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MONITORING THE COMMERCIAL POTENTIAL OF INTELLECTUAL TECHNOLOGIES

The model of monitoring the commercial potential level of intellectual technologies (intellectual property objects) using the arctangent function is developed and substantiated. The correlation between the level of the technological product quality and the level of the business risk concerning the product's introduction and consumption serves as the basis for the model. Four characteristic sets of the monitoring function values are identified; in every set there are provided appropriate recommendations for companies.

Key words: monitoring, market attractiveness, intellectual technology, quality, business risk.

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МОНІТОРИНГ КОМЕРЦІЙНОГО ПОТЕНЦІАЛУ ІНТЕЛЕКТУАЛЬНИХ ТЕХНОЛОГІЙ

Розроблено та обґрунтовано модель моніторингу рівня комерційного потенціалу інтелектуальних технологій (об'єктів інтелектуальної власності) з використанням функції арктангенсу. В основу моделі покладено співвідношення рівня якості технологічного продукту та рівня комерційного ризику впровадження і споживання. Виділено чотири характерні множини значень моніторингової функції, в кожній з яких для підприємства наданj відповідні рекомендації.

Ключові слова: моніторинг, ринкова привабливість, інтелектуальні технології, якість, комерційний ризик.

Problem statement

The complexity and multiplicity of conditions for persistent development of the domestic industry arising from the characteristics of its operation require the use of complex activities and organization of software development, which includes the study of trends, monitoring of the obtained results, making timely adjustments to achieve strategic goals. The real opportunities for this are given by the monitoring system of production and business activities of industrial enterprises, which is an effective tool for monitoring and ensuring proper functioning of various economic objects and processes. This economic category has been used in the field of industrial and business activities industry widely and for a long time. Our investigations show that the most often the monitoring concept finds its use in the economy of nature [1], in anti-crisis management [2; 3], in the financial [4] and innovative activities [5; 6; 7; 8; 9], while monitoring market conditions [10] and economic activity of the enterprise [11]. The author believes that monitoring capabilities can be effectively used while tracking the commercial potential of technologies in planning and practical implementation of the transfer processes [12; 13; 14].

Analysis of recent research and publications

The researches and analysis of the economic monitoring systems formation and use were conducted in the works of local and foreign scientists, including: T.Ashyhmynoyi [1], I.Hladenko [5], S.Kvitko [11], Yu.Klyetkinoyi [13], T. Kobeleva [2; 3; 10], A.Kozyryeva [14], V. Lohanovoyi [6], V.Minyashkina [4], E. Ogorodnikov [9], P. Pererva [2; 3; 12; 15], S.Polyakova [7], T. Fedoseev [8], L.Tovazhnyansky [2; 3; 12; 15], N. Chukhray [16] etc.

However, in our opinion, the theory and practice of monitoring can be very effectively implemented in other areas of the market activity of industrial enterprises, particularly to monitor formation processes, economic evaluation, modification and management of intellectual activity (intellectual property objects) of innovation-oriented industrial enterprises [13; 14; 15; 17]. We should also note the lack of development of a set of tasks related to monitoring investigation of the market area of the industrial enterprises; besides the methodological basis for monitoring the technological market situation has not been investigated in full measure; the role and place of the monitoring in the market processes management have not been defined; the organizational and methodological provision of intellectual technologies transfer is completely absent; optimization of its communication with the environment haven't taken place. The theoretical importance of these problems and their practical importance for the efficient operation of businesses include the development and improvement of the monitoring of the level of commercial potential (market attractiveness) intelligent technologies which are available both for their developers and owners.

Objectives

The aim of the paper is development and substantiation of the methodological recommendations on the formation and implementation of the monitoring mechanism of the level of intellectual technologies market attractiveness (commercial potential) at industrial enterprises and development of recommendations concerning effective use of this mechanism for transfer operations.

Materials

Our investigations indicate that first of all a consumer of any product pays attention to its quality features. Without diminishing the role and importance of price (value) of the product, we note that the qualitative characteristics of the product for the consumer always come first. After the initial evaluation of consumer characteristics of goods the consumer evaluates his financial possibilities of how his material (financial) opportunities correlate with the quality indices of the product which a seller offers to him. Therefore, in our opinion, the quality of the product is the primary factor of consumer satisfaction, and the price of the product - secondary. Here we note that opportunities of maximum satisfaction of consumer needs, the size of the potential economic impact, payback period etc. have a decisive influence on the consent of the buyer (consumer) to accept the price of the seller. The assumptions given above prove the fact that while monitoring the commercial potential of the intellectual performance the great importance is given to their quality indices, the potential variation of which (as in the direction of both improvement, and worsening) significantly affects the condition and size of the possibilities of intelligent technologies transfer (commercialization). The developer of technologies reasoning from the situation correlations in the corresponding market has an opportunity to manage commercial opportunities of his intellectual product, changing the size of its consumer properties (index of quality Technology), which is crucial while monitoring the commercial possibilities of intelligent technology.

In contrast to the consumer, the developer of an intellectual product first of all pays attention to an integrated risk index of intellectual product creation and commercialization. Indeed, for a developer of the technology in the early stages of its life cycle commercial prospects have a fairly large degree of uncertainty. And surely the developer of the technology has no guarantees of investment return at the stage of the intellectual product creation, and especially their return with significant income. However, if he invests its resources in this development, it means that the risk level of the investment failure to return is acceptable for the developer. Similar arguments can take place after development of the technology has already been successfully completed and now the task of its commercialization arises. The risk level of the successful transfer (commercialization) of the technological product may vary under the influence of both

macro environment factors (independent of the developer), and of micro environment factors which can be influenced by the developer. Based upon this, the position and size of the business opportunities of intellectual technology can be changed in some way when the integrated risk level (index) index of the intellectual product creation and commercialization changes.

Much as in the situation with a complex index of technological product quality change, the developer of the technology reasoning from the level of micro-and macro environment factors of risk has an opportunity to control commercial possibilities of his intellectual product, reducing or increasing the level risk of its successful commercialization (risk index of commercialization of the technology), that is, in our opinion, also extremely important while monitoring commercial opportunities of intellectual technologies.

Based upon the assumptions given above, the monitoring function *F*, which would reflect the complex characteristics (indices change) of the quality (consumer characteristics) and the risk (the possibility of successful commercialization) of the technological product is proposed to be introduced to the monitoring mechanism of the intellectual activity of the enterprise.

In our opinion, the most appropriate function that will perform the monitoring task can be the arctangent function, which has been successfully used to monitor anti-crisis indices of engineering enterprises performance [2; 3; 12] and the market conditions of an isochronous engines [2; 10].

The analytical view of monitoring arctangent function *F*, which is offered to evaluate the state and dynamics of market attractiveness (commercial potential) level change of the intellectual technology is as follows:

$$F = arctg\frac{p}{4}\left(\frac{IQ_{techn}^{kompl} - IR_{techn}^{kompl}}{\sqrt{(IQ_{techn}^{kompl})^2 + (IR_{techn}^{kompl})^2}}\right), \quad (1)$$

where IQ_{techn}^{kompl} – an index of the complex (integral) quality indicator of the intellectual technology, set by the ratio of the complex index of quality; IR_{techn}^{kompl} – current or prospective risk state of the successful commercialization of intellectual technology set (calculated) by the enterprise-developer by taking into account the current and prospective state of micro- and macro environment factors of risk (IR_{techn}^{kompl} = 0 .... 1; IR_{techn}^{kompl} = 0 means completely risk-free opportunity of the technological product transfer (commercialization); IR_{techn}^{kompl} = 1 means the presence of the absolute impossibility of successful commercialization of intellectual technology).

Our investigations proves the fact that the choice of the arctangent function is determined by more accurate and objective analysis of the situation when the quality index tends to a maximum, and the risk index – to a minimum, but in general, the function *F* tends to unity. Also the choice of the proposed analytical arctangent function is determined by the fact that it is exposed to the normalization of values in the range [–1; +1] to a greater extent.

An extremely important element of the monitoring function (1) is measurement of risk indices IR_{techn}^{kompl} and quality IQ_{techn}^{kompl} in the same system and in the corresponding evaluation. The practice of establishing an index of a complex (integral) indicator of an intellectual technology quality IQ_{techn}^{kompl}, in our opinion, depends on the intellectual product quality which is defined. Here we mean the level of uniqueness of the intellectual development. In our opinion, all intellectual products in the first approximation can be divided into two characteristic groups.

1. Technologies (Intellectual Property Objects), which have no analogues are unique in their way, are protected from copying and counterfeiting patents. For such technologies in the corresponding marketplace there are no analogues for comparison or comparative characteristics of their quality. Here we do not mean the absolute originality (although such cases can be predicted), which completely eliminates the comparative base. In some cases in the market, despite the complete originality of the intelligent

technology, we can find some items for comparison which this time at a high-level perform similar functions or meet the same production needs that should be taken into consideration when determining the quality index IQ_{techn}^{kompl} of an intellectual technology. For these technologies IQ_{techn}^{kompl} is set by the ratio of complex quality index IQ_{techn}^{kompl} calculated by using qualimetric modeling [17], to the same index, calculated in the same way, but using the standard (maximum best) indices:

$$P_{techn}^{kompl} = \sum_{i=1}^{m} [P_i - P_i^{mar} / P_i^{etal} - P_i^{mar}] .$$

The improved methods of qualimetric modeling allow finding the desired ratio IQ_{techn}^{kompl} using the following model:

$$PQ_{techn}^{kompl} = \sum_{i=1}^{m} [P_i - P_i^{mar} / P_i^{etal} - P_i^{mar}] g_i , \quad (2)$$

where: P_{techn}^{kompl} – a composite index of the original intellectual technology quality; P_i – an absolute *i*-th index of a specific intellectual technology quality (with the significant complexities of its finding, its absolute value can be replaced by an expert evaluation of the indicator value, for example, according to 5-point scale); P_i^{etal} – the maximum possible, the best standard value of the *i*-th index value; P_i^{mar} – the minimum possible, worst, rejected value of *i*-th index; γ_i - weight (specific gravity) of the *i*-th value index in the integral index; *m* – a number of quality indices of an intellectual technology.

When using this approach, the value IQ_{techn}^{kompl} ranges from 1.0 (IQ_{techn}^{kompl} the proposed technology is fully consistent with the reference values of basic indicators of quality) to zero (the proposed technology fully meets the requirements of the reference value as a baseline). As an example, table 1 shows the calculation of the integral index as a completely original intelligent technology in the field of inorganic chemistry the method of synthesis of net plasma sorbent polymer, imprinted with target molecule [17].

Table 1

The calculation of the integral index in the completely original intelligent technology

Name of the first *i*-th index of technology quality	Calculated values					
	P_i	P_i^{etal}	P_i^{mar}	P_{techn}^{kompl}	γ_i	IQ_{techn}^{kompl}
Scope of exclusive rights and adequacy	5	1	5	1	0,19	0,19
Reduced production costs due to the use of intelligent technology	3	5	1	0,5	0,10	0,05
The value of the equipment for consumer technology	4	1	5	0,75	0,10	0,08
Market demand for equipment	4	1	5	0,75	0,19	0,14
The presence of similar solutions on the market	5	5	1	0	0,19	0,00
The effectiveness of sales strategies	4	1	5	0,75	0,10	0,08
The level of the sector development	4	1	5	0,75	0,07	0,04
The degree of government influence on pricing	1	5	1	1	0,06	0,06
Index of the new technology comprehensive (integral) parameters IQ_{techn}^{kompl}						**0,643**

Technologies (intellectual property) that have analogues close in consumer quality and field of use in the relevant technology market are not unique in their own way, there are opportunities for comparing the quality level of the proposed and existing technology products. In this case, we offer to carry out the measurement (evaluation) values IQ_{techn}^{kompl} using the Harrington desirability function recommendations which, in our opinion, to the greatest extent correspond to solving the problem. For example, the index

IQ_{techn}^{kompl} = 1.0 is the level of product quality that exceeds the best world analogues. The scale of relevant assessments of quality indices offered by us (which are objective in their character) proposed for commercialization of intelligent technology is presented in table 2, which is built using boundary scale Harrington values.

Table 2

The economic interpretation of the quality indices values

Economic characteristics of the index IQ_{techn}^{kompl}	The index IQ_{techn}^{kompl}
The level of technology quality, which exceeds the best world analogues	1,0
The level of the technology that meets the best world analogues	0,8..1,0
Good quality , the level of which is higher than the average world level	0,63…0,8
Average quality of analog technologies , which are presented in the global market now	0,63
Satisfactory technology quality that exceeds the minimum acceptable level, but needs improvement	0,37...0,63
Minimum acceptable level of technology quality (corresponding to marginal profitability levels of its consumption)	0,37
Poor quality of intelligent technology that does not meet the aim (loss-making production when it's used)	0,37…0,2
Absolutely unacceptable quality of intelligent technology	0,20…0,00

The function *F* is designed to give objective and accurate assessment of market attractiveness (market potential) of intelligent technologies at industrial enterprises and describe the process peculiarities.

Our analysis of the function field *F* can identify and justify a number of specific situations in a state of intellectual market prospects of industrial enterprises, which largely affect the formation and assessment of the commercial potential of smart technologies. The main point and interval values of monitoring function *F* and its economic characteristics are presented in table 3.

Table 3

Economic characteristics of monitoring function *F* field values

commercial potential state tendencies name	Value of the function *F*	The argument value		commercial potential state tendencies characteristics
		IQ_{techn}^{kompl}	IR_{techn}^{kompl}	
The trend of dead quality	$F = (-1)$	$IQ_{techn}^{kompl} = 0$	$IR_{techn}^{kompl} > 0$	Absolutely unacceptable consumer technologies quality, accompanied by the high-risk introduction
The trend of increased risk	$(-1) < F < 0$	$IQ_{techn}^{kompl} < P_{techn}^{kompl}$	$IR_{techn}^{kompl} > IQ_{techn}^{kompl}$	Market perceives this product with reservations due to its high level of commercial risk, which is not always compensated by the level of available commercial consumer characteristics technology
The trend of risk compensation	$F = 0$	$IQ_{techn}^{kompl} = IR_{techn}^{kompl}$	$IR_{techn}^{kompl} = IQ_{techn}^{kompl}$	The technology is equally attractive for consumers in quality and hinders the process of its transfer by the level of risk
The trend of active marketing	$1 < F < 0$	$IQ_{techn}^{kompl} > IR_{techn}^{kompl}$	$IR_{techn}^{kompl} < IQ_{techn}^{kompl}$	The most suitable situation. The technology offers great opportunities for transfer at the expense of high quality and low risk
The trend of ideal conditions	$F = 1$	$IQ_{techn}^{kompl} > 0$	$IR_{techn}^{kompl} = 0$	The unique achievement of the company. Virtually risk free transfer provides significant commercial benefits in case of relevant marketing support

Thus, the results of the above analysis, the area calculated values monitoring function F allows to analyze and assess the conditions of market appeal (market potential) of intelligent technologies that are owned by an industrial enterprise. Practical usage of monitoring function F allows timely preventing and considering desirable and undesirable market trends in the field of intelligent technology transfer both on the enterprise technological market itself and on the consumer market of the enterprise intellectual products (market products produced with the use of intellectual property). In cases where the monitoring control of the function F tends to value (–1), it means that the quality of intellectual products is absolutely unacceptable by consumers, which in addition is also accompanied by a significant risk of introduction. Function F tending to zero indicates that the technology market, where the enterprise works, takes the intellectual product with reservation due to its high level of commercial risk, which is not always compensated by the level of available technology consumer characteristics. In cases when function *F* tends to (+1) this may mean that the company has created a very successful technology product (in some cases a unique product) with a rather low level of commercial risk of its introduction and use. These initial conditions provide significant commercial benefits for the developer enterprise if appropriate marketing support is given, although their realization can be implemented under certain conditions.

Research of practical possibilities of using monitoring function *F* gives the intellectual product developer company real opportunities for its successful timely commercialization and realistically assesses the commercial prospects of creative work results on the relevant technology market in terms of their quality and commercial risk.

Conclusions

1. The approach to the study of technology products market appeal (market potential) proposed by the author has methodological value because it allows to formalize the process of analyzing and predicting transfer capabilities of the developer enterprise and can be used in the practice of home technology products (intellectual property) upon grounding marketing program on the relevant technology market.

2. The analysis monitoring function values is extremely interesting and attractive for potential users of technology products that can make their business decisions more reasonably in different periods of time depending on the result of the monitoring. With some amendments to the specific character of the business o non-scientific and industrial nature, given methodological recommendations for monitoring the market appeal (market potential) of technology product (intellectual property) can be successfully used at other industrial enterprises that plan to conduct transfer operations with intelligent technology.

3. Using the monitoring function F for the purposes of intelligent technologies analysis and assessment of market appeal (market potential), we believe, can provide sufficiently objective data to form an idea of the market status of each product developed by the company, which has the potential for practical use to improve the products produced by this or other companies, or engineering processes.

4. Monitoring results allow the developers to create a technological product transfer program, including both current and long-term transfer opportunities and possibilities for its further improvement.

Prospects for further research

Conclusions and recommendations provided in the article can be found further developed in the course of intellectual work process audit of intellectuals. In our view, process audit is a very promising direction of improving the efficiency and effectiveness of intellectual developments commercialization in industry. Developing innovation management mechanism based on technological audit is extremely important topic for scientific research, it reflects the realities of modern world, agrees with the economic development goals of Ukraine and challenges facing businesses and organizations that have achievements in the intellectual sphere.

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