

Cite This Article:

Vorotnikov V. A. Innovative prospects evaluation as a tool of managerial efficiency increase for complicated technical systems creation [Online] // *Economic Processes Management: International Scientific E-Journal*. 2016. 1. Available: http://epm.fem.sumdu.edu.ua/download/2016_1/2016_1_3.pdf

Received
05.02.2016

Accepted
09.02.2016

УДК 339.13

JEL Classification: C53, O31, O32

**INNOVATIVE PROSPECTS EVALUATION AS A TOOL OF
MANAGERIAL EFFICIENCY INCREASE FOR
COMPLICATED TECHNICAL SYSTEMS CREATION**

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The article deals with problems of management for the complicated technical systems creation according to the competitiveness criteria. It is proposed to form an analytical apparatus using the expert-analytical tools of project management, technological forecasting, investment planning, innovation management and marketing. The concept of using forecasting innovation component step to assess the competitiveness of the integral index is based on the fact that through the use of patent-innovative parameters can compensate for the lack of technical and economic. The approach, which allows on the basis of conceptual patents of the R&D project to generate indicators of novelty, technological level, the degree of legal protection and linking it with the degree of feasibility in the group indicator of innovative competitiveness. Methodology linking patent-innovation and technical and economic parameters requires a high correlation of their group competitiveness indicators, which in turn leads to a correlation with the integral indicator.

Keywords: *novelty management, complicated technical systems, innovative competitiveness, patent-innovative indicators, forecasting prospects.*

Introduction. The modern paradigm of knowledge-based economy determines the shift of shares in the capital structure from the material to intangible assets. This factor is particularly important in cases of creation of high-tech radical innovations as the tracer scientific technological progress and economy innovation development.

One of the main prerequisites for successful innovation development is to ensure the adoption of dynamic objective managerial decisions. The most important factor that increases the objectivity of such solutions is an adequate evaluation of the role of novelties and intellectual property (IP).

Innovative qualities of technical novelties are protected by patents, can significantly affect the prospects of an innovation, which is formed by the results of R&D. However, methodological and practical problems of the patents valuation do not make efficient use of IP to determine the feasibility of investment in high-tech innovative product. This deficiency is particularly evident for the complicated technical systems (CTS) as small-scale production unique high-tech innovative product (UHIP), which can be a significant proportion of the IP cost by the concepts of innovation management.

Analysis of recent researches and publications.

Innovation has associating with progress in the knowledge-intensive and high-tech industries and this has led to a preoccupation with radical innovation and high-tech activity in innovation theory, practice and policy (Smits et al., 2010, p. 422). An important share of innovation and technological change are increasingly linked directly to scientific knowledge and involve a variety of transfer mechanisms that go beyond R&D collaboration and personal mobility.

To indicate a high degree of novelty of the innovation the terms “radical”, “disruptive”, “breakthrough”, “revolutionary” are used. Currently, the agreement in their interpretation is absent, but the increased risk of these innovations is a recognized fact. According Bilkić et al. (Bilkić et al., 2013, p. 3) “the costs and complexity give rise to high technical uncertainty in that a breakthrough invention is not guaranteed. Furthermore, there is high market or commercial uncertainty since even if a breakthrough invention is made, it may not be successful commercially.”

In the modern management concepts of innovative product competitiveness is estimated by the expected profit from the sale of finished products (Walsh, 2006). Moreover, most of the investment planning methods is guided by forecasts of mass production profitability. They do not use novelty’s indicators and other innovative parameters of conceptual solutions, that on the one hand represent the technical essence of an innovative product, and on the other IPR particularity.

As a means of these problems solving has been proposed and actively developed the concept of adaptive management performance of the product at all its life cycle stages (Mescon et al., 1988). In the classical formulation of the western emphasis it also made on the performance technical and economical of the new product and is almost considered indicators of novelty and other specific CTS qualities which can be determined using patents.

Many analysts often associate the prospect of high-tech R&D with high levels of innovation development of the object as innovative technical innovations are protected by patents can be viewed as an important factor in justifying the decisions on public funding. For example, focus on innovativeness of the European Union supported projects in the framework programs (WIPO, 2011, p. 34) that their direct

or indirect purpose is to finance the process of creating a specific IPR and its exploitation serving the common interest of society.

Innovativeness is often used as a measure of the degree of newness of an innovation (Kumar & Phrommathed, 2005, p. 7). At the same time, in our opinion, it should not be limited only to the assessment of novelty, if it is intended to be used in forecasting the prospects of an UHIP, which is formed by the results of research and development.

As WIPO analysts (WIPO, 2010, p. 9), in the countries with economies in transition, especially aggravated the problems of innovation management that is the difficulty of identifying the best ideas for the correct market with the right resources, a lack of coordination, and challenges measuring innovation.

Most authors recognize that all empirical studies have objective difficulties in precise values for IPR obtaining. This is largely due to the fact that the assets of IPRs is usually implemented within the CTS as a multi-component product, and evaluating the separate contribution made by IPR is difficult.

In other words (Frietsch et al., 2010, p. 14), firstly, the economic value of patents is not determined solely by the characteristics of a single patent, but by various factors of a technology, firms, competitors, and markets, so that the economic or commercial value of individual patents can hardly be derived from the information contained in a single patent document and, secondly, the economic benefits of a technological product can hardly be assigned to one single patent, because this product is usually the result of several technologies – also often protected by several patents – implemented in one device, machine etc.

We have to also recognize that it is impossible to objectively determine the value of IPR in the absence of an active market of innovative products and IPR, which is especially characteristic when creating radical innovations. How to sum up Smith and Parr (Smith & Parr, 2005, p.220) “in developing an opinion of the economic life of intangible assets or intellectual property, one is often dependent on subjective techniques. There is rarely a detectable track record on which to base more statistical means of study. There are, however, some exceptions.”

Fleisher and Bensoussan (Fleisher & Bensoussan, 2003, pp. 390-391) point out that the basis of the concept of the S-curve of the life cycle of technology reflects the need to include the forecast prospects of technologies in strategic planning, taking into account the fact that technological planning a strategy, in which the degree of uncertainty is one of the highest. Compensate for the lack or absence of information for the analysis of radical innovations possible through the integration of patent information in the S-curve analysis for strategic planning. Translation of patent data information in the competition allows to predict technology trends and plan for the potential competitiveness, based on new technologies.

In opinion Smith and Parr (Smith & Parr, 2005, p. 235) S-curves are most useful in the case of embryonic technology because of the evidence that the S-curve shape most often fits the growth pattern of embryonic technology. In cases there will be no early sales data available on the basis of an analysis of all available information, choose a curve type and shape that is thought to best exemplify what is expected to come.

Considering the problem of formation of innovation indicators, Greenhalgh and Rogers (Greenhalgh & Rogers, 2010, p. 62) noted that a large number of potential measures of innovation, as well as their complex and overlapping nature, has led to the development of methods for combining these into an innovation index seeks to combine a number of other measures into a single figure.

Previously unsettled problem constituent. One of the most important conditions for creating competitive complicated technical systems (CTS) is that the analytical apparatus innovation management should be based on indicators that objectively and fairly describe the prospect of CTS in the early stages of creation. At the heart of building a system of indicators should be based on an integrated approach to rapid assessment and situational adjustment in R&D competitiveness indicator CTS-specific radical innovations.

Innovative quality technical innovations are protected by patents, can significantly affect the prospects of an innovative product, which is formed by the results of R&D. However, in the management of the CTS creation not used the possibility of using innovative indicators on patent data. Methodological and practical problems of the patents valuation do not make efficient use of IPR to determine the feasibility of investment in innovative product. This deficiency is particularly evident when creating a CTS unit, or small-scale production as a unique high-tech innovative product (UHIP), which according to the concepts of innovation management can be a significant proportion of the IPR cost.

According to the author of this article, the expansion of the analytical database management decision-making at the expense of patent-innovative parameters (PIP) with high reliability and objectivity at the stage of preliminary study is one of the efficient ways of the high-tech research and development methodology improving.

Main purpose of the article is to formulate the basic methodology for the application of the provisions of the patent-innovative indicators in the management of creating a competitive CTS as UHIP.

The above conditions provide a basis to formulate the main hypothesis of our study.

Hypothesis: The validity and usefulness of the CTS forecast prospects as a tool of management can be significantly improved through the use of PIP derived from patents and characterize the degree of the object novelty in relation to its technical level and feasibility.

Results and discussions

In assessing the use of IPR in innovation management analytical instruments, confronted by paradox. No one disputes the significance of IPR as part of the UHIP. Thus, on the one hand, it recognizes the complexity of determining its share in the total income from the IPR – most authoritative experts have concluded small realistic financial assessment of IPR in the early stages of innovation, particularly when it comes to CTS. On the other hand, almost no attempt to use non-financial methods of the IPR role evaluation in the creation of innovations, including high-tech. In saying this, we do not take into account the methods based on the use of patent statistics. Typically, using data on the number of patents and references to them are measured innovative activity of firms or define a steady trend of technological development in a certain direction. They are meaningless at the dawn of the technology and, as will be shown below, are not always effective at the stage of finalizing the real analogues that previously existed only on paper.

Among specialists in the field of business innovation is no unity in understanding the priorities and objectives of obtaining IPR. Prevailing concepts, built on two principles. The first recommends a situational approach in determining the appropriateness of the legal protection, and the second excludes the existence of a universal best strategy for the use of the IPR.

At the same time, when it comes to ensuring the unimpeded use of output on the market IPR, the cost of IPR is not in itself a decisive factor, and on the basis of the information available to patents for inventions, it is possible to generate indicators to describe the novelties innovative features. When forecasting the prospects for factors UHIP unimpeded use, the use of innovative performance innovations derived on the basis of patents, can be an effective means to inform management decisions.

We also note that the nature and the patentability of conceptual solutions, determining the appearance of CTS, usually set at the stage of pre-study. And this is especially true for radical innovations that are created in the research organizations with considerable experience in this or related fields. When forecasting the prospects of innovative UHIP the parameters that reflection in the parent patent, it can be regarded as the most objective factor, complementing the key technical and economic indicators CTS.

We emphasize that the definition of financial indicators UHIP in the early stages of the life cycle is inadvisable because of their extremely low reliability. Of much greater significance is the estimation of financial risks based on the probability of achieving the objectives of the project, i.e. the creation of CTS with the set of technical and economic characteristics and with the preservation of favorable market conditions.

We believe that in the early stages of creating UHIP method for determining the prospects of innovative R&D results based on the PIP can be an effective means of

improving the validity of decisions on investing R&D. This is especially significant when creating UHIP like CTS manufactured in small quantities, thus to predict their prospects effectively apply existing instruments of financial and investment analysis which focused on the mass production of goods.

We formulate the following assumptions forming the expert-analytical unit assessing the prospects of innovation.

Firstly, despite the changes in the range and reliability of indicators describing the state of the object at different stages of the R&D development, in order to manage the development of CTS is necessary to observe the continuity of key monitorable indicators whose values are used to implement the process control.

Secondly, the formation of the indicators set of management prospects CTS competitiveness criterion, including key indicators monitored, it is appropriate to provide the basis of the implementation conditions of all management functions, ranging from forecasting and planning, to evaluation of the CTS development effectiveness.

Thirdly, it is necessary to determine the field of management, for the most rational use of innovative CTS competitiveness indicators, based on PIP. In particular, it is required to assess whether the expert-analytical apparatus evaluation will take into account the prospects of innovation and align the interests of developers and investors R&D to establish a CTS.

The proposed methodology of constructing expert-analytical apparatus assess the prospects of innovation comes from the possibility of using non-financial data about the prospects UHIP to assess the investment attractiveness of R&D to establish a CTS. The methodology incorporated a comprehensive approach to the unification of technical-operational, economic and innovative options in the integration index prospects CTS.

In the formation of innovation prospects indicators should involve not only the parameters based on the essential characteristics of the patent formula, but those are outside the scope of the formula. First of all, it refers to the description of the fragments relating to justify the possibility of practical implementation of innovations. The most important methodological challenge is to develop analytical expressions that correctly identify and agree with each other all the partial indicators in the framework of summary measure of innovation prospects. At the same time, a basic methodological assumptions are the creation of analytical tools that are suitable for universal use in the corporate management of innovation and management of public procurement.

Considering the above opinion of analysts WIPO management problems in countries with economies in transition, addressing evaluation of innovative promising innovations is today one of the most urgent tasks for the development companies and investors to create a UHIP. We will also take into account their conclusion (WIPO

2010) on the need for a special IPR strategy for the Research Institute on the basis of the fact that a considerable amount of R&D carried out scientific research institutes, which are experiencing serious difficulties with the use of the IPR system to protect the results of its research activities and their commercialization.

In our opinion, one of the most important elements of such strategy is an objective assessment of the prospects of innovations, which is beneficial not only to developers CTS, but also to public investors in justifying decisions on the implementation of competitive financing of R&D. This assessment may be based on innovative features innovations reflected in the materials patents. This primarily refers to the essential features of the claims and the description section, characterizing the quality of the object design innovative R&D project.

For a comprehensive forecast of the prospects UHIP on the results of R&D is not sufficient to confine patent indicators CTS as an object of design. It is necessary to take into account the totality of indicators that may be of interest to justify the investment in the implementation of high-tech R&D.

One of the rational choices such records may serve as input into the analytical apparatus, justifying the decision to establish a CTS spillover assessments of the innovations prospects and innovations of lower technical level, with the potential dual-use.

Thus, a general indicator of the CTS creating innovative prospects will be determined based on an assessment of three components – the level of innovation in general, the prospects of the CTS as an object of art, the total volume and the level of local innovations which have immediate prospect of dual-use as well as spillover innovations indirectly promote innovation progress in the development of the technology:

$$GIP = IP_{CTS} + W_{SLI} IP_{SLI} + W_{Sp} IP_{Sp} \quad (1)$$

where P_{CTS} – CTS innovation prospects indicators;

P_{SLI} – innovation indicators of dual-use local novelties;

P_{Sp} – innovation indicators impact on the development of other technologies.

By the formation of CTS innovation prospects indicators there are two possible approaches. The first is focused on the analytical apparatus of decision-making on public R&D funding on a competitive basis, which is convenient to use at competitive rates. The second approach focuses on the formation of indicators that can be used equally effectively in both corporate management and in the management of public procurement.

In cases where the application of innovative competitiveness parameters for determining indicators of innovation prospects CTS proposes the following formula:

$$IP_{CTS} = P_i R_i \quad (2)$$

where P_1 – indicator of CTS innovativeness;
 R_1 – risk score to ensure CTS competitive advantages.

We believe that for the calculation and the integral index, and the index of CTS innovative competitiveness can use PIP, the formation of which will be discussed below. A more detailed analysis of the structure and to select the method of CTS innovative competitiveness indicators application should be the subject of a separate study.

To determine the performance of innovative local or spillover promising innovations write the following formula in general form:

$$IP_S = \sum_{i=1}^n K_S T_S L_S R_S \quad (3)$$

where K_S – factor the possibility of spillover or double application novelty;
 T_S – rate the technical level of novelty;
 L_S – index of the newness level of novelty;
 R_S – rate risk to innovate.

The problem of dual-use innovations identification and innovations followed spillover ranking their constituent indicators of innovation is quite complex and requires a separate study. In this article we confine the analysis of approaches to the formation of the index of innovative prospects CTS as an object of art.

Indicator of innovative CTS prospects that can be universally applied in corporate management and in the management of public procurement, rational form as an integral indicator of PIP. In the formula for its calculation must be taken into account the impact of the innovative progress CTS as an object of art, the extent of its patent protection and the likelihood of feasibility:

$$P_I = (I_{IPR} + I_{NOV}) I_{FD} \quad (4)$$

where I_{IPR} – an indicator of the protection level for CTS relevant technical level of the object development and the object of patent protection;
 I_{NOV} – an indicator of the CTS novelty;
 I_{FD} – an indicator of the effect of the feasibility degree.

$$I_{IPR} = T_{Lev} W_{Comp} \quad (5)$$

where T_{Lev} – benchmark technical level novelty as an object of development;
 W_{Comp} – weight of comparable rank of the object of development and most of the R&D conceptual invention.

The proposed values of these quantities for the CTS-UHIP presented in Table 1.

Table 1. The components to form exponent security CTS

Level rank	Characteristic technical level object technology as object of development or invention	Grading scale value baseline technological level	Ranks correction of the difference of object development and invention	
			The degree of compliance (the difference of ranks)	The weighting factor of rank corresponding
1	The functional unit	1-10	low (5)	0,01
2	A separate unit as a set of nodes	10-100	weak (4)	0,02
3	A simple system as a set of components and assemblies	100-200	medium (3)	0,05
4	A complex system as a set of simple systems and components (part of complex products or CTS)	300-500	moderate (2)	0,1
5	Separate complex product (included in CTS top level affects its basic characteristics)	700-800	high (1)	0,5
6	CTS top level as a set of complex systems and independent product	900-1000	full (0)	1

Source: developed by author

To determine the level of novelty on set of essential differences, we write the following equation:

$$I_{NOV} = H_{NL} N_{Cor} \quad (6)$$

where: H_{INL} – the exponent of the object changes novelty character of patents;
 N_{Cor} – the novelty factor correction on real counterparts.

The proposed values of these quantities for the CTS-UHIP presented in Table 2.

Table 2. Components of the index level for the formation of novelty

The exponent of the character object changes novelty in technology patents		Correction factor of novelty on real analogues	
The change character	Value	The analogues presence	Grading scale
The formal novelty	1	In a development of the industrial production	0,1
Minor changes to minor signs	10	The design study	0,2
Changes to the essential features of which do not lead to an improvement in the basic characteristics of CTS	50	The pre-design studies	0,3-0,4
Changes essential features which improve the basic characteristics of CTS	200	The sources of patent information	0,5-0,6
Fundamental modernization	500	Fragments of the concept were known earlier	0,7-0,8
Radical changes	1000	A fundamentally new concept without analogs	0,9-1,0

Source: developed by author

To determine the influence of the feasibility indicator degree write the following equation:

$$I_{FD} = D_{St} M_{Cor} \quad (7)$$

where D_{St} – indicator of the feasibility;
 M_{Cor} – correction factor for the development phase.

The value of summary measure feasibility can be calculated as the sum of the partial indicators presented in the equation:

$$D_{St} = V_{TC} + V_M + V_{RS} + V_{SD} + V_{IA} \quad (8)$$

where V_{TC} – an indicator of the possibility in principle to implement the technical concept of the development of the object;

V_M – an indicator of the technological possibilities of manufacturing facility development with planned costs;

V_{RS} – adequacy of resource support R&D;

V_{SD} – an indicator of the success of the risks development (probability of achieving and deviations from the planned values of time and technical-economic characteristics);

V_{IA} – exponent of investment appeal (the likelihood of attracting outside investment).

The proposed values of these quantities for the CTS-UHIP presented in Table 3.

**Table 3. Components of the index for the formation
of the feasibility degree impact**

Components summary measure feasibility correction factor for the development stage		Correction factor for the development stage	
Feasibility Criteria	The value of the individual index	Development Stage	Grading Scale
Evaluation of the possibility in principle to implement the technical concept of the object development	0,1-0,2	Concept	0,1
Estimation of technological opportunities of manufacture of the object to the planned development costs	0,1-0,2	Preliminary design	0,2
The adequacy of resource support for R&D	0,1-0,2	Technical project	0,5
Risks successful development	0,02-0,2	Production of design documentation	0,7
The degree of investment attractiveness	0,02-0,2	Experimental and industrial design	1

Source: developed by author

The lower end of the particular values range indices corresponds to an earlier forecast of upper – time positive conclusion with a high certainty degree. In this regard, the correction factor can be figuratively called the coefficient of success confidence.

This is consistent with another paradox of innovation, which is caused by the influence of the CTS development stage on its investment attractiveness. With the completion of this indicator level is growing exponentially and with the development of the industrial design that has been tested, its value will be more than an order of magnitude higher than at the stage of the forecast. In this regard, the value of novelty as object development for investors is appropriate to consider in relation to the extent practicable.

An illustration of such adjustment can serve many breakthrough projects in the aerospace industry. For example, when the firm Orbital Corp. concluded a high probability of successful completion of the development Air-space System (ASS) Pegasus was the obvious need for the development of the object of patent protection to ensure its smooth launch on the market. Despite the existence of a significant number of patents protecting various concepts that are left in the form of project proposals, experts Orbital Corp. able to maximize the use particular patent law and bypass counterparts. Lacking absolute novelty of the concept, a single patent protecting the ASS Pegasus as a whole as CTS allowed to reach the maximum level of investment attractiveness of the criteria to ensure the smooth use of the market.

Not so contrasting, but essentially similar characteristics of patents protecting the concept was first put into practice the CTS demonstrate such pioneering projects as the Space Shuttle and Sea Launch.

Thus, in order to really novelty could be the basis of summary measure of innovation prospects CTS, this value should be adjusted according to two factors.

On the one hand, it acts downward trend, which takes into account the real novelty of the concept, not the art of casuistry originator applications in juggling terms. It aims to identify and eliminate the introduction of misleading investors in the applicant as a result of manipulation aimed at declaring unreasonably high claims of novelty.

On the other hand, the increasing trend is a factor of practical implementation. He was more than offset by the loss in the conceptual priority to the technical nature (what can be called the ideological superiority of earlier analogs), if it is possible to obtain legal protection for the CTS as an object of design in general. This is because from the perspective of an investor justify any terminological manipulation patents, which ensure the smooth use of the facility R&D.

The proposed methodology for determining the prospects of innovative R&D object development focuses primarily on the creation of CTS, so to evaluate the use of its performance analysis of possible situations that could be and really was in the process of developing ASS Pegasus as an innovative technical solution.

Associate calculations correspond to the real situation and possible developments in the case, if it decided to carry out R&D Orbital Corp. is not their own, and by attracting public investors. At the same time, investment in software

producing the patent application would be framed already at the pre-stage. The calculation results are presented in Table 4.

Table 4. Dependence PIP CTS from development stages on the example of ASS Pegasus and its analogs

Innovative parameters	The technical level			Level of novelty			The feasibility degree			Integral indicator of PIP (P_I)
	I_{IPR}	K_{CR}	T_{Lev}	I_{NOV}	H_{INL}	N_{Cor}	I_{FD}	D_{St}	M_{Cor}	
Analogs in concept stage	1000	1	1000	1000	1,0	1000	0,34	0,1	0,034	68
Prospects ASS Pegasus in the early stage	1000	1	1000	1000	1,0	650	0,34	0,1	0,034	56,1
Recognized as a high probability of success	1000	1	1000	1000	0,65	650	0,8	0,7	0,56	924
At the stage of production	1000	1	1000	1000	0,65	650	1,0	1,0	1,0	1650

Source: calculated by author

We emphasize two nodal points of the formation for the proposed method final assessment. The first correction is introduced lowering the level of ASS Pegasus novelty due to the existence of the earlier concept of unique game that Orbital Corp. has managed to get around due to the qualification of the applicant in the patenting procedure. More lenient experts agree adopts the information sources with similar ASS concepts ($K=0,7-0,8$), more stringent experts will refer to the patent sources ($K=0,5-0,6$), so as a result of their generalizations we obtain the views of the average value of about 0,65. On the second point with the introduction of the value of assessing the feasibility of innovation prospects ASS Pegasus not only compensates for the loss, but also far superior analogs which have remained at the conception stage.

Analyzing data from the table, as follows clarify and supplement the basic provisions set forth previously forming technique drawing conclusions about the CTS creation prospects.

Firstly, the importance of innovation prospects at different stages of the CTS creation differ quite significantly, which leads to the need for a differentiated approach to decision-making on the financing of works at various stages of the CTS creation. For example, through the development of various rating scales of decision-making, which will be included in the procedure of the expert opinions issue.

Secondly, for the purposes of corporate management, and for the purposes of investment management performance and the technical level of innovation should be complemented by the assessment of feasibility. Performance of technical and economic groups should be comparable to the largest of them, for example, by introducing the correlation coefficients, and corresponded to assess feasibility.

According to the above values innovation component competitive game ASS Pegasus, which cater to the start of production, it is possible to construct a curve, similar to the nature of the typical S-curve initial part of the life cycle having innovative CTS with high modernization potential. Obviously, the same character will have a curve techno-economic component, and therefore the curve of the integral index of the CTS-UHIP competitiveness. A similar set of indicators similarity curves observed for the competitiveness of the Shuttle, Sea Launch and many other CTS having a radical novelty.

The feasibility of using innovative component of UHIP competitiveness to produce a final conclusion about the prospects of the development of CTS due to the fact that the technical and economic indicators in the early stages of CTS have low accuracy and reliability, and PIP reflect the pioneering essence of CTS in relation to specific performance and possession benefits that gives legal protection of IPR. Moreover, in the early stages of development on the basis of patents describing the conceptual essence of the CTS, formed unchanged largest private performance. General indicators of innovation factors of competitiveness corrected only in the degree of the project. Thus, for the CTS with the radical novelty of the competitiveness innovative component was calculated with the proposed method, under certain conditions it may be sufficient to generate forecasts in the early stages of the life cycle. Below we define these terms in view of the fact that to meet the challenges of strategic planning is not enough only one curve, constructed from the "ideal" values.

In order to visualize the control variables to achieve acceptable indicator of innovative competitiveness factors we use the corridor of possible values as the area between the maximum potential and the minimum acceptable value.

The graph (Fig. 1), the curve of maximum predicted values coincide with the curve will peak, and the curve of the minimum allowable value is based on the premise that the game competitors did not enter the market.

The real curve integral index of competitiveness will be somewhat less than "planned" because the cost of removal achieved with the help of satellites ASS Pegasus exceeds earlier forecasts by more than 25%, but, compared with more recent and realistic forecasts of not more than 15% of the declared. However, the final conclusion about the prospects for predicting the results remain unchanged. Therefore, we can conclude that the technique works satisfactorily under the following conditions:

- Innovative technical solutions provided specific competitive advantages;
- Implemented the adequate legal protection of the conceptual essence of CTS;
- Deviation of its performance as a result of R&D do not exceed a certain critical value.

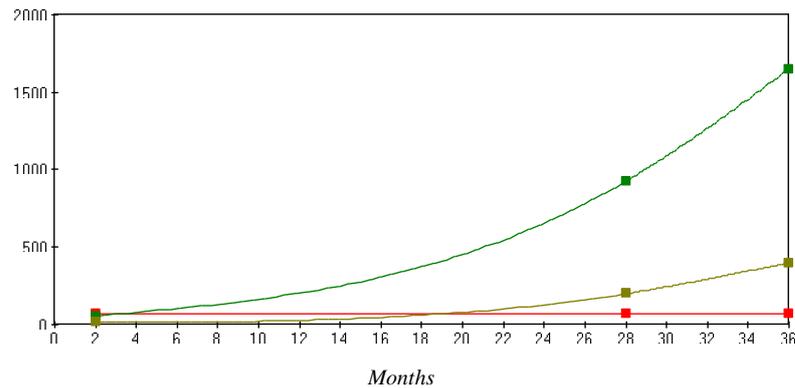


Fig.1. Changing of CTS competitiveness during the R&D

Source: developed by author

At the same time, be aware that each of these conditions has additional restrictions. Thus, the lack of competition of exceptional performance characteristics CTS will be successful only if it is impossible more or less acceptable to compensate them with a much lower cost to achieve the targets. Legal protection of CTS novelty can be considered optimal if the totality of the essential features of the patent claims head exhaustively describes the experimental industrial design, prepared for production. The value of the tolerance progress indicators values planned in each case should be set heuristically based on the specifics of the CTS and the competitive situation.

It should be noted that most of these constraints explicitly begin to play at the completion of R&D. Therefore, the analysts, as well as studies to develop tools for management decisions to establish CTS with high novelty are required complicating the ability to anticipate the circumstances. The proposed method allows to consider various options for the competitive situation development, operating the most objective and reliable data that are available in the early stages of creating UHIP from the stage of strategic planning.

Thus, the practical value of the proposed method consists in the fact that in the course of the R&D project monitors find the point the current value of the competitiveness within the corridor of acceptable values and based on the analysis of its situation managers supervise the implementation of the project, develop and decide on the implementation of the corrective effects.

Since the indicators are influenced by the resources allocated to carry out R&D, management competitiveness CTS is better to build on the basis of the resource

approach. At the same time, it is necessary to take into account that the control system is a resource that plays an important role in the implementation of R&D.

From the perspective of optimizing control action it makes sense to pay attention to changes in the organizational scheme of the project. This is the only factor of resource management, a change which does not require direct financial costs, so it is advisable to treat it as a priority issue, ensuring acceptable values of the key technical and economic CTS characteristics.

According to the concept of situational response to changes in the environment, improvement of management in the performance of R&D should be focused on the adaptive adjustment of the CTS indicators. That is, promptly produced forecasts for change management purposes – CTS indicators are considered as the basic data for the flexible management of reform, taking into account changes in the competitive situation.

We believe that the definition of CTS competitiveness in the process of implementation of R&D can be constructed in a process of monitoring changes in the characteristics of serial CTS in conjunction feasibility and innovation indicators. If this process is to introduce a procedure into account the influence of factors external and internal environment of the organization, the developer can build a block diagram according patent of Ukraine №67754 System for adaptive control of R&D project.

The proposed algorithm integrated performance management of CTS is able to realize the adaptive improvement of the organizational structure within the administrative mechanism of situational choice of the projects organizational charts. His analytical component provides optimum production corrective action (for example, increasing the autonomy of the project team) based on operational conclusions on the competitiveness of the value according to the planned CTS acceptable level. Thus, the proposed algorithm allows economically solve the problem of the adaptive control when the CTS competitiveness R&D, implementing a mobile response to environmental changes.

Conclusions and further researches directions. Develop an objective conclusion on the feasibility of CTS establishing is an essential element of management innovation. In order to increase the objectivity of the CTS establishing feasibility conclusion in low reliability of the technical and economic characteristics of a rational extension of the analytical framework for the assessment of innovation performance through the use of CTS.

In the early stages of CTS most objectively justified characteristics of innovation CTS can be obtained on the basis of patents protecting the conceptual essence of CTS in the form of constructive schemes and operating principles.

The main PIP of the CTS is the technical level, the degree of novelty and validity of practical implementation, the determination of which is not limited to patent data.

Evaluation of CTS novelty becomes an effective tool for forecasting the prospects of CTS only when the indissoluble link with the assessment of the feasibility and the smooth launch UHIP market.

The most complete picture of the CTS creation prospects can be obtained by summarizing the assessment of three components: the level of innovation in general, the prospects of the CTS as an object of art, the total volume and the level of local innovations which have immediate prospect of dual-use as well as spillover innovations, indirectly contributing to progress in the development of innovative art.

A promising area for further research is to analyze the use of PIP in the management of public procurement of R&D to create CTS-UHIP.

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**ОЦІНКА ІННОВАЦІЙНОЇ ПЕРСПЕКТИВНОСТІ ЯК ЗАСІБ
ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ МЕНЕДЖМЕНТУ
СТВОРЕННЯ СКЛАДНИХ ТЕХНІЧНИХ СИСТЕМ**

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У статті розглядаються проблеми управління виробництвом складних технічних систем за критеріями конкурентоспроможності. Пропонується формувати аналітичний апарат з використанням експертно-аналітичних інструментів управління проектами НДР і ДКР, технічного прогнозування, інвестиційного планування, інноваційного менеджменту та маркетингу. Концепція використання на стадії прогнозування інноваційної складової конкурентоспроможності для оцінки інтегрального показника виходить з того, що шляхом застосування патентно-інноваційних параметрів можна компенсувати відсутність технічних і економічних. Пропонується підхід, що дозволяє на підставі даних патентів на концептуальний вигляд об'єкта розробки проекту НДР і ДКР генерувати показники новизни, технічного рівня, ступеня правової охорони і пов'язати їх з показником ступеня здійсненності в рамках групового показника інноваційної конкурентоспроможності. Методологія ув'язки патентно-інноваційних та техніко-економічних параметрів передбачає високу кореляцію їх групових показників конкурентоспроможності, що в свою чергу призводить до кореляції з інтегральним показником.

***Ключові слова:** менеджмент НДР і ДКР, складні технічні системи, інноваційна конкурентоспроможність, патентно-інноваційні параметри, прогнозування перспективності.*

**ОЦЕНКА ИННОВАЦИОННОЙ ПЕРСПЕКТИВНОСТИ КАК
СРЕДСТВО ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ МЕНЕДЖМЕНТА
СОЗДАНИЯ СЛОЖНЫХ ТЕХНИЧЕСКИХ СИСТЕМ**

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В статье рассматриваются проблемы управления созданием сложных технических систем по критериям конкурентоспособности. Предлагается формировать аналитический аппарат с использованием экспертно-аналитических инструментов управления проектами НИР и ОКР, технического прогнозирования, инвестиционного планирования, инновационного менеджмента и маркетинга. Концепция использования на стадии прогнозирования инновационной составляющей конкурентоспособности для оценки интегрального показателя исходит из того, что путем применения патентно-инновационных параметров можно компенсировать отсутствие технических и экономических. Предлагается подход, позволяющий на основании данных патентов на концептуальный облик объекта разработки проекта НИР и ОКР генерировать показатели новизны, технического уровня, степени правовой охраны и увязать их с показателем степени осуществимости в рамках группового показателя инновационной конкурентоспособности. Методология увязки патентно-инновационных и технико-экономических параметров предполагает высокую корреляцию их групповых показателей конкурентоспособности, что в свою очередь приводит к корреляции с интегральным показателем.

***Ключевые слова:** менеджмент НИР и ОКР, сложные технические системы, инновационная конкурентоспособность, патентно-инновационные параметры, прогнозирование перспективности.*