The object of research is the process that forms strategies and methods for effective commercialization of intellectual products at industrial enterprises. The problems of introducing intellectual property objects into the economic circulation in the field of industrial production have been analyzed. The most important of them are economic and managerial problems, which consist in the lack of necessary funding and are determined by the difficulty of assessing the market competitiveness of an intellectual product. Special attention was paid to market, technical-technological, and legal problems, the presence of which inhibits the development of the technological market and significantly affects the efficiency of intellectual and innovative activities. The presence of these problems predetermined the main goal of the study – to devise methods and strategies for the commercialization of intellectual property objects.

Three basic strategies for the commercialization of intellectual products have been studied: the strategy of promoting an intellectual product, the strategy of diffusion of innovations, and the strategy of accumulating maximum income. Based on them, an integrated strategy for the commercialization of intelligent products for enterprises of the machine-building industry, which is oriented towards achieving the goals of maximizing the economic and social effect of the production of an intelligent product, was formed and substantiated. The main component of an integrated strategy is an organizational mechanism that provides investment support for innovative activities and scientific and consulting support for an intellectual product.

The research results could be used to form programs of intellectual and innovative activity of industrial enterprises and would serve as a basis for further scientific research on these issues

Keywords: intellectual property, commercialization strategies, technological market, technology transfer, innovative activity

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FORMATION OF INTELLECTUAL PROPERTY COMMERCIALIZATION STRATEGIES

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1. Introduction

For the modern economy, the development of innovation-oriented production is one of the most important conditions for the sustainable growth of production processes and increasing the efficiency of their functioning. The high level of competition between Ukrainian and foreign manufacturers [1] stimulates industrial enterprises to create and introduce into economic circulation (commercialization) objects of intellectual property and innovative products [2]. Intellectual property and innovative products (technologies) created on its basis represent a source of significant competitive advantages in modern business.

The modern concept of industrial and commercial activity under the conditions of active globalization processes and widespread digitalization of society is determined by the intellectualization of the most important factors of production (labor, land, information, capital, entrepreneurial abilities) [3]. Under such circumstances, changes in the ratio of intellectual and material assets in favor of the former are becoming more and more widespread. It is they that at this time play a decisive role in creating innovations and ensuring their commercial success in the target market. Intellectualization of production contributes to the active search for competitive advantages by increasing the share of intangible assets and increasing the role of the intellectual and innovative component in the process of production and sales of products [4]. The study of trends in the development of industrial production is related to solving a number of important problems that determine the need and level of research and development (R&D) in the process of industrial and commercial activity [5, 6]. This kind of tasks should include increasing the demand for innovations and the results of innovative changes, maximizing economic results from the introduction of intellectual technologies into economic circulation, developing effective strategies for the commercialization of intellectual products, etc.

The most significant economic interest among these tasks is the strategy of introducing intelligent and innovative technologies into economic circulation, which can qualitatively change the results of the production and commercial activity of any industrial enterprise. The intelligent and innovative development of production and the introduction into economic circulation of the results of scientific activity are mutually complementary elements of intellectual and innovative activity that contribute

to the sustainable development of enterprises of any industry. At the same time, the issues of commercialization of innovations in the field of industrial production have not yet been fully studied. The issue of devising a strategy for the introduction of intelligent and innovative technologies into the economic circulation for enterprises in the field of industrial production requires a detailed analysis. Their consideration involves the study of technologies for internal and external transfer of innovations, creation of commercialization programs, and construction of innovative models for the prospective development of industrial production [7–10].

Despite increased attention to the problems of technology transfer and commercialization of innovations in various industries [11, 12] among modern researchers, there is still no consensus on the identified problems. In particular, this concerns the determination of the content, place, and role of commercialization in the field of industrial production, problems of program-target management and the development of a commercialization strategy at enterprises of the machine-building industry [11, 13]. At the same time, the potential of mechanical engineering production is not sufficiently studied in modern economic literature, therefore the formation of strategies for introduction into economic circulation in this industry is relevant and important [14–16]. Thus, relevance is determined not only by the importance of devising an effective strategy for the introduction of intelligent products into the economic circulation in the field of industrial production. Equally important and significant are the tasks of improving the methods and mechanisms of forming this strategy and implementing it at enterprises of the machine-building industry, which could be adequate to the modern requirements of market relations [11, 17]. All this provides objective grounds for conducting a study of existing strategies for the introduction of intellectual products into economic circulation and determining the factors that prevent their effective use.

2. Literature review and problem statement

In modern economic literature, the strategy of introducing intelligent and innovative technologies into economic circulation is understood as "a set of specific actions that ensure the process of commercialization" [11]. But in such an understanding, the very meaning of commercialization is lost to which attention is drawn in work [18]. According to the authors, a more precise definition of the commercialization process should be associated with the final result of intelligent and innovative activity – profit [6, 19]. This opinion is also supported by studies [20, 21].

In the long-term, researchers distinguish linear (or "process") and functional strategies for the commercialization of intellectual products [22]. Linear commercialization strategies are a step-by-step description of the process of commercializing innovations. But these strategies, as noted by the authors of work [23], do not provide for the possibility of returning to previous stages in order to refine the product or correct the identified shortcomings of the intellectual product. The reason for this may be the lack of a detailed market component in process and functional commercialization strategies. Their content is mainly reduced to the determination of the potential capabilities of the manufacturer and its products, which in many cases cannot lead to commercial success without taking into account the capabilities and trends of the technological market.

In work [24], the authors declare Goldsmith's commercialization strategy to be one of the most common linear strategies for the commercialization of an intellectual product. Supporting this opinion, it should be noted that the fact that this strategy of introducing intellectual products into the economic circulation covers the entire process of commercialization from the birth of an idea to the implementation of the strategy of bringing innovative products to the market is important. Goldsmith's commercialization strategy includes all phases of the life cycle of an intellectual product: conducting scientific research, technical implementation, development, implementation, growth, and maturity, which is confirmed by the results of other studies presented in [6, 11]. However, Goldsmith's innovation commercialization model [24] does not provide for a detailed analysis of innovation commercialization from three main points of view: technical, market, and production. A solution to this problem may be the development of a passive commercialization strategy (takes into account the market component) and an active strategy (takes into account the technical and production component). At the same time, their organic combination can provide the desired result. In this regard, works [5, 6] emphasize that at each stage of the commercialization of an intellectual product, three steps are assumed within the framework of technical, market, and business components of commercialization. The movement of intelligent products within such a strategy is carried out from top to bottom from left to right [24]. A number of scientists are confident that the strategy of commercialization of intellectual products presented in [24] is suitable for completely new, previously unknown ideas [19, 20]. Objects of intellectual property possess absolute novelty, but only at the stage of their creation. As emphasized in work [22], significant profits from these processes can be obtained only in the case of wider use of an intelligent product, which at this stage is already transformed from completely new to simply new (innovative). All this provides grounds for developing an integrated commercialization strategy that would organically combine the technical, market, and business components of commercialization.

In study [25], Rothwell and Ziegfeld's linear strategy for commercialization of an intellectual product is presented in detail. This strategy is a block diagram that reproduces the relationship between the components of commercialization and their interaction. The central link of Rothwell and Zegfeld's strategy is the technical side of development, which is formed under the influence of emerging and developing market needs and technology development [11]. The disadvantages of the strategy include the overconfidence of the authors that the strategy will be effective. But every commercialization strategy has inherent features of commercial risk, and ignoring it can lead to negative consequences, which researchers consider in detail in their studies [23, 26].

The strategy of Andrew and Sirkin (Andrew James & Sirkin Harold), which is reported in detail in study [27], presents in a graphic format the curve of the cumulative cash position of a typical commercialization project depending on time. Funds on the vertical axis are represented as a simple positive or negative value, the change in value as a result of a change in business cash flow from negative to positive [27]. The horizontal axis is the successive stages of commercialization, from idea generation through commercialization to implementation. Andrew and Sirkin's intellectual product commercialization strategy focuses the innovator's and investor's attention on the economic side of the commercialization project and provides answers to economic questions. We

note that economic problems (project payback, time of its implementation, availability, and efficiency of investments) are extremely important in projects of commercialization of an intellectual product. Without denying the importance of the economic component of the process of commercialization of innovations, let's pay attention to the fact that the marketing (market) component is no less important, which was practically ignored by the authors of this model. This is the approach used in work [18], in which it is recommended to overcome the difficulties inherent in the strategy of Andrew and Sirkin by combining the methods of diffusion of intellectual property objects and the promotion of an intelligent product.

As part of the research, in various publications, we also analyzed the commercialization strategy by Smith, which is presented in work [28]. This strategy was developed for the Australian Institute for the Commercialization of Innovation. The main stages of this strategy for the commercialization of intellectual products reflect the needs of the investor and the entrepreneur, which from the point of view of marketing is practically unacceptable since the needs of the consumer are practically of no interest to anyone. In Smith's model, emphasis is placed on the need to select ideas at a preliminary stage, which includes an assessment of technology and its capabilities. In the early stages of commercialization of innovations, ideas are tested and unviable are weeded out. As ideas flow through the model, the emphasis gradually shifts from "filtering" weak ideas to protecting and cultivating promising ideas [28]. Despite its shortcomings, this strategy clearly identifies the need for forecasting tools that direct innovators' efforts and resources by helping to identify the technical and market characteristics of a promising idea.

A variation of the linear strategy for the commercialization of intellectual products was also developed at Carnegie Mellon University [29]. The strategy was called an interactive commercialization strategy. This strategy is quite simple and consists of three main steps and an iterative loop at a critical decision point. At the early stage of commercialization, finance, technology, and marketing experts are involved, then the innovation is presented to potential licensees or investors. If the process does not lead to successful commercialization, the intellectual property license is transferred to the innovator [20]. But this strategy is used for commercialization only for university scientific developments, not related to the possibilities of own use; its use makes no sense for industrial innovations.

The commercialization unit of the University of Queensland developed an eight-step linear strategy for commercialization [30]. The main emphasis of the model is not on the sequence of commercialization steps but on choosing the right pool of experts to determine the commercialization strategy. The disadvantage of the model is that it focuses a lot on the creation of a new enterprise, and not on the iterative improvement of an existing product or service and its promotion. At the same time, it should be recommended to the expert group to identify and systematize the existing problems of commercialization of intellectual property objects in the field of the company's activity and form their proposals already on this basis. Without such actions, the practical use of the eight-step linear strategy of commercialization is impractical.

Back in 2006, the Canadian group of experts on commercialization formed a functional strategy for the commercialization of innovations [4]. This strategy describes the various components of the commercialization process and their relationship. It places ideas at the heart of a process in an iterative cycle that innovators, entrepreneurs, and investors carry out through process elements related to intelligent technologies ("R&D"), business ("firms"), and the market [4]. Analysis of this strategy allows us to conclude that ideas can arise at any stage of the commercialization of an intellectual product or its life cycle. It is also important to conclude that in the process of commercialization, several iterations of this cycle may be needed to refine ideas and business models before commercialization becomes possible [21]. To a greater extent, this strategy is suitable for the commercialization of patents themselves, rather than innovative products created using them.

Our review of the literature [5, 6, 11–30] and practical development of strategies for the commercialization of intellectual products show that a large number of various strategies for the commercialization of intellectual products have been created and are used in practice. These strategies, to one degree or another, determine the need to create or find suitable conditions or combinations of certain circumstances, which with a high probability could lead to the successful introduction of intelligent products into the economic circulation.

3. The aim and objectives of the study

The purpose of this study is to form scientific and methodological provisions and practical recommendations regarding methods and strategies for commercialization of intellectual property objects in the field of industrial production. This provides a real opportunity to apply the results in practice, to regulate and manage the introduction of intelligent products into the economic circulation at an industrial enterprise.

To achieve the set goal, it is necessary:

– to identify and systematize the problems of commercialization of intellectual property objects in the field of industrial production, in particular, in the machine-building industry, and to identify modern theories, the methods of which can be used to solve the identified problems;

– to justify the expediency of combining the methods of diffusion of intellectual property objects and the promotion of an intelligent product when devising an effective strategy and commercialization program;

– to develop an integrated strategy for the commercialization of intellectual property objects for a machine-building enterprise and to propose an organizational mechanism that ensures the implementation of an integrated strategy;

– to substantiate the methodology for evaluating the effectiveness of the results of commercialization of intellectual property objects by machine-building enterprises.

4. The study materials and methods

The object of our study is the process that forms effective strategies for the introduction of intellectual property objects into economic circulation. The subject of the research is organizational and economic relations that arise in the process of commercialization of intellectual property objects in the field of industrial production.

The main hypothesis of the study assumes the need to intensify the commercialization of intellectual property objects in the field of industrial production. Its relevance is explained by the need to improve methods and strategies for the production of intelligent products demanded by the market, with the simultaneous maximization of the effect of its promotion at the expense of the market offer of a group of related products. This

will significantly increase the efficiency of commercialization of intellectual property objects in the field of machine-building production and the competitiveness of intelligent products.

To achieve the objectives, the research used the methods of structural approach, system analysis, induction and deduction, observation, and comparison. These methods were applied to clarify the conceptual apparatus of intellectual property objects in the field of machine-building production and to systematize the problems of commercialization of intelligent products in the field of industrial production.

Table 1

Dynamics of applications for objects of intellectual (industrial) property in Ukraine

Objects of industrial property	Years of observation						
	2016	2017	2018	2019	2020	2021	2022
A total of applications received	51,559	53,465	54,786	57,189	46,031	49,134	28,971
Inventions	4,092	4,046	3,969	3,852	3,183	3,395	2,760
Useful models	9,560	9,118	9,120	8,459	5,281	4,422	2,378
Industrial samples	2,302	2,480	3,042	2,678	2,026	1,838	819
Trademarks:	35,605	37,817	38,652	42,194	35,539	39,472	23,014
– including according to the national procedure	29,600	30,183	30,900	33,736	27,895	31,351	16,095
– including based on the Madrid system	6,005	7,634	7,752	8,458	7,644	8,121	6,919
Geographic indications	–	4	3	6	2	7	–

Source: [31]

Table 2

Dynamics of creation and commercialization of intellectual property objects at machine-building enterprises

Name of the company	Year					
	2018	2019	2020	2021	2022	2023*
LLC «SKB Ukrelektromash»	4	3	5	6	2	–
JSC «Turboatom»	18	22	20	25	14	8
PJSC «FED»	12	11	14	16	7	3
PJSC «Novokramatorsk Machine-Building Plant»	36	44	48	54	19	14
PJSC «Kryukiv Carriage Building Plant»	14	16	21	19	7	4
PJSC «KrAZ»	21	28	30	22	9	4
PJSC «Kremenchutsk Wheel Plant»	6	8	7	6	2	–
JSC «Electrovazmash»	24	32	29	37	18	14

*Note: *data for 9 months.*
Source: authors' field research

5. Results of research into the processes that form strategies for the introduction of intellectual property objects into economic circulation

5. 1. Determining and categorizing problematic factors affecting the processes of commercialization of intellectual property objects

A key factor in the competitiveness of an enterprise, region, industry, or country is a high level of intelligent and innovative activity. Competitiveness means "the ability to produce goods that can sell themselves", and innovation means "the introduction of a new or significantly improved idea, product, service, process or practice, intended to obtain an advantage as a result" [11]. Based on these definitions, the relationship between these terms is obvious. However, at this time, business entities demonstrate a rather low level of implementation of innovations created on the basis of intellectual property objects.

Table 1 gives the dynamics of registration of internal agreements regarding the trade of licenses for objects of intellectual (industrial) property.

The data given in Table 1 demonstrate that in recent years, the activity of participants in the Ukrainian market of IP objects has significantly decreased (since 2020, there has been a decline to some extent in terms of the number of applications submitted to the Patent Office of Ukraine). Hopes for some improvement in the current state of affairs in the future also do not inspire much optimism. Violation of the national economic complex of this country by military actions to a greater extent concerns high-tech industries, which are the main suppliers of applications for patents in the field of industrial property.

Domestic machine-building enterprises suffered specific losses in the field of creation and commercialization of intellectual property objects, as evidenced by the data in Table 2.

The data in Table 2 indicate a sharp slowdown in the processes of creation and commercialization of intelligent and innovative products at the leading machine-building enterprises of Ukraine in the last two years.

The results of the study of the processes of introducing intellectual property objects into economic circulation at industrial enterprises of Ukraine allow us to state that these processes are significantly influenced by five main problematic groups of factors (Fig. 1).

The systematization of groups of problematic factors affecting the processes of commercialization of intellectual property (Fig. 1) was carried out taking into account the peculiarities of the introduction of innovations into economic circulation in industrial production, in particular in the machine-building industry. Methods of solving identified commercialization problems are also defined. Based on the data presented in Fig. 1, the main groups of problematic factors influencing the results of intelligent and innovative activity at the country's industrial enterprises can be divided into managerial, economic, legal, technical and technological, and market (marketing) [6, 11].

Economic factors are primarily related to the low effectiveness of the state scientific and technical policy aimed at preserving, rather than expanding the country's scientific and technical potential. To a greater extent, they characterize the underdevelopment of the system of small innovative entrepreneurship and state mechanisms that stimulate the support of such structures in knowledge-intensive production. They also emphasize the reproduction of the degeneration of domestic science, based on insufficient funding of scientific research and the outflow of scientific personnel. They highlight the low efficiency of innovative activity, which is explained by the underdevelopment of existing institutions, rules, and laws that regulate economic relations in the intelligent and innovative sphere.

Legal factors are related to the improvement of tax legislation, which stimulates the innovative activity of economic enti-

ties in the sphere of knowledge-intensive production and the cooperation of all participants in the innovation cycle. In addition, they demonstrate the effectiveness of the system for protecting the legal rights of owners of intellectual property objects.

Management factors reproduce the underdevelopment of the infrastructure of the technological (innovation) market; highlight the shortcomings in the training of personnel from innovative and active specialties, both from a quantitative and qualitative point of view. They explain the capitalization of science mainly at the level of individuals while the outdated scientific equipment and testing base limit the creative realization of already existing personnel potential and the attractiveness of scientific activity for young specialists. They also highlight the gap between science and education, and as a result, scientific results are not capitalized in the field of education, and young specialists are not involved in conducting scientific research.

Market (marketing) factors characterize the absence of long-term systemic demand for intelligent and innovative products. This leads to the fact that the long-term nature of research with the short-term state innovation policy, which determines the demand (state order) for intelligent products from industrial enterprises, is mainly situational in nature. The influence of supply on demand in the field of intellectual innovation at this stage is very weak. This is due to the technological backwardness of most enterprises, the consumer gap between the number of created inventions and the number of inventions actually implemented on a commercial basis at Ukrainian enterprises is increasing.

Technical and technological factors reproduce the difficulties with the creation of a prototype of intelligent and innovative products and its subsequent tests. The above-mentioned factors determine the legal, economic, managerial, marketing, and technical-technological problems of introducing intellectual property objects into economic circulation.

According to the results of our research, it should be stated that the economic problems of commercialization of the results of innovative activity of economic entities are dominant for the modern Ukrainian engineering industry. First of all, they should include the low quality of products, the long process of import-substitution and the backwardness of Ukrainian production technologies, and the presence of unscrupulous domestic and foreign competitors. The insufficient stimulation of foreign capital investments in the machine-building industry and the lack of own intelligent and innovative developments and products created on their basis are also important.

It is proposed to start the process of introducing the results of the intelligent and innovative activities of industrial enterprises into economic circulation from the moment the idea itself appears. This approach generally determines the need to use managerial, economic, informational, financial, and marketing theories and methods. The detailing of the problems of introduction of intellectual products into economic circulation is shown in Fig. 2.

The basic methods used to solve the urgent problems of today (Fig. 2) are proposed to be reduced to the following provisions.

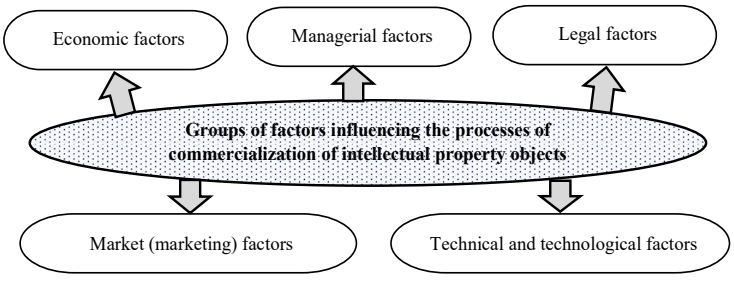

Fig. 1. Systematization of groups of problematic factors affecting the processes of commercialization of intellectual property objects in industry

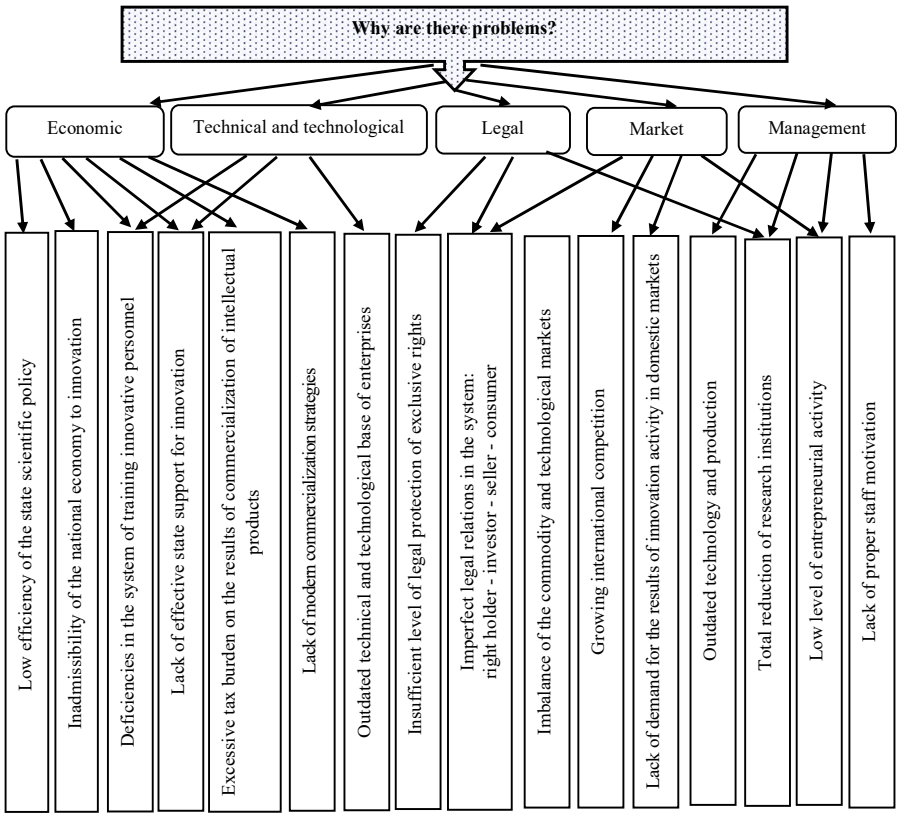

Fig. 2. Formation of problems and causes of low efficiency of intellectual products at machine-building enterprises

Economic methods involve the creation of small innovative enterprises, technology parks, temporary creative complexes; creation of patent and venture companies; support small and medium-sized innovative businesses; creation of an adequate revenue distribution mechanism during the implementation of innovative projects. Financial methods make it possible to create systems of economic support (benefits, loans), grants; attraction of free funds of risk capital; stimulation of enterprises to compensate part of the costs of R&D and development of new technologies. Management

and legal methods contribute to the creation of an institute of innovation intermediaries; development of innovation market infrastructure; improvement of intellectual property protection institutions. Market methods form an effective mechanism for the commercialization of intelligent products and the involvement of young talented specialists in scientific activity.

5. 2. Justification of the expediency of combining in the strategy of commercialization methods of diffusion and market promotion of intelligent products

The development and implementation of commercialization strategies in the machine-building industry involves the creation of a market infrastructure designed not only to stimulate and support this process but also to exercise direct control over it. Therefore, the problem of rational, effective, and mandatory production and use of intelligent and innovative products under modern socio-economic conditions in the country is becoming especially relevant. It requires new approaches to the development and implementation of strategies for the introduction of intelligent products into economic circulation in order to improve the innovation process in the industry and increase its investment attractiveness.

Table 3 gives a comparative analysis of foreign and domestic experience in the development and implementation of strategies for the commercialization of intelligent products in the field of knowledge-intensive production in general and in the machine-building industry in particular. Thus, under the conditions of a changing market environment, the decrease in the efficiency of the Ukrainian machine-building industry urgently requires the generation of ideas aimed at compensating for negative factors in the development and implementation of strategies for the commercialization of intelligent products.

Our research makes it possible to identify three basic strategies for the commercialization of intelligent products in the industrial domain.

Strategy for the promotion of an intelligent product. Within the framework of this method, the intellectual development right holder can use all development rights himself/herself, thus using the results of his/her intelligent and innovative work as an intangible asset of production and commercial activity. This asset is able to ensure the production of competitive and high-tech products. Accordingly, all income from the potential market will belong to him/her. In this case, there is a vertical transfer of intelligent technologies and the results of innovative activities.

Innovation diffusion strategy. The right holder receives income both from the assignment of rights to intellectual property objects and from their use. At the same time, the income from the use of the results of intelligent and innovative activities in the potential market will be divided between the right holder and the right user.

Strategy for accumulating maximum income from intelligent products. The right holder of an object of intellectual property can transfer the entire volume of exclusive rights to another person, in which case the result of innovative activity will be a product. At the same time, the right holder realizes the horizontal transfer of technology and loses the entire amount of potential income from the use of the intellectual product.

It is clear that the most profitable, but also the riskiest method of commercialization of intellectual property objects in machine-building production is the strategy of promoting an innovative product. Within the framework of this strategy, the author of an intellectual product carries out the process of its commercialization by organizing a business for the production of products based on the results of his scientific activity. Commercialization of intelligent products through the vertical transfer of technologies requires large financial investments that may not be available to the right holder. Therefore, in order to attract financial resources for the purpose of industrial development of the results of intelligent and innovative activity, it is necessary to independently and rationally use this method for promoting an innovative product. At the same time, it is rational to combine it with the method of diffusion of innovations through the implementation of the following forms of vertical technology transfer:

– joint development and use of an intelligent product with an interested partner;

– research and production cooperation (joint venture), i.e., the association of parties for joint development of technologies, joint development of serial production, cooperation in production and sales.

Table 3

Comparative analysis of foreign and domestic experience in the development and implementation of commercialization strategies

Attribute	International experience	Ukrainian experience
The level of resource provision of innovative activity	Availability of sufficiently large financial resources in the industry	Systemic underfunding of intellectual and innovative developments, despite the existence of a development strategy
A key trend in the organization of innovative activities	Research budgets are focused on the accounts of major business entities	R&D budgets are distributed among the enterprises of the industry, there is no possibility of their consolidation
A key source of effectiveness of commercialization strategies	Intensive creative activity and high investments in R&D	Work with state structures to include corporate projects in the state order
The degree of maturity of the market mechanism	Corrected operation of the market mechanism	Fragmentation of the market mechanism and the presence of a large number of administrative barriers
Organization of work with personnel	Formation of a wide range of competences among employees of the innovation sphere	Prolonged, fruitless discussions about standards of professional activity
Interaction with related industries	High technical level of related industries and their high interest in interaction	The technical level of related industries is quite high and there is little interest in interaction
The state of development of innovative and production infrastructure	High level of infrastructural support of innovation commercialization projects	Insufficient level of infrastructural support of innovation commercialization projects
Relation to mergers and acquisitions	The main tool for the generation and development of resources for the commercialization of innovations	It is the main tool for survival in conditions of intense competition

5. 3. Development of an integrated strategy for the commercialization of intellectual property objects for machine-building enterprises

The basis of the formation of a competitive strategy for the commercialization of intelligent products is the interaction between the external environment of the enterprise and its management system, which ensures the adaptation of the enterprise to the conditions of operation in the external environment. It is proposed to define the strategy of commercialization of intellectual products as a set of consistent types of behavior that allow the enterprise to position itself in the environment, and changes in the strategy can be considered as a reaction to changes in external conditions.

Understanding the commercialization strategy as one or another model of enterprise behavior under new market conditions, two groups of commercialization strategies can be distinguished: active and passive.

Active commercialization strategies (often called technological strategies by manufacturers) are a response to changes occurring in the external environment through the constant creation, implementation, and consumption of technological innovations. Having chosen one or more active commercialization strategies, the enterprise chooses the use of a new technological idea as the main success factor. Among active intelligent and innovative strategies, two fundamentally different types of strategies can be distinguished: leadership and imitation. If the technology embodied in the new product is new to the market, the firm implements a technology leadership strategy. If the technological idea is already known to the market but is used for the first time by the company itself, then we are talking about imitation strategies.

Passive (as defined by manufacturers – marketing) strategies are based on constant innovations in the field of marketing of intelligent products. The company can choose a strategy of commercialization of innovations in the field of product differentiation, highlighting new and new competitive advantages. The segmentation strategy involves the permanent search for new market segments or entire markets, as well as the use of new methods for the market and the company to reach these groups of buyers. The company's choice of passive strategies for the commercialization of intellectual products can also mean such a way of responding to changes in the external environment, such as constant innovations in the field of sales forms and methods, communication policy, etc.

An integrated strategy for the commercialization of intelligent products is proposed, the use of which allows one to balance the individual characteristics and parameters of an active strategy related to the creation of new businesses based on the results of intelligent and innovative activities, as well as a passive licensing strategy.

The integrated strategy of commercialization of innovations is aimed at achieving the goals of maximizing the economic and social effect of the production of an innovative product. At the same time, it should have sufficient potential to create a fragmented industry by building a small innovative enterprise with exclusive rights to the results of innovative activities of a group of interconnected enterprises in the machine-building industry. In addition, it should be noted that the integrated strategy of commercialization of intelligent products, which, on the one hand, is the basis for creating and maintaining competitive advantages aimed at maximally satisfying the needs of potential consumers. On the other hand, it ensures full use of production capabilities, innovative, scientific-technical, and intellectual potential of a group of interconnected machine-building enterprises.

The components of the integrated strategy for the commercialization of intellectual products are shown in Fig. 3.

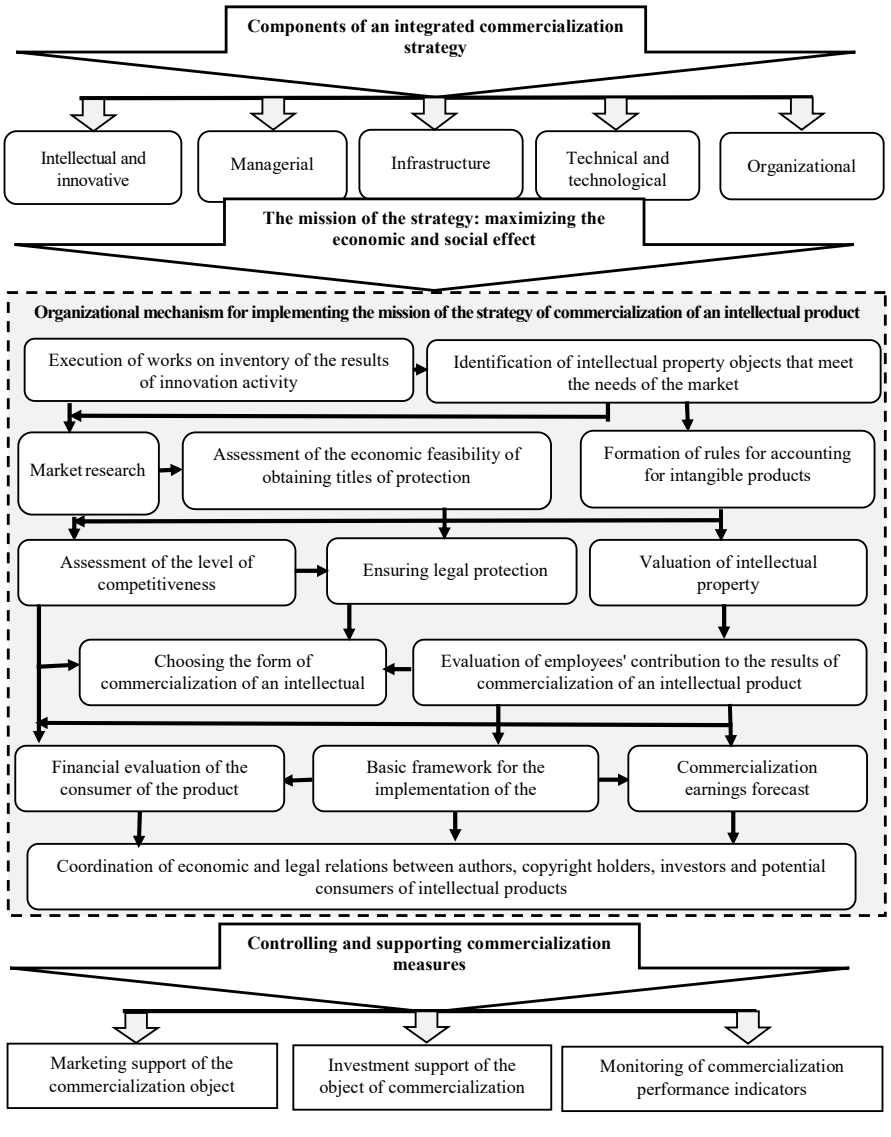

Fig. 3. Organizational mechanism for the implementation of an integrative strategy for the commercialization of intellectual property

At the same time, the most important components of the integrated strategies for the commercialization of intellectual products shown in Fig. 3, from the point of view of its development and implementation, are:

– the management component related to the formulation of the mission and goals of the enterprise's intelligent and innovative activity;

– intelligent and innovative component related to the description of an intellectual product, or a product created on its basis, which is being developed and implemented;

– the technical and technological component related to the structuring of the phases of the life cycle of the intellectual product developed by the enterprise and its partners, the exclusive rights to which will be transferred to the joint innovative enterprise being created;

– the institutional component, which describes the content of the main stages of the development and implementation of an integrated strategy for the introduction of an intellectual product into economic circulation;

– the organizational component, which is related to the development and implementation of the organizational mechanism for the implementation of the commercialization strategy.

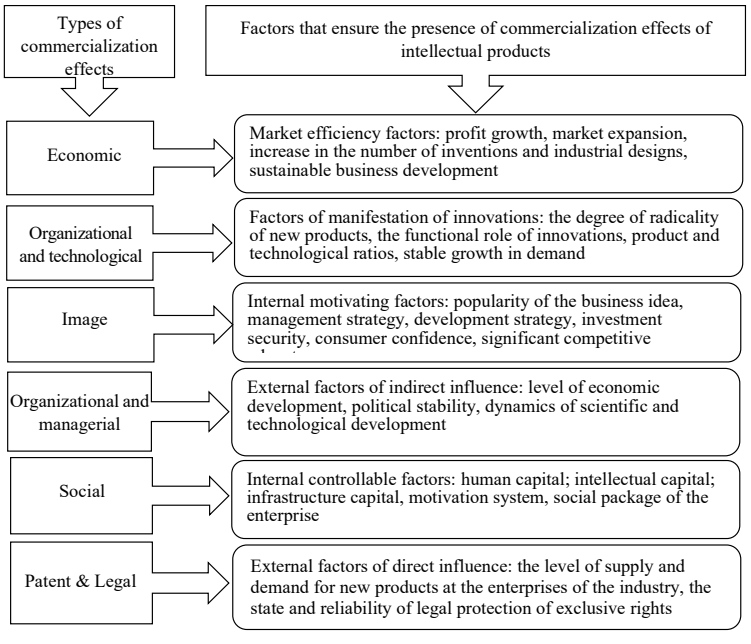

Fig. 4. The main components of the methodology for assessing the effectiveness of commercialization of intellectual products at machine-building enterprises

5. 4. Justification of the methodology for evaluating the effectiveness of the results of the commercialization of intelligent products at machine-building enterprises

The essence of the methodology for evaluating the effectiveness of the commercialization of intellectual products in the field of machine-building production consists in determining all possible types of effects from the use of the results of intelligent and innovative activities. These effects are manifested in an increase in the growth rate of intellectual product production, taking into account external corrective factors associated with a high degree of innovative activity in the industry. Their value is also affected by the intensive diffusion of innovations and shortening of the life cycle of products while simultaneously increasing the level of their competitiveness. An important role belongs to the dynamics of resource flows of a high-tech machine-building enterprise from its own intellectual development and the transfer of part of the exclusive rights to intellectual products to its partners.

The main components of the methodological provisions, which we recommend should be taken into account when managing the processes of introduction into economic circulation of intelligent products in the field of machine-building production, are shown in Fig. 4.

The economic effect of the commercialization of intellectual products at machine-building enterprises is largely shaped by the system of information support of the organizational mechanism of the practical implementation of the commercialization strategy. Efficiency factors should primarily include an increase in profit from the implementation of the results of intellectual activity since it contributes to the creation of a demanded and competitive product at the expense of information about consumer needs. An important factor is the trends and achievements of the scientific and technical revolution, which are contained in the information support system of the organizational mechanism for implementing the commercialization strategy.

The organizational and managerial effect of commercialization consists in substantiating forecasts of the direction of socio-economic development of the machine-building industry based on reports on the dynamics of patenting in one or another field of knowledge in the field of high-tech production.

The organizational-technological effect of commercialization is provided by the reduction of labor-intensive management operations, as well as the effective use of accumulated information about intellectual products, both within the enterprise and in other organizations.

The social effect reproduces the acquisition of new information and work skills within the framework of the implemented strategy of commercialization of intellectual products, which contributes to the improvement of qualifications and, as a result, the development of personnel.

The image effect reproduces the development of intellectual property management systems, leads to an increase in the trust and commitment of customers (which is expressed in an increase in financial results from commercialization), as well as the degree of trust and commitment of employees to their company.

The patent-law effect characterizes the introduction of an organizational mechanism for the implementation of strategies for the commercialization of intellectual products at machine-building enterprises. It provides opportunities to control the processes of submitting and receiving applications for security documents, the timeliness of payment of state duties and payments for exclusive rights, and to regulate relations related to the results of intellectual activity.

The integrated effect of commercialization is expressed in reducing the labor intensity of operations related to the management of innovative activities at machine-building enterprises, increasing the efficiency of the commercialization process. Its value ($E_{integral}$) is determined by specifying the economic effect (E_e) with the help of corrective coefficients of organizational-technological (C_{ot}), social (C_s), image (C_{im}), organizational-management (C_{om}) and patent-legal (C_{pl}) ef-

fects. This is due to the difficulties of directly calculating the value of these effects. Corrective coefficients are determined by the method of expert evaluations in the interval [0, 1].

Recommendations for assessing the economic effect of the commercialization of intelligent products at machine-building enterprises are based on the ratio of costs and economic results. Their use makes it possible to determine the effectiveness and efficiency of the commercialization process based on the profit for a certain period of time (T) by their rights holders. The first component of the formula reflects the company's income from the application of the results of intelligent and innovative activities in the company's own production and economic activities. The second component is income from their implementation through the transfer of rights to the results of intelligent and innovative activities, which reflects the essence of the integrated strategy of commercialization of intellectual products:

$$E_{integral}=\sum_{t=1}^{T}\left[\begin{array}{l}\sum_{j=1}^{m}\left(N_{jt}\times P_{jt}-C_{jt}\right)+\\ +\sum_{i=1}^{n}\left(L_{it}-C_{it}\right)\end{array}\right]\times\left(1+\beta\right)^{-t},$$

j=1...m; i=1...n,

where N_{jt} and P_{jt} are the volume and price of the i-th product of the machine-building industry based on the results of intelligent and innovative activity at the t-th moment, respectively; L_{it} – the amount of the enterprise's licensing income (flat-rate payments, royalties) from the sale of the i-th type of result of intelligent and innovative activity; β – rate of reduction of various expenses, relative units; C_{it} and C_{jt} are costs for obtaining the results of innovative activity of the i-th and j-th types at the time t.

6. Discussion of research results regarding the formation of strategies for the introduction of intellectual property objects into economic circulation

The strategy of commercialization of innovations in industrial production is a complex process, which consists not only in choosing one of the methods of transferring the obtained result but also in detailed planning of the process of its commercial use. Achieving this result is possible by making decisions regarding the expediency of securing intellectual property rights to the object under development, the timing of bringing the results of intellectual products to the market. Methodological recommendations for the practical determination of the economic results of the commercialization of intellectual property objects at domestic enterprises are of considerable interest in this area. In particular, it can be quite interesting to carry out a regression analysis of the impact of the proposed measures of commercialization of intellectual property on the profitability of a machine-building enterprise. But such a task can be the subject of a separate scientific study and is not included in the scope of the tasks of this paper and is defined as a prospect for further research.

The basic characteristics of the practical implementation of the integrated strategy of commercialization of intellectual products correspond to the main theoretical and methodological components of this strategy. We researched the organizational, marketing, production, and financial characteristics of the implementation of an integrated strategy for the commercialization of intellectual products, which are interconnected and of primary importance for the creation of a small innovative enterprise jointly with partners for innovative activities.

The main methods of their commercialization at machine-building enterprises should be highlighted in the results obtained on the basis of the conducted research regarding the formation of strategies for the introduction of intellectual products into the economic circulation. The practice of implementation of the results of intelligent and innovative activity by rights holders [11, 18, 23] allows us to determine the advantages and disadvantages of the developed methods and strategies of commercialization of intellectual products (Fig. 2). Their identification and consideration in the formation of new commercialization strategies allows one to significantly increase the effectiveness and validity of this type of development. The proposed methodology for evaluating the effectiveness of the commercialization of intelligent products at machine-building enterprises (Fig. 4) makes it possible to more accurately determine methodological approaches and commercialization strategies from a number of available alternatives.

Among the most used commercialization strategies proposed for use at enterprises of the machine-building complex (Table 1, Fig. 3), the following should be highlighted.

The strategy of promoting an intellectual product involves the use of growth methods, the simple majority method for patents, the method of increasing investment attractiveness, and the method of active commercialization. The promotion strategy has a number of advantages, which include maximizing the market value of the business entity, ensuring the highest level of profitability, limiting the actions of competitors in the field of development of intellectual technologies. The important disadvantages of the promotion strategy include a high level of risk and resource intensity, the need for significant amounts of financial resources, and long access to target markets.

The diffusion strategy involves passive and absorptive methods of licensing support, extensive use of franchise relations. This strategy provides the necessary differentiation of commercial risks from the introduction of intelligent products into the economic circulation and quick access to target markets. At the same time, when using it, complex and confusing schemes of possession and disposal of the results of intellectual activity may arise, scientific developments are highly accessible to hidden competitors.

The strategy of accumulating maximum income from an intellectual product uses the method of selling patents, granting a full license; the flanking or frontal attack method and the blocking method. It has a number of important advantages related to the relatively easy involvement of external sources of resources for the development of the results of intelligent and innovative activities, stimulates the effective flow of R&D processes, and ensures the integrated commercialization of innovations. The disadvantages of the strategy are mainly related to the presence of a high risk of complete loss of potential income from the practical use of the results of intelligent and innovative activities.

Certain commercialization strategies also have some limitations regarding their use. These restrictions are related to the specifics of the production and commercial activities of machine-building enterprises, which are not typical of, for example, metallurgical, chemical, and energy enterprises.

In any case, after the basic choice of the strategy and method of introducing intelligent products into the economic circulation, it is necessary to move to the stage of detailed strategic planning. This stage is presented in detail as part of the organizational mechanism for the implementation of the integrated strategy of commercialization of intellectual property objects (Fig. 3). Within its framework, the essence of a methodical approach to the assessment of commercialization results should be formed in order to increase the validity of choosing a strategy for their achievement.

The methodical approach to evaluating the results of the commercialization of intellectual products consists in determining the conditions and opportunities for expanding the domains of innovative activity and increasing the level of promising innovative activity of the machine-building enterprise (Fig. 4). Therefore, the ability of a business entity in the field of mechanical engineering to adapt to changes in its external environment is defined as an important characteristic when evaluating the results of the commercialization of intellectual products.

First of all, the factors that have a fundamental influence on the choice of a strategy for the commercialization of intelligent products in the economic sector of mechanical engineering are defined (Fig. 3). These factors are systematized in four areas: the internal potential of intellectual products, the potential of an economic entity, factors of the external environment, and the economic efficiency of the commercialization project based on the use of the results of innovative activity.

A comprehensive consideration of the system of factors in the context of the presented methodological approach to evaluating the results of commercialization already allows us to present the methodology of forming a strategy for the commercialization of intellectual products of a business entity in the form of a set of several stages. First of all, it is necessary to identify the results of innovative activity and make a decision on the method of securing ownership rights to them. Then analyze the market potential of intelligent products, determine strategies for their introduction into economic circulation and choose the most effective of them with the aim of using it for the commercialization of intelligent products.

The most important actions of the company-right holders when using an integrated strategy of commercialization, the essence of which is shown in Fig. 3, there is a definition of the fair value of an intellectual product from the point of view of its owner. The most adequate methods within this strategy are the replacement cost method, the replacement cost method, the historical cost method, and the direct sales comparison method. It is also important to study the conditions of possible license agreements, as well as to determine the expediency of providing technical assistance to the buyer (consumer) of the results of intelligent and innovative activities.

The integrated commercialization strategy has certain difficulties in its use, which in general can lead to the need to form both an active and passive commercialization strategy, finding their optimal (integrated) combination in the future. Therefore, despite the positive characteristics of the integrated commercialization strategy, certain enterprises are inclined to more convenient to use, but less effective strategies [25]. When using an active strategy in its virgin form, the enterprise must have a strong intellectual potential, able to generate new ideas and translate them into intellectual technologies. If the top management of the right holder's enterprise is inclined to use a passive commercialization strategy, then in this case it is important to choose the most adequate type of license, the choice of payment method within the framework of the license agreement. Also, in the case of choosing a payment in the form of a royalty, the most effective rate of this payment method is determined. The most suitable methods of its determination are the method of discounted cash flows, the method of capitalization of income, the method of profit preference, the method of cost growth, the method of exemption from royalties, the method of comparison of direct sales [11].

When using an active commercialization strategy, it is important to choose the most suitable organizational and legal form of doing business. It is necessary to analyze the expediency of creating a legal entity and carrying out entrepreneurial activities within the framework of individual entrepreneurship without the formation of a legal entity. The advantages are also tax savings and simplified business management, but a significant disadvantage is low creditworthiness, which is certainly an important fact within the framework of the strategy of independently introducing an intellectual product into economic circulation at one's own enterprise.

Implementation of these strategies for the commercialization of intellectual products is carried out on the basis of a program-targeted method of management. The result of the application of program-target management is a program document that reflects the purpose and set of measures aimed at the most effective implementation of the tasks of the organization of the intellectual activity of the business entity in the field of mechanical engineering. At the same time, great attention is paid to the effectiveness of the use of interconnected resources, executors, and deadlines for the implementation of individual measures provided for by this or that strategy for the commercialization of intellectual products.

The proposed strategy of commercialization of intellectual products has certain difficulties of effective introduction into practice of intelligent and innovative activities of industrial enterprises. Limitations of widespread use are associated with the difficulties of obtaining objective and reliable information related to intellectual property objects and their commercial characteristics. At the stage of creating an intellectual product, this kind of information is extremely difficult to obtain, its content is mostly related to expert assessments of leading specialists in a certain field of activity.

The program-target method of managing the processes of commercialization of intellectual products, despite its significant potential, is considered only in the production plan. Its development and presentation as a basic strategy for the commercialization of innovations for machine-building enterprises should be attributed to the prospects of further scientific research and methodical development.

7. Conclusions

1. The main problems in the commercialization of intellectual products in the field of industrial production have been identified and systematized. The greatest attention is paid to economic and management problems, the essence of which boils down to the lack of necessary funding and the difficulties of assessing the competitiveness of intellectual property objects. No less important are market problems,

the essence of which is to overcome barriers on the way to bringing a new product to the technological market. Technical and technological problems related to the creation of a prototype of an intellectually innovative product and its testing. Legal problems arise in connection with the need for examination and registration of the legal status of an intellectual product. Identification and early elimination of problems of intellectual commercialization, characteristic of this industrial production, makes it possible to increase the efficiency of the process of introducing intellectual products into economic circulation.

2. The expediency of combining the methods of diffusion of intellectual property objects and the promotion of an intelligent product in the development of an effective strategy and commercialization program is substantiated. Three basic strategies for the commercialization of intelligent products in the industrial domain have been identified:

– a strategy for the promotion of an intellectual product, within the framework of which the right holder can use all the development rights himself/herself and all the income from the development of the potential market will belong to him/her;

– the innovation diffusion strategy provides for the rights holder to receive income both from the assignment of rights to intellectual property objects and from their use. At the same time, the income from the use of the results of intelligent and innovative activities in the potential market will be divided between the right holder and the right user;

– a strategy for accumulating maximum income from intellectual products. The right holder of an object of intellectual property can transfer the entire amount of exclusive rights to another person, and in this case, the result of innovative activity will be an intellectually innovative product.

Each of the recommended strategies has its characteristics, which, combined with the capabilities of the industrial enterprise, can create optimal conditions for their practical use.

3. An integrated strategy for the commercialization of intellectual products for enterprises of the machine-building industry, which is focused on achieving the goals of maximizing the economic and social effect of the production of an intellectual product, has been formed and substantiated. The main component of an integrated strategy is an organizational mechanism that ensures:

– investment support for innovative activities;

– scientific and consulting support of a new product, including its promotion to the market, testing, examination, and registration of legal status; monitoring of high-tech production performance indicators.

An integrated commercialization strategy has all the possibilities for forming the most powerful commercial potential of an intellectual product.

4. The method of evaluating the effectiveness of the results of the commercialization of intelligent products by machine-building enterprises is proposed and substantiated. The proposals are based on the determination of the growth rates of intelligent and innovative product production, taking into account external adjustment factors. The value of the coefficients is associated with a high degree of innovative activity in the industry, intensive diffusion of innovations and reduction of the life cycle of products while increasing the level of its competitiveness. The practical use of this methodology makes it possible to significantly increase the validity and effectiveness of management decisions in the field of intelligent and innovative activities of machine-building enterprises.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study and the results reported in this paper.

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All data are available in the main text of the manuscript.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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