26. COST-EFFECTIVENESS DETERMINANTS OF THE COMMERCIAL POTENTIAL MANIFESTATION OF SCIENTIFIC-INNOVATIVE TECHNOLOGIES

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Introduction. In the current realities of business development, modern trends in the innovative development of technological products, and the impact of global intellectual-innovative and techno-technological standards on the activities of industrial enterprises, conducting effective business in our country becomes extremely challenging without the utilization of innovative technologies. These technologies can, to a large extent, ensure the sustainable development of enterprises at the modern level.

Scientific-innovative production is an integral component of the production-commercial and intellectual-innovative activities of every industrial enterprise, as it facilitates the renewal of production processes, enhances the quality and consumer value of products, accelerates the speed of sales and product utilization, and increases the efficiency of customization processes based on the individual needs of each consumer. The implementation of scientific-innovative technologies in industrial enterprises objectively prompts transformative changes in their production activities, contributes to the development of the interaction algorithm between the structural units of the enterprise, changes its normative functionality, and advances methodological principles for enhancing the competence of production personnel [1].

An exceptionally important element of this study is the establishment of scientifically substantiated prices for scientific and technical products. In the conditions of the modern competitive environment of technological markets, the price appears as the most crucial tool and method for effective competitive struggle in the global and national markets. The pricing process is, to some extent, a structured system that, from scientific positions, ensures the alignment of commercial-production interests of all existing subjects of the technological market. A scientifically substantiated price level can sufficiently provide the necessary level of competitiveness for the results of production-commercial activities of industrial enterprises and, to some

extent, guarantee the break-even nature of their production and market realization of products.

Under such conditions, the development and improvement of existing approaches to methods of forming competitive pricing for scientific and technical products become an extremely important and relevant task. The goal is to enhance the efficiency of the production-commercial activities of Ukrainian enterprises, ensuring their production, financial, market stability, and economic security.

Literature review. In scientific research conducted by Ukrainian and foreign scholars, the relevance of the commercial implementation of innovative technologies, their role, perspectives, and strategic priorities have been extensively discussed. However, in our opinion, insufficient attention has been given to the issues of the commercial application of innovative technologies, specific algorithms, and tactical solutions in defining various intellectual-innovative technologies necessary for the development of industrial enterprises.

Scientific works of numerous domestic and foreign researchers are dedicated to the problems of the effectiveness of utilizing the commercial potential of intellectual-innovative technologies and competitive pricing for scientific products. Many researchers have contributed to the development of pricing issues, such as Kornienko G. [1], Kocziszky Gy. [2, 19], Nagy S. [3], Gutsan O.[4, 7], Kosenko A. [5, 13, 17], Besprozvannykh O.[6], Kuchinskyi V. [8, 10], Tkachov M. [9, 15, 20], Nazarenko S. [11], Pererva P.G. [12, 16, 25], Kobeleva T.O. [18, 21], Kosenko O.P. [24], Maslak M. [25] and others. The majority of existing scientific research results predominantly examine the overall effectiveness of production-commercial activities of various economic entities. This is often done using either a structural approach, which involves the concept of modernizing the organizational and legal form of management in the production and intellectual-innovative activities of the enterprise, or a technological approach, based on the content of scientific-analytical work at different technological stages of processing scientific and technical information. At the same time, aspects of pricing for scientific and technical products, especially the methods of investigating the process of establishing competitive prices considering the competitive position of the enterprise, remain insufficiently explored.

Given these premises, tasks related to assessing the economic efficiency of innovative technology utilization urgently require further research and the development of an economic mechanism for their implementation. Unfortunately, as our research indicates, the issues of the commercial application of innovative technologies as a means of improving the efficiency of industrial enterprises in our country are not given sufficient attention by researchers under objective circumstances. The necessity to improve the methodological aspect of pricing in a competitive environment and its impact on the efficiency of utilizing the commercial potential of scientific-innovative technologies have prompted the selection of the direction for this study.

Results. The level of commercial opportunities (commercial potential) of scientific-innovative technology is shaped through the utilization of various types of effects that can be obtained by:

- technology developers seeking to commercialize their technological products, including patents, inventions, utility models, trademarks, industrial designs, etc.
- manufacturers of innovative products created using innovative technology, benefiting from improved production or market performance indicators.
- intermediaries who enhance their methods of promoting and selling products.
- consumers of innovative products, created using innovative technology, benefiting from cost savings in its operation.
- society as a whole, benefiting from the improvement in the quality of life of its citizens.

For each of the subjects involved in utilizing the commercial opportunities of innovative technology, there are both general and specific types of effects of commercial potential manifestation, as illustrated in Fig. 1.

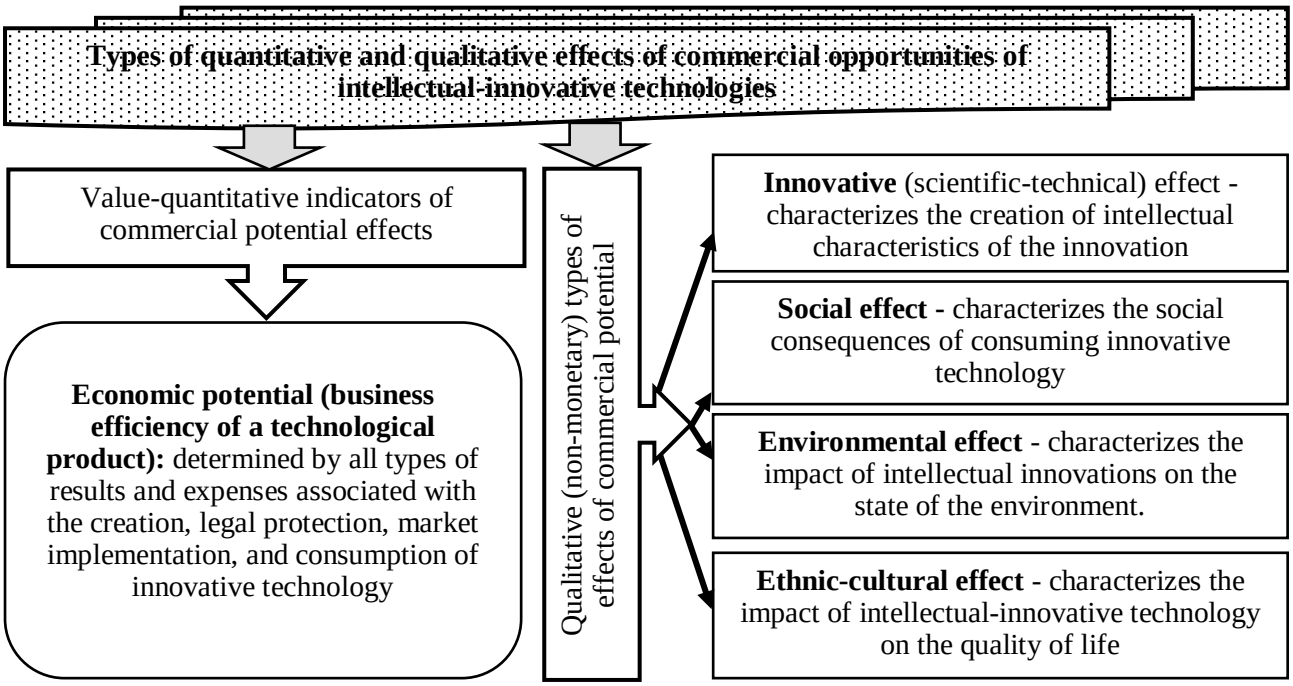

Figure 1 - Types of Effects Manifesting the Commercial Potential of Intellectual-Innovative Technology

Source: author's development

The widely accepted approach to assessing the effectiveness of the commercial implementation of innovative technologies is the ratio of the profit generated by the consumption of a given technology to the total expenses incurred by the enterprise for its creation (acquisition) and utilization.

However, in our opinion, evaluating the effectiveness of the commercial potential solely based on one indicator, firstly, limits the scope of technology application, and secondly, provides a limited economic picture of the real contribution of the technological product to the economic achievements of the owning enterprise. The problem lies in the fact that the impact of innovative technologies on the profitability of the enterprise is somewhat indirect and is manifested through the improvement of industrial business processes, increased efficiency in obtaining analytical data, ensuring rationality and efficiency in decision-making, and so on. The actual

(commercial) profitability of implementing innovative technologies is extremely challenging to isolate from the overall profit of the enterprise [1, 3, 24].

Therefore, in our opinion, the value of the technological product efficiency indicator may not provide accurate information regarding the rationality of implementing a specific innovative technology to some extent. This is associated with challenges in determining the results of innovative activities since merely calculating efficiency as the difference between resources spent and savings obtained in this context is insufficient. The consequences become much more complex and should be evaluated in terms of the strategic development goals of the entire industrial enterprise.

The technological market of innovative technologies is evolving extremely dynamically, responding to the needs of the business environment. As a result, new intellectual-innovative developments have emerged that implement resource planning technologies, integrate consumer-oriented strategy modules, and synchronize interaction with customers and consumers.

The efficiency of using innovative systems in economic management of the enterprise directly depends on two main factors:

- impact on increasing management efficiency;
- reduction of enterprise costs, which increases the profitability of the industrial enterprise.

The processes of managing the innovative infrastructure of the enterprise, particularly the processes of implementing innovative technologies, involve reasoned investment of resources in acquiring technological products, developing implementation projects, and utilization. It also includes conducting preparatory work, developing new management technologies, and training staff.

In the early stages of preparatory and project work, calculations are of a prognostic nature. Economic efficiency calculations after the implementation or modernization of a comprehensive innovation project or individual innovative technologies in domestic economic literature are often considered through two methodological approaches: the first is based on calculations of annual economic effects, and the second is based on calculations of integral economic effects. When calculating the annual economic effect, a comparison is made between the annual volume of market sales, production costs, and profit from product sales in the reporting period (after innovative changes in the production system of the enterprise) with similar indicators in the base period (before changes in the production assortment of the enterprise). In the case of calculating the integral economic effect, a comparison is made between the indicators of the cost and income parts of the enterprise's activities for the entire accounting period since the introduction of changes to the production program of the industrial enterprise [1, 2, 17].

However, neither the first nor the second method of determining economic efficiency can accurately assess the commercial contribution of innovative technology to the overall economic development of the industrial enterprise. This is due to numerous factors that can influence the compared indicators. For example, the annual sales volume may change due to the introduction of new products into the production program of the enterprise, changes in demand, or advertising policies. Therefore, we believe that it is necessary to determine the economic effect of using innovative

technologies based on all factors: economic, organizational, technical, and social, at all stages of the life cycle of innovative technology. For this purpose, a combination of various analysis methods should be used, which can be divided into two groups: cost-quantitative methods (business efficiency, innovation efficiency) and qualitative-quantitative methods (social, environmental, and systemic-synergetic efficiency), as emphasized by various researchers [1, 11, 12, 16, 24].

Research on the business efficiency of innovative activities BE_{IIT} is a tool widely used to justify any intellectual business project. In quantitative analysis methods, traditional approaches and indicators for calculating quantitative-value indicators of economic efficiency are used, taking into account the specificity of intellectual and innovative technologies (Fig. 2).

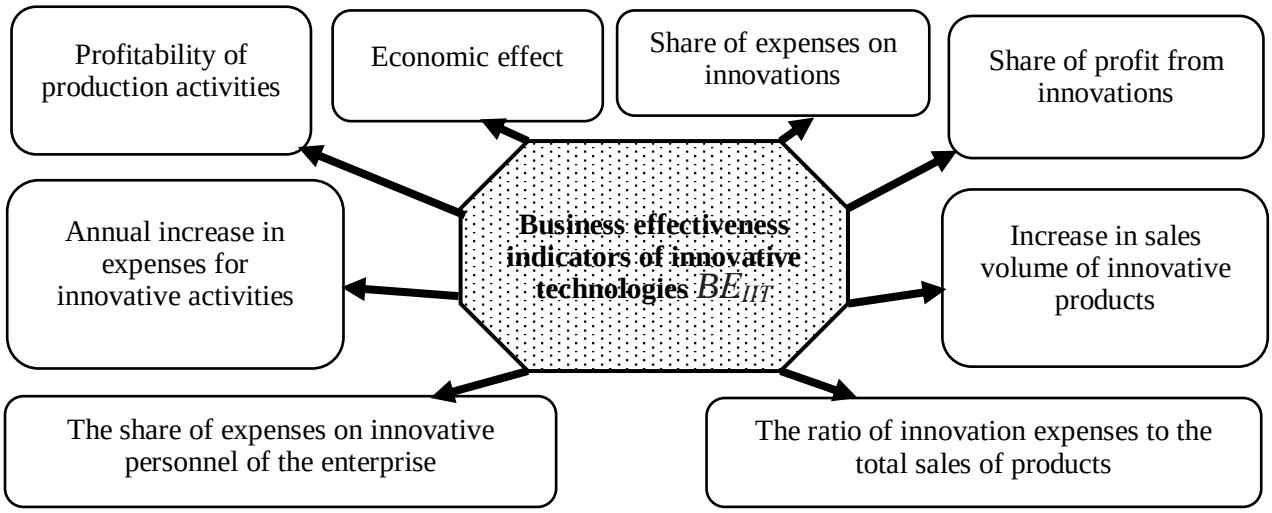

Figure 2 - Key indicators characterizing the business effectiveness BE_{IIT} of the commercial potential of innovative technology

Source: author's development

The advantage of existing methods for assessing the business effectiveness of innovative technologies BE_{IIT} lies in the presence of basic principles taken from classical economic efficiency theory. Using the values of business efficiency allows for the assessment of economic indicators in the development, implementation, and utilization of intellectual-innovative technologies.

Qualitative analysis and evaluation methods complement quantitative calculations. They help assess all indicators of the commercial potential of innovative technologies and compare them with the overall business strategy of the industrial enterprise. These methods allow professionals to independently select the most important characteristics of innovative products depending on their specifics and make changes to the ratio between these indicators using coefficients of their significance.

Innovative (scientific-technical) efficiency of IE_{IIT} reproduces the growth of new scientific and technical knowledge intended for the gradual development of theoretical and methodological principles of science and technology. The scientific effect characterizes the acquisition of innovative scientific knowledge and additional scientific information intended purely for internal scientific use. The scientific and technical effect reproduces the possibilities of consuming the results of other research activities, ensuring the acquisition of information essential for the development of innovative products. Figure 3 presents key indicators characterizing the state of

innovation efficiency IE_{IIT} of the commercial potential of innovative technologies.

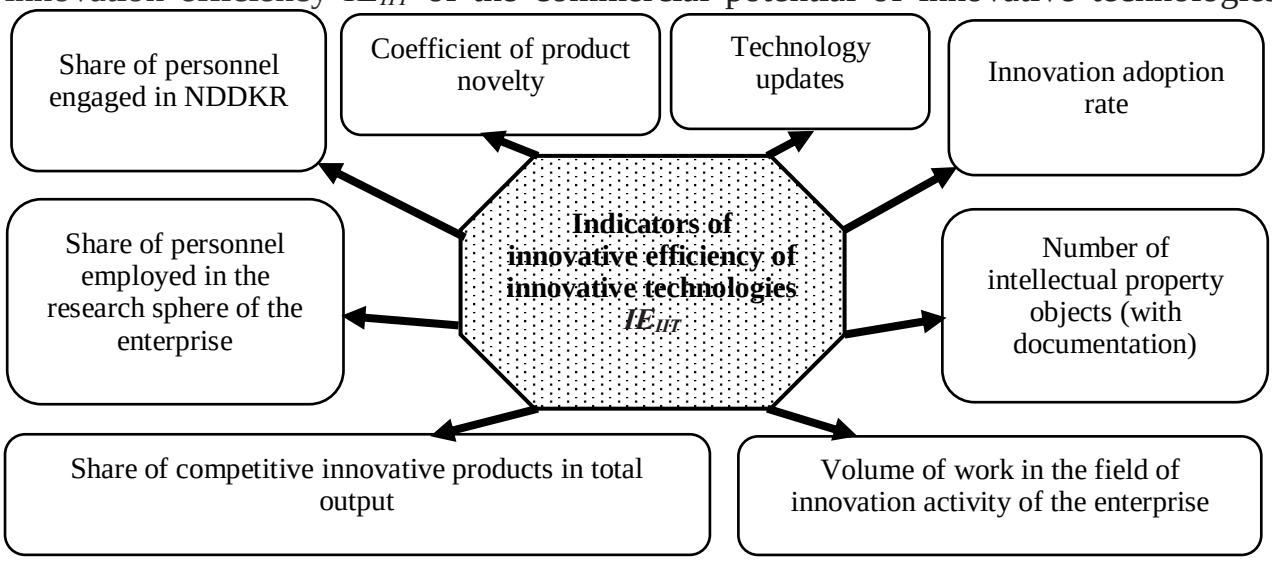

Figure 3 - Key indicators characterizing the innovation effectiveness IE_{IIT} of the commercial potential of innovative technology

Source: author's development

Moving on to the characteristics of indicators of the social effect of intellectual activity SE_{IIT} in the field of scientific and technological progress from the standpoint of the consumer-value concept, it should be noted that social effectiveness cannot be achieved without a corresponding economic basis. Therefore, the social components of the commercial potential of innovative technology are an extension of the quantitative and value characteristics of business efficiency.

Social efficiency SE_{IIT} also involves assessing the relationship between costs and results for a specific type of activity - intellectual work. The peculiarity of this work lies in the fact that there is no value equality between costs and results, and the beneficial effect exceeds the costs of its achievement to a small extent from the beginning.

Figure 4 presents key indicators characterizing the state of social efficiency SE_{IIT} of the commercial potential of innovative technologies.

Since the social result of innovation-intellectual activity is labor, the criterion for its social efficiency, measurements of its impact on social development and human development should be derived from the methodological content of labor and reduced to the liberation (economy) of direct living labor. Another form of socially significant effect of innovative scientific and technical activity is the increase in labor productivity, which is entirely justified and considered one of the main criteria in the societal development of modern human needs. This social result manifests itself when considering the development of productive forces from the standpoint of consumer value.

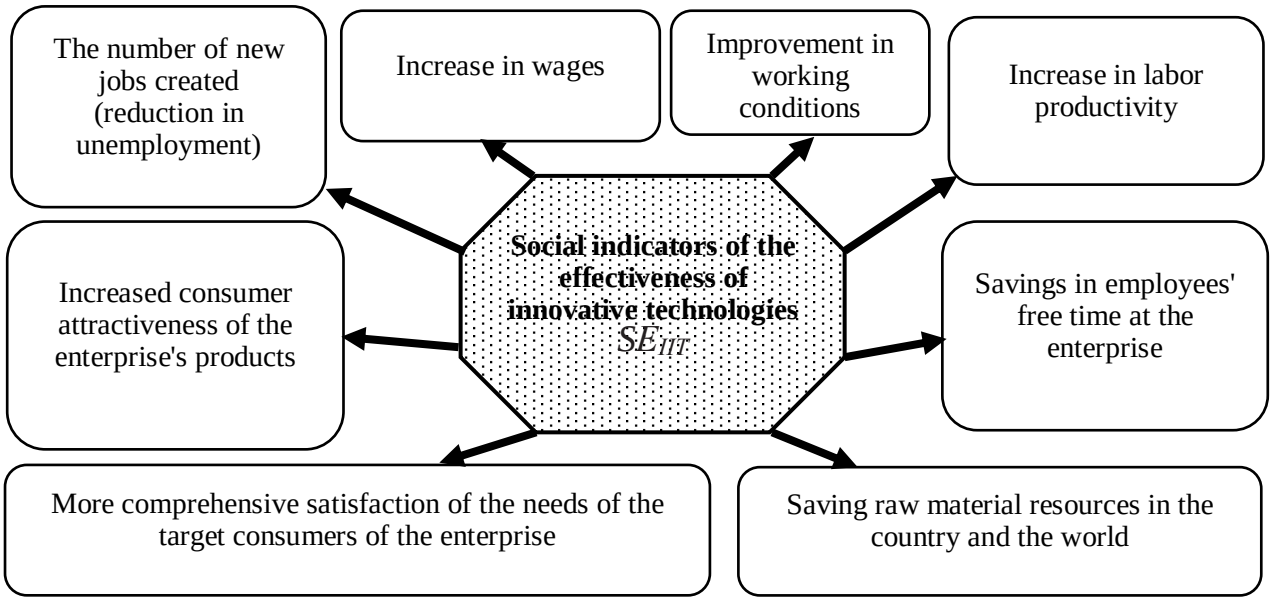

Figure 4 - Key indicators characterizing the social effectiveness SE_{IIT} of the commercial potential of innovative technology

Source: author's development

Environmental efficiency of innovations EE_{IIT}, can generally be considered a component of social efficiency. However, recently, in the majority of cases, it is regarded as a separate type of efficiency of innovative technologies. The environmental aspect focuses on the preservation and improvement of the environment, minimizing the use of air, water, and land resources both in the production of innovative products using innovative technology and during its use by consumers.

The environmental effect of EE_{IIT} manifests itself in a significant reduction in the destructive impact of innovative production on the environment and the improvement of environmental quality. Its qualitative characteristics are usually described using relative indicators.

Figure 5 presents the key indicators that mainly characterize the state of environmental efficiency of technology's commercial potential.

An essential aspect for increasing the level of commercial potential of innovative technology is its contribution to the systemic and synergistic development of the production of innovative products using this technology, characterized by the presence of a systemic-synergetic effect SSE_{IIT}. A systemic approach is evident when the enterprise as a whole or its individual units or a group of interacting enterprises are considered as a system that ensures development. The entire system may acquire new special properties that could not be formed or obtained separately. This is the essence of the emergent property of modern complex economic development systems. Emergence is the main characteristic of the presence or absence of a systemic development effect. In this regard, emergence is most inherent in intellectual-innovative technologies, which, by definition, are emergent.

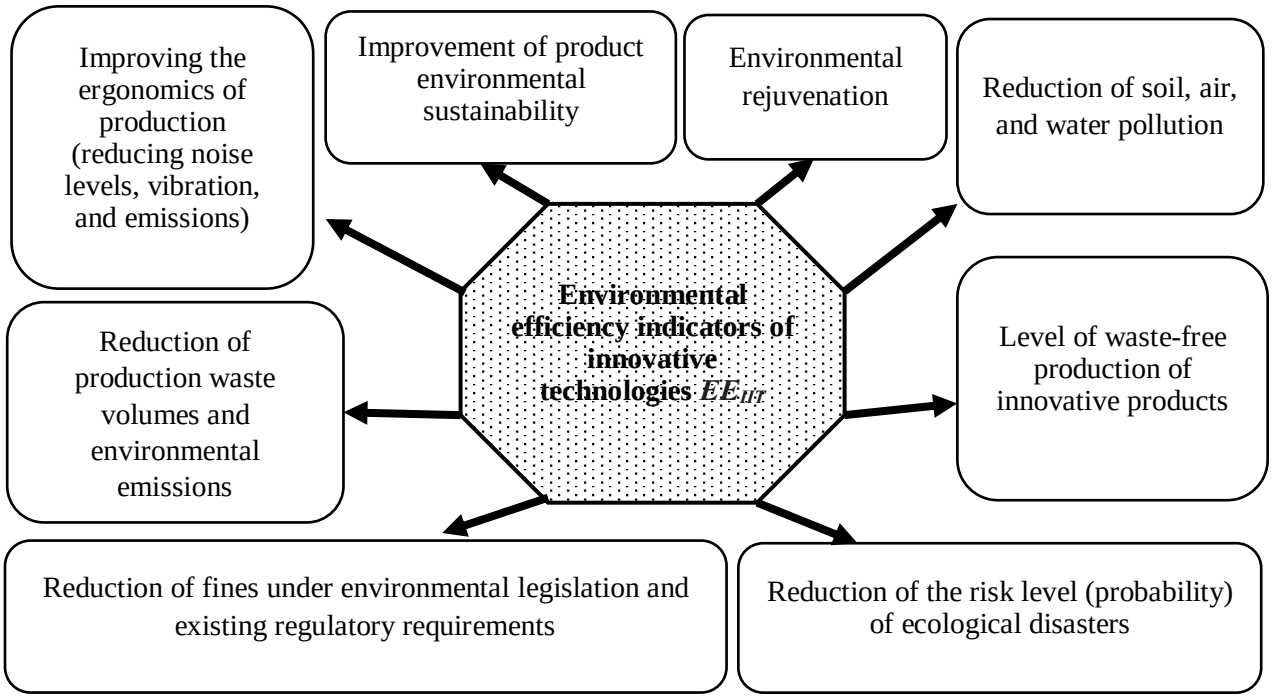

Figure 5 – Main indicators characterizing the environmental efficiency EE_{IIT} of the commercial potential of innovative technology

Source: author's development

System effects, expressed through the prism of emergent quality, should be distinguished from synergistic effects of development. As known, the synergy of a system lies in the fact that the performance of the system equals the sum of the results of the activities of each element plus the synergistic effect, which equals the additional result caused by the interaction of their elements. Thus, the synergistic effect of development in the activities of, for example, a group of integrated enterprises is manifested in their overall contribution to the obtained result plus the additional effect from their mutual cooperation. In turn, the systemic effect is manifested in the emergence of a new "breakthrough" result/indicator, the achievement of which allows for the innovative technology.

The indicators that constitute the systemic-synergetic effect from the use of the commercial potential of innovative technology are presented in Fig. 6.

During this study, it was identified that there is currently an insufficient level of development in the methodological foundations for evaluating the effectiveness of systemic-synergetic development in complex innovative systems under the current conditions of domestic economic development.

The comprehensive economic assessment of the commercial potential of intellectual-innovative technology ECP_{IIT}, taking into account all the proposed components for determination, is defined by the following dependency:

$$ECP_{IIT} = BE_{IIT} + IE_{IIT} + SE_{IIT} + EE_{IIT} + SSE_{IIT} \quad (1)$$

In our opinion, when forming the pricing determinants for scientific and innovative technologies, it is advisable to adhere to classical principles of price formation. These principles involve determining the price as the sum of profit and cost.

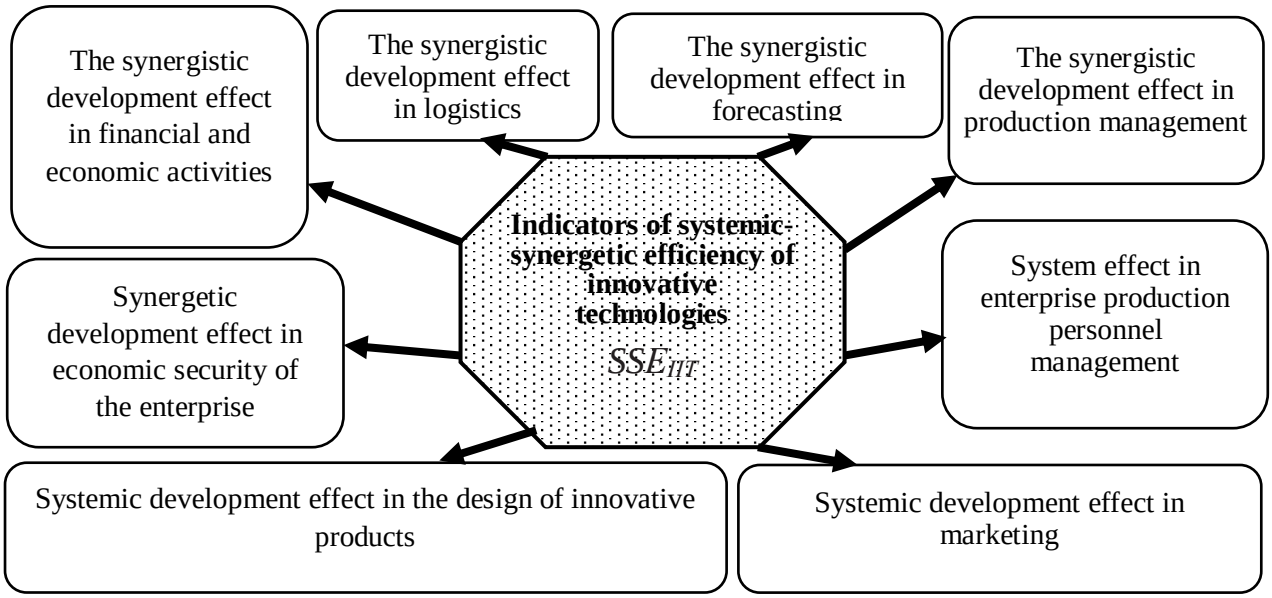

Figure 6 – Main indicators characterizing the systemic-synergetic efficiency SSE_{IIT} of the commercial potential of innovative technology

Source: author's development

- In the conditions of the increasing role of scientific and technical development in the Ukrainian economy and the formation of the market for scientific and innovative products, there is an urgent need to consider modern requirements for setting prices for such products. Scientific and technical products include completed scientific research, design, engineering, and technological work, experimental samples of innovative products, and objects of intellectual property. An analysis of the available domestic and foreign experience indicates that when setting prices for scientific and technical products, developers, in the majority of cases, use three basic concepts:

- cost-based concept, which is based on setting the price P_{stp} for scientific and technical products using the total costs of their creation C_{stp} and the desired profit S_{stp}: $P_{stp} = C_{stp} + S_{stp}$;

- performance-based concept, according to which the determination of the price for scientific and technical products is based on a portion of the economic effect ECP_{IIT}, which corresponds to the requests and efforts of the developer of scientific and technical products and is determined using a coefficient K_{ee}: $P_{stp} = ECP_{IIT} \; x \; K_{ee}$. The practice of setting prices for scientific products indicates that their price is derived from the potential effect that the consumer (licensee) of scientific products can obtain (usually, the value of K_{ee} is in the range of 0.3 to 0.5).;

- compromise pricing concept involves forming the price for scientific and technical products as the sum of NDDKR costs and profit, defined as a corresponding portion (percentage) of the economic effect ECP_{IIT}, expected from the consumer's use of the scientific and technical product (coefficient K'_{ee}): $P_{stp} = C_{stp} + (ECP_{IIT} \; x \; K'_{ee})$.

All the considered pricing concepts find wide application in global practice. However, different countries prefer one or some of them. Particularly challenging situations arise when the licensor forms the license price for scientific and technical products. Such circumstances are caused by the fact that the actual value assessment of the license (price) can only be determined in practical use of the scientific and technical product (license object) by the licensee.

The license price is proposed to be determined taking into account several factors that shape it:

- the potential amount of additional profit that the consumer can obtain from using the scientific product;
- actual costs for the creation and legal protection of intellectual and innovative technology;
- the amount of alternative costs for creating a substitute product that may have the same consumer values as the given technology;
- knowledge transfer costs, which are inseparable from the technology developer and concern the "informal knowledge" inherent in the developers;
- prices for technological products that perform similar production and commercial functions among competitors;
- potential costs of independent technology development by the buyer;
- costs in case of infringement of exclusive (patent) rights.

To establish the license price, two main approaches are used.

1. Royalty method - periodic deductions from the consumer's income over the agreement's duration. This is the most popular type of license pricing, used in 9 out of 10 cases. The license price in the form of royalty payments P_{lic} is proposed to be determined as follows:

$$P_{lic} = \sum_{i=1}^{T} N_{stpi} \; x \; P_{1stpi} \; x \; R_{stpi}, \quad (2)$$

where: N_{stpi} – the volume of production of products manufactured using the scientific and technical product in the *i*-th year; P_{1stpi} – the price per unit of product in the *i*-th year; R_{stpi} - the royalty amount for the given scientific and technical product in the *i*-th year (the average royalty rate is 3…7%); i = 1, 2…(T-1) – the license term.

The lump-sum (one-time) payment method, the amount of which is more often determined based on expert assessments. It should be noted that a lump-sum payment can be made either directly in cash or by transferring securities of the licensee (practice shows about 5-20% of shares) or by exchanging scientific and technical documentation. The lump-sum payment method is used in cases where the licensor cannot sufficiently control the actual profits of the licensee.

Possible is the combination of these two basic methods (a combined approach to licensing pricing). In this case, the licensor receives initial payments in the form of an upfront fee until the licensee starts producing innovative products developed based on the scientific and technical product. Subsequently, when the object of the license is commercially utilized, payments are made in the form of royalties. In our opinion, initial payments (recommended within 25% of the license price) are often a certain guarantee that the licensee has serious intentions for the commercial use of the licensed object. Additionally, their presence allows compensating for initial expenses associated with the conclusion of the licensing agreement: production of technical documentation, material carriers of information (experimental samples, devices, special equipment), and so on.

In our view, when forming a licensing agreement, it would be expedient to establish minimum guaranteed payments that we propose to be paid after the reporting period, regardless of the results of the commercial development of the licensed object, production volumes, and the profit received by the licensee. The size of guaranteed

payments may depend on the type of licensing agreement. For example, their total amount should not exceed 75% of the total royalty for exclusive and full licenses and 50% for a non-exclusive license. Implementing such a system of licensing for scientific and technical developments would, firstly, somewhat create financial protection for the developer of intellectual property, and secondly, be a significant incentive for them to conduct further scientific research.

Conclusions. The multi-profile nature of intellectual and innovative activity of industrial enterprises provides grounds for considering all areas of its activity. In this context, evaluating the effectiveness of intellectual and innovative activity solely from an economic point of view does not reveal its full essence. To assess the effectiveness of its results, there is a need for analysis of both quantitative and qualitative indicators of all possible effects, the detailed classification and economic essence of which have been investigated.

It has been established that the most important types of effects from the use of intellectual products include economic (value indicators), scientific-technical (novelty, usefulness, reliability), market (demand, supply, price), social (social outcomes), and ecological (environmental indicators). The integral economic effect from the implementation of intellectual and innovative projects is determined as the sum of all these types of effects. Thus, the integral economic effect from applying the results of scientific research and development includes all components of reproductive development.

It is justified that the evaluation of the effectiveness of intellectual and innovative activity of industrial enterprises should fully take into account a comprehensive approach to the concept of "efficiency." This means that, in addition to indicators characterizing the economic effect of expenses (investments) in intellectual and innovative activity, the degree of achieving the goals of this activity in scientific-technical, market, social, ecological, and other spheres should be assessed. It is necessary to combine quantitative and qualitative assessments, taking into account the goals of all participants in intellectual and innovative activity. Moreover, the beneficial effect of implementing an innovation cannot always be evaluated solely using value estimates or quantitative indicators. Therefore, with a qualitative approach, the efficiency of intellectual and innovative activity of industrial enterprises should be assessed in terms of maximum compliance with the set goals.

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