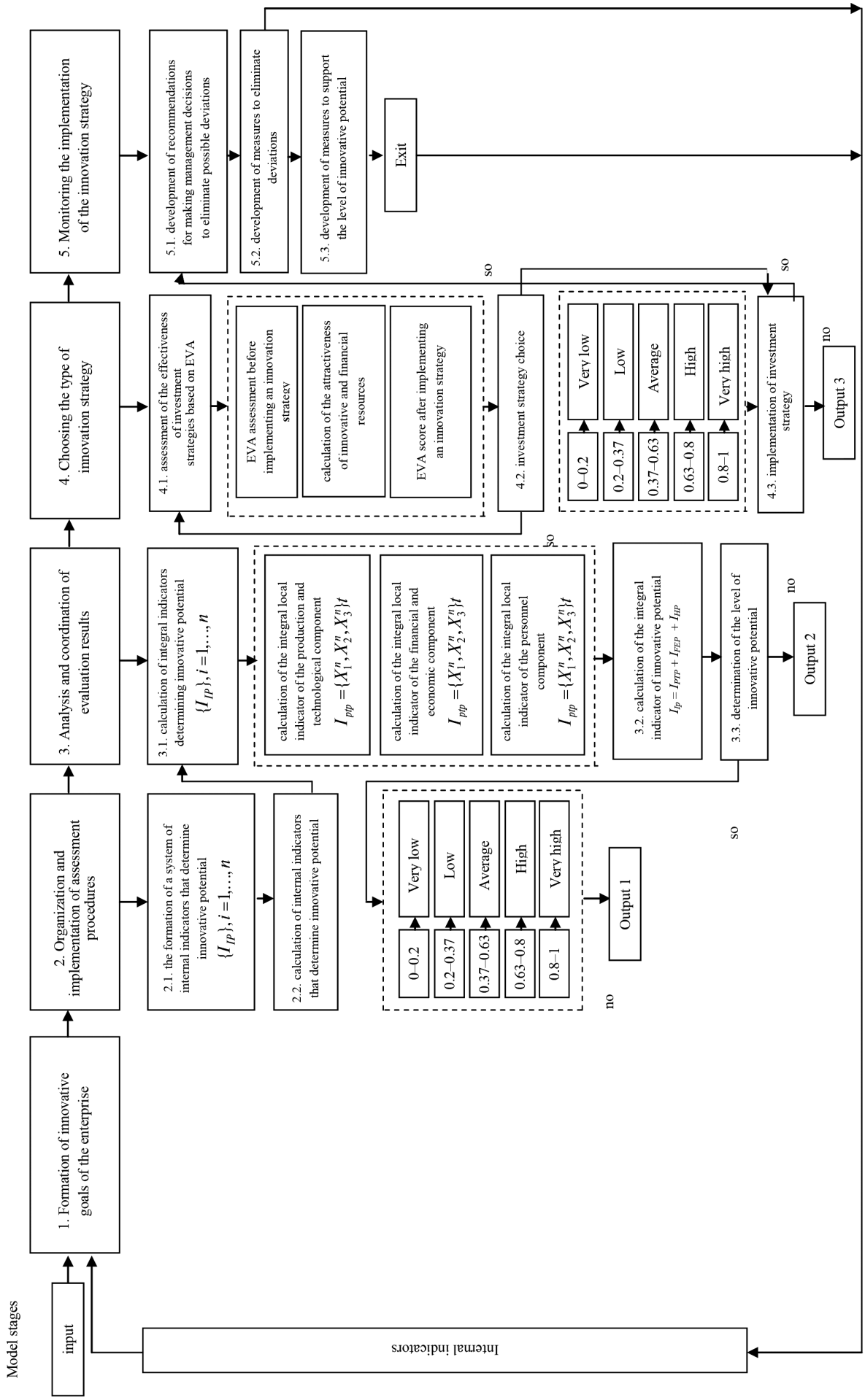

Fig. 2. A simulation model for choosing an innovative strategy of the industrial enterprise

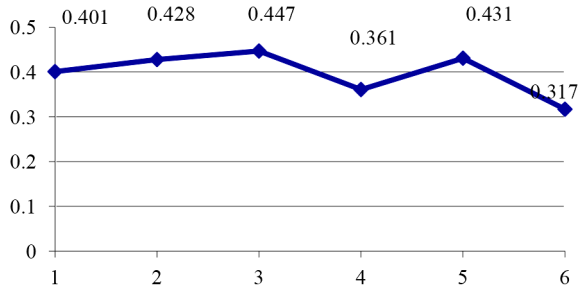

Fig. 3. Dynamics of the integrated evaluation of the production-and-technological component of the innovative potential of industrial enterprises for 2020

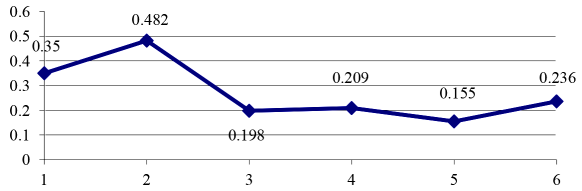

Fig. 4. Dynamics of the integrated evaluation of the financial component of the innovative potential of industrial enterprises in 2020

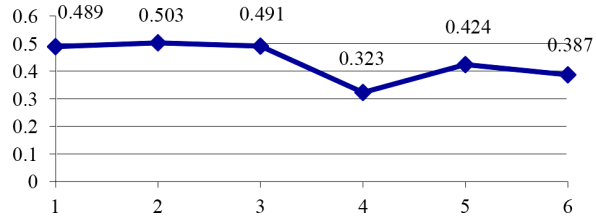

Fig. 5. Dynamics of integrated evaluation of personnel and component potential of industrial enterprises in 2020

carried out in a package of applications for numerical analysis Matlab.

Due to the developed simulation model, the calculations of resulting indicators of the models of integral assessment of production and technological, financial and human resources

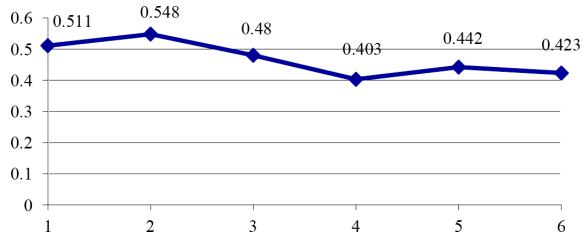

Fig. 6. Dynamics of the integrated evaluation of the innovative potential of industrial enterprises for 2020

Table 5

The results of the evaluation of the innovative potential of industrial enterprises

Enterprise Number	Innovation Potential Level	
	Value	Middle
1	0.511	Middle
2	0.548	Middle
3	0.480	Middle
4	0.403	Middle
5	0.442	Middle
6	0.423	Middle

components of the innovative potential of the enterprise were made (Table 6).

The results show that changes in the source data led to changes in the values of indicators for such a component of innovative potential as the financial component.

In order to evaluate the adequacy of the obtained simulation model for the formation of innovative strategies of the industrial enterprise, the average absolute error in percentage (MAPE) was used [11] and the following indicators were obtained (Table 7).

The obtained value of the MARE indicator of 2.41 % of the model of integral evaluation of the innovation potential of the enterprise indicates rather high prediction accuracy, namely 97.59 % and allows it to be used for further efficient work in the field of choosing appropriate strategies for the development of industrial enterprises.

Table 6

The results of rose models with 2020

Enterprise	Personnel component		Production-and-technological component		Financial component		Level of innovative potential	
	Actual	Calculating	Actual	Calculating	Actual	Calculating	Actual	Calculating
1	0.489	0.55424	0.401	0.43663	0.350	0.66992	0.511	0.59646
2	0.503	0.45185	0.428	0.58372	0.482	0.54867	0.548	0.54795
3	0.491	0.73267	0.447	0.13702	0.198	0.62341	0.480	0.57001
4	0.329	0.70134	0.361	0.40034	0.209	0.65850	0.403	0.64121
5	0.323	0.42087	0.431	0.63298	0.155	0.62246	0.442	0.57715
6	0.387	0.36271	0.317	0.61844	0.236	0.65722	0.423	0.56343

Table 7

Results of evaluation of adequacy of the obtained simulation model of forming innovative strategies of the industrial enterprise

	Model of integrated evaluation of production-and-technological component of innovative potential	Model of integrated evaluation of financial component of innovative potential	Model of integrated evaluation of personnel component of innovative potential	Model of integrated evaluation of innovative potential
MAPE	13.86 %	27.16 %	8.12 %	2.41 %

Table 8

Results of the assessment of the adequacy of the recognized model of the development of the innovative strategy of machine technology, thousand $

Enterprise number	Actual value EVA	Increasing EVA in15 %	Decreasing EVA in 15 %
1	–11,439	–952	–11,712
2	–10,661	–1251	–10,951
3	1273	1570	1082
4	–329	12	–357
5	307	353	261
6	835	960	710

In order to test the developed simulation model, a series of experiments with various variations of input parameters was carried out. The first variant of the input parameters reflects the actual situation at the enterprise; in the second variant, the value included in the EVA calculation changes – the values of these indicators increase by 15 %. In the third embodiment, the values included in the EVA calculation are reduced by 15 % compared with the actual data (Table 8).

The results show that the companies follow the strategy of imitation, but only the enterprises of numbers 3, 5, 6 implement the innovation strategy efficiency, as evidenced by the positive value of EVA. Enterprises 1, 2, 4 are carrying out an inefficient innovation strategy.

Conclusion. Evaluation of innovative potential on the basis of financial and economic narratives allows you to determine the growth opportunities of the enterprise in quantitative terms and choose the best areas, based on resources and available opportunities. Ignorance of the potential, underestimation or overestimation of its components leads to the adoption of erroneous decisions and inefficient use, and often simply to the irrational use of resources.

A simulation model of the component evaluation of the innovative potential of industrial enterprises and the choice of innovative strategies is suggested. This model provides for the interconnection of various components of the innovative potential and their dynamic management instruments, covers all stages of the evaluation and meets the conditions for this process, which allows predicting the values of indicators and the level of innovative potential in order to select an innovative strategy.

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Фінансово-економічні наративи оцінки інноваційного потенціалу підприємства

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Мета. Розробити та науково обґрунтувати методичний підхід оцінювання інноваційної стратегії підприємства й доцільність її моделювання.

Методика. У процесі дослідження були використані загальні та спеціальні методи: систематизування – для узагальнення теоретичних основ; порівняльний аналіз і

синтез з метою уточнення понять; формально-логістичний – для формування методичного підходу; графічно-аналітичний метод – для наочного подання результатів дослідження; емпіричного дослідження – для дослідження інноваційного потенціалу; імітаційного та множинно-регресійного моделювання – для формування стратегічних орієнтирів.

Результати. Обґрунтовано методичний підхід оцінки інноваційного потенціалу підприємств і побудована імітаційна модель вибору стратегії підприємств, що дозволяє аналізувати кількісні показники структурних елементів потенціалу, визначати стан і рівень розвитку кожного компоненту. У ході дослідження розроблено методичний підхід оцінки інтелектуального потенціалу промислових підприємств.

Наукова новизна. На відміну від існуючих, методичний підхід оцінки інноваційного потенціалу підприємств передбачає: комплексну оцінку інноваційного потенціалу промислових підприємств; економетричні моделі визначення складових інноваційного потенціалу підприємств; імітаційну модель вибору інноваційної стратегії, що виступає інформаційно-аналітичним інструментом для розробки варіантів стратегій орієнтирів розвитку. Доведено, що впровадження розробленого методичного підходу дозволить прийняти ефективну інноваційну стратегію розвитку підприємства з урахуванням фінансово-економічних наративів.

Практична значимість. Результати дослідження можуть бути використані практиками, вченими, державними службовцями (Мінекономрозвитку та його структурні підрозділи, органи місцевого самоврядування у сфері економіки) для розробки й реалізації інноваційних стратегій, а також для розробки управлінських рішень у галузі інновацій, збільшуючи додану вартість, капіталізацію й рівень конкурентоспроможності.

Ключові слова: *інновації, стратегія, інноваційний потенціал, підприємство, імітаційна модель, фінансово-економічні наративи*

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