

UDC 657.9:336.63

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METHODOLOGY OF FINANCIAL AND ECONOMIC ANALYSIS OF INNOVATIVE ACTIVITIES OF ENTERPRISES IN THE CONDITIONS OF THE DIGITAL ECONOMY

Abstract. The relevance of the study is due to the need for a systematic study of the issues of methodological support for the analysis of innovative activities of enterprises in the context of the development of the digital economy. It has been established that a feature of the information and analytical system for managing innovation is the use of a set of methods: statistical, economic and mathematical and specific methods for predicting the results of innovation. At the same time, the system of methods and techniques for analyzing innovation activity significantly differs from the traditional toolkit, since in most cases the object of management is unique in its kind, and the subject of an innovative project (innovative product), as a rule, has no analogues.

The article substantiates the need to apply analytical procedures at all stages of the implementation of innovative projects. It is proposed to conduct the process of assessing the effectiveness of the implementation of an innovative project in the following stages: monitoring the external environment, determining the innovative potential of an enterprise, studying the effectiveness of an innovative project, quantitative and qualitative analysis of the risks of innovation, economic analysis of innovation, development of an innovation strategy.

A method is proposed for determining the price of innovative products as an important component of assessing the effectiveness of an innovative project, and the main indicators of the effectiveness of innovative activities are highlighted. The results of the calculation of certain indicators form the basis for making decisions on the administration of innovative activities, and their factor analysis will determine the unused reserves of growth in the efficiency of the enterprise's innovative activities.

It was found that in the digital economy, classical methods of economic analysis of innovation activity are complemented by innovative ones, such as simulation modeling, decision tree, sensitivity analysis, correlation-regression and variance methods, probability method, analog method, SWOT-analysis, PEST-analysis, SNW-analysis, R-analysis.

It has been determined that the analysis of innovation in the digital economy provides for the creation of a fundamentally new information model using modern technical and technological means of collecting and processing significant data sets, the functioning of which should be based on the principles of «consistency» and «communication».

Keywords: economic analysis, innovation, innovative project, the digital economy, methods of analysis, information and analytical support.

Formulas: 3; fig.: 1; tabl.: 1; bibl.: 38.

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МЕТОДИКА ФІНАНСОВО-ЕКОНОМІЧНОГО АНАЛІЗУ ІННОВАЦІЙНОЇ ДІЯЛЬНОСТІ ПІДПРИЄМСТВ В УМОВАХ ЦИФРОВОЇ ЕКОНОМІКИ

Анотація. Актуальність дослідження зумовлена необхідністю системного дослідження питань методичного забезпечення аналізу інноваційної діяльності підприємств в умовах розвитку цифрової економіки. Установлено, що особливістю інформаційно-аналітичної системи управління інноваційною діяльністю є використання комплексу методів: статистичних, економіко-математичних і специфічних методів прогнозування результатів інноваційної діяльності. При цьому система методів і методик аналізу інноваційної діяльності значно відрізняється від традиційного інструментарію, оскільки здебільшого об'єкт управління є унікальним у своєму роді, а предмет інноваційного проекту (інноваційний продукт), як правило, не має аналогів.

У статті обґрунтовано необхідність застосування аналітичних процедур на всіх етапах реалізації інноваційних проектів. Запропоновано проводити процес оцінювання ефективності реалізації інноваційного проекту за такими етапами: моніторинг зовнішнього середовища, визначення інноваційного потенціалу підприємства, вивчення ефективності інноваційного проекту, кількісний і якісний аналіз ризиків інноваційної діяльності, економічний аналіз інноваційної діяльності, розроблення інноваційної стратегії.

Запропоновано методикау визначення ціни інноваційної продукції як важливу складову оцінювання ефективності інноваційного проекту, а також виокремлено основні

показники ефективності інноваційної діяльності. Результати розрахунку окреслених показників формують основу для ухвалення рішень щодо адміністрування інноваційної діяльності, а їхній факторний аналіз дозволить визначити невикористані резерви зростання ефективності інноваційної діяльності суб'єкта господарювання.

Установлено, що в умовах цифрової економіки класичні методи економічного аналізу інноваційної діяльності доповнюються інноваційними — такими, як імітаційне моделювання, дерево рішень, аналіз чутливості, кореляційно-регресійні та дисперсійні методи, метод імовірностей, метод аналогів, SWOT-аналіз, PEST-аналіз, SNW-аналіз, R-аналіз та ін.

Визначено, що аналіз інноваційної діяльності в умовах цифрової економіки передбачає створення принципово нової інформаційної моделі з використанням сучасних технічних і технологічних засобів збору й обробки значних масивів даних, в основі функціонування якої мають бути покладені принципи «послідовності» та «зв'язку».

Ключові слова: економічний аналіз, інноваційна діяльність, інноваційний проєкт, цифрова економіка, методи аналізу, інформаційно-аналітичне забезпечення.

Формул: 3; рис.: 1; табл.: 1; бібл.: 38.

Introduction. The economic analysis toolkit is constantly updated and improved under the influence of the transformation of the conditions for the functioning of business entities, a change in the sectoral structure of the economy, the development of digital culture, changing the socio-cultural vectors of the development of society. Digitalization as a concept of economic activity, which is based on digital technologies, is widely implemented in all countries of the world without exception.

In the digital economy, a key factor of economic activity is large amounts of data in digital terms. The value system of the modern business environment is incomplete without a high-quality digital existence, which is changing the previously widespread management practices, from strategic planning to operational decisions in the field of communications and marketing.

The analytical substantiation of management decisions is carried out in new conditions, because the composition of users of accounting information and the requirements for the results of the analyst's work change, the method of communication between the user of analytical data and the analyst specialist, objects of economic analysis are transformed, new phenomena and processes of economic activity arise that require the use of an updated analytical instrumentation.

We can argue that the methodology of economic analysis needs modernization, since the modern conditions for the functioning of progressive sectors of the economy and types of economic activity require sound scientific and methodological support of management. The need for further development of theoretical and practical developments in the field of economic analysis in recent years is due to the requests of enterprises that are interested in using scientifically based methods of financial and economic forecasting of the efficiency of using available resources, primarily intellectual, social, communicative and natural for commercial purposes.

The digital economy is developing through the intensification of innovation, development, implementation and commercialization of innovative products. Insufficient involvement of enterprises in innovation processes is associated with a high degree of uncertainty in the return on investment and a significant risk of financial losses. The lack of scientifically substantiated information and methodological support for forecasting the effectiveness of innovative activities significantly slows down the flow of resources and capital into the high-risk sphere.

Analysis of research and problem statement. In our opinion, insufficient attention is paid to the systematic study of the issues of methodological support of the analysis of innovative activities of enterprises in the context of the development of the digital economy. As basic scientific research in the field of theory and methodology of economic analysis of innovative activity, the scientific works of Birman G. and Schmidt S. [1], Plaskov N. S. [2], Gerasimova E. B. [3], Dutta S., Lanvin B., Wunsch-Vincent S. [4], Marmier F., Gourc D., Laarz F. [5]. In order to assess the level

of information support of economic analysis, the scientific potential of such accounting scientists was used: Osadchey O. A. [6; 7], Maksimova V. F., Lokhanova N. A. [8], Carlsson-Wall M., Kraus K. [9], Dainienė R., Dagilienė L. [10]. The following domestic and foreign researchers paid attention to the theoretical aspects of innovative activity: Butticiè V., Caviggioli F., Franzoni C., Scellato G., Stryszowski P., Thumm N. [11], Alcácer J., Beukel K., Cassiman B. [12], Mensch G. [13], Prodanova N., Plaskova N., Samusenko A., Abdulrahman T., Polyanskaya T., Cernostana Z. [14], Demidenko D., Dubolazova J., Malevskaya-Malevich E. [fifteen]. The peculiarities of the influence of digital culture on the functioning of a modern subject of economic activity, issues of digitalization of the economy are discussed in the works of Mayer-Schoenberger V. [16], Ivanova V., Malinetskiy G. [17], Ben Youssef A., Boubaker S., Dedaj B., Carabregu-Vokshi M. [18], Richardson L. [19].

The scientific potential of these scientists became the theoretical basis for further research and contributed to the development of certain organizational and methodological provisions of the economic analysis of innovation activity, but the methodological aspects of a comprehensive analysis of innovation activity in the digital economy remain insufficiently studied.

The results of the research. The peculiarity of the information and analytical system for managing innovation is the use of a set of methods: statistical, economic and mathematical and specific methods for predicting the results of innovation. At the same time, the system of methods and methods of analysis differs significantly from the traditional tools of economic analysis, since in most cases the object of management is unique in its kind, and the subject of an innovative project (innovative product), as a rule, has no analogues. Note that qualitative methods based on expert assessments are quite common and should be converted into quantitative indicators to obtain parametric data and their inclusion in the general system of digital identification of objects, processes, factors and the results of their influence on the level of innovation efficiency.

In the digital economy, classical methods of economic analysis of innovation activity are supplemented, such as: simulation modeling, decision tree, sensitivity analysis, cluster method, method of few sets, method of equivalents, scenario method, correlation-regression and dispersion methods, probability method, analogue method, SWOT analysis, PEST analysis, SNW analysis, R analysis, heuristic methods, etc.

To implement an integrated approach, the economic analysis of innovation should be applied at all stages of the implementation of innovation projects. We propose to carry out the process of a comprehensive assessment and substantiation of the effectiveness of the implementation of an innovative project by a business entity (for product innovations) in the stages shown in *Fig.*

A significant contribution to the development of the theory of innovation belongs to the German scientist G. Mensch, who considered the reasons for the introduction of innovations. The scientist was the first to classify innovations in relation to scientific and technological progress into basic, improving and pseudo-innovations. According to G. Mensch's classification, basic innovations can lead to the emergence of new industries; when implementing new improving innovations, qualitative changes occur in existing products, technologies, processes of organizing production and sales, and the way of life as a whole. According to the scientist, pseudo-innovations are differentiated products that are not significant and do not have qualitative novelty [13].

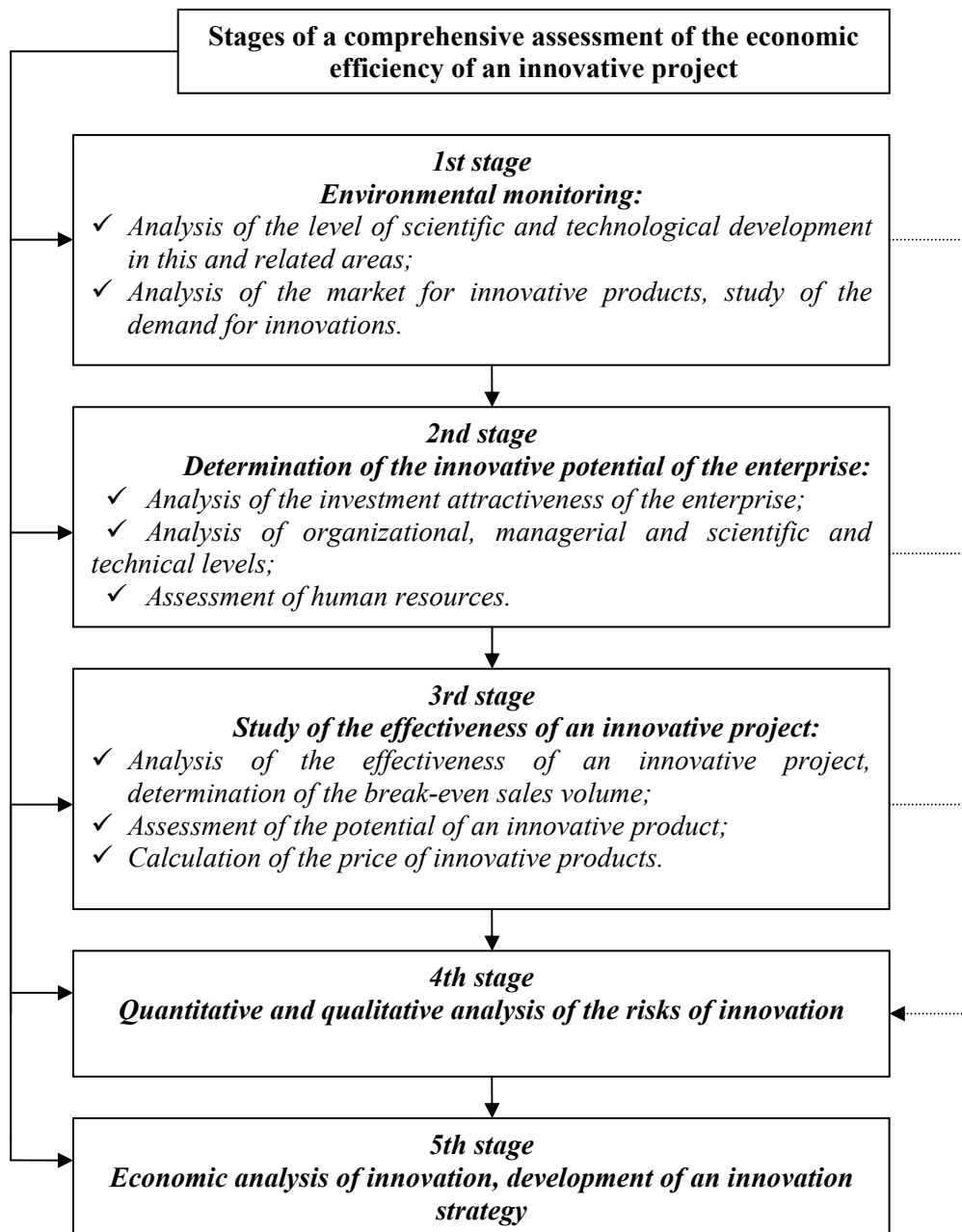


Fig. The process of a comprehensive assessment and substantiation of the effectiveness of the implementation of an innovative project of an enterprise

For product innovations, an important criterion in the planning of an innovative project is the fulfillment of the break-even conditions, while the determination of prices for an innovative product depends on the nature of the innovation.

For basic innovations, the price is determined by the formula (1):

$$P = \frac{Pr + (Q \cdot AVC + FC + RC)}{Q}, \tag{1}$$

where P — is the price of a unit of innovative products; Q — is the volume of innovative products produced during the period of implementation of the innovative project; AVC — is the average variable cost of producing a unit of innovative products; FC — fixed costs for the production of innovative products; Pr — is the planned financial result from the implementation of innovative products; RC — research and development costs associated with the use of the research innovation project.

For borrowed innovations, the price is calculated using the formula (2):

$$P = \frac{P_3 \cdot \frac{Q_{product}}{Q_{buyer}} \cdot \overline{I_{pl}}}{\frac{Q_{plproduct}}{Q_{plbuyer}} \cdot \overline{I}} = P_3 \cdot \frac{\overline{I_{pl}}}{\overline{I}}, \quad (2)$$

where P_3 — is the price of a unit of production in the market of borrowed innovation; $Q_{product}$ — the volume of products sold in the market of borrowed innovation; Q_{buyer} — is the number of buyers in the borrowed innovation market; $Q_{plproduct}$ — planned volume of sold innovative products; $Q_{plbuyer}$ — the planned number of buyers of innovative products; $\overline{I_{pl}}$ — average income level of potential buyers of innovative products; \overline{I} — is the average income of buyers in the market of the involved innovation.

To determine the price of a product by improving innovations, the method of integral assessment of the potential of an innovative product is used, which takes into account the current market situation with respect to the base product and allows us to identify the price at which the implementation of an innovative product will not lead to a decrease in demand. In this case, the price of an innovative product is determined by the formula (3):

$$P = P_0 \cdot \frac{C}{C_0}, \quad (3)$$

where P_0 — is the average unit price of the basic product; C — integral assessment of the potential of innovative products; C_0 — integral assessment of the base product potential.

The above methodology for determining the price of innovative products for improving innovation involves the following steps:

- 1) determination of parameters for assessing the potential of innovative products and development of a price formation algorithm;
- 2) assessment of the parameters of basic innovative products by an expert group;
- 3) assessing the potential of innovative products: on the basis of indicators and their significance, an integral assessment of the potential of basic and innovative products is determined;
- 4) formation of the price of innovative products in the course of calculating the multiplicity factor of the potentials of basic and innovative products.

It is advisable to carry out a retrospective comprehensive analysis of innovation activity based on the results of several years, because during this period the practical implementation of innovations takes place, and therefore the economic analysis can become the basis for the formation of an enterprise's innovative strategy (*Table*).

Table

The main indicators of the effectiveness of innovative activities of the enterprise

№	Index	Characteristic	Settlement procedure
1	The profitability of an innovative project	The effectiveness of innovative activities based on the results of the implementation of an innovative project	$\frac{\text{Net profit from the sale of innovative products}}{\text{The total costs of implementing an innovative project}}$
2	Cost-effectiveness of innovation	Ratio of implemented innovations and costs of innovative activities	$\frac{\text{Number of implemented innovations}}{\text{Innovation spending}}$
3	Indicator of innovative activity	The level of attraction of the enterprise to innovation activity	$\frac{\text{Innovation spending}}{\text{Total expenses of the enterprise}}$
4	Profitability of innovation	The level of commercial efficiency of innovation	$\frac{\text{Profitability of an innovative project}}{\text{Indicator of innovative activity}}$

Source: compiled by the authors based on [14; 20—38].

The results of calculating the proposed indicators form the basis for making decisions on the administration of innovative activities, and their factor analysis will determine the unused reserves of growth in the efficiency of the enterprise's innovative activities.

It should be noted that the analysis of innovation in the digital economy provides for the creation of a fundamentally new information model using modern technical and technological means of collecting and processing significant data sets, the functioning of which should be based on the principles of «consistency» and «communication».

The implementation of the principles of «consistency» and «communication» in the practice of information flow management is extremely difficult, because it presupposes a fundamentally different methodological base on which information systems serving modern innovative enterprises are based.

Implementation of an information management system based on the principles of «consistency» and «communication» has a number of advantages that allow:

- to combine all the functions of enterprise management into a single information structured field;
- promptly receive management reporting information of any level with the required degree of periodization and detail;
- carry out daily monitoring of the fulfillment of the necessary indicators of the business plan and compliance with internal standards with a given degree of detail in the context of management functions, business processes, with the decoding not only of deviations, but also measuring the influence of factors on effective performance indicators;
- substantiate the system of internal regulations and standards for the use of enterprise resources for the formation of realistic strategic, current, operational budgets with interrelated indicators, etc.

Conclusions. The activation of innovation activity is largely determined by the possibility of developing and implementing methodological tools for a system of high-quality information and analytical support of management functions at all stages of the innovation process. To implement an integrated approach, the economic analysis of innovation should be applied at all stages of the implementation of innovation projects. The process of assessing and substantiating the effectiveness of the implementation of an innovative project by a business entity is proposed to be carried out in the following stages: monitoring the external environment, determining the innovative potential of the enterprise, studying the effectiveness of an innovative project, quantitative and qualitative analysis of the risks of innovation, economic analysis of innovation, development of an innovation strategy. It has been found that in the digital economy, classical methods of economic analysis of innovation are complemented by innovative ones, such as simulation modeling, decision tree, sensitivity analysis, the method of few sets, correlation-regression and dispersion methods, the method of probabilities, the method of analogs, SWOT-analysis, PEST-analysis, SNW-analysis, R-analysis.

A method for determining the price of innovative products is proposed as an important component of assessing the effectiveness of an innovative project, and the main indicators of the effectiveness of innovative activities are highlighted, which serve as the basis for building an enterprise's innovative strategy.

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Статтю рекомендовано до друку 02.12.2020.

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The article is recommended for printing 02.12.2020.

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Yurkiv N.