STRATEGIC DECISIONS IN THE SYSTEM OF MANAGEMENT OF INNOVATION ACTIVITY OF ENTERPRISES

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ABSTRACT

It has been proven that the decisions of business executives to implement product, technological or managerial innovations almost always require adjustment. The reasons for this are that innovations require the use of non-standard approaches to solving problem situations in strategic innovation activity management. Due to the high risk of innovation activity, its capital intensity and intellectual demand, development and implementation of regulatory decisions in innovation activity management systems is carried out collegially (collectively). Studies have shown that the key problem in the technological process of making a collegial regulatory decision is choosing the best solution from a number of alternatives. Critical analysis of the known methods of collective streamlining of possible alternatives showed that each of these methods has certain disadvantages, but the way out is to apply a cumulative approach to generalizing the results of the analysis of existing alternatives. The proposed approach makes it possible to adequately streamline possible regulatory decisions, taking into account the preferences of each of the entities involved in the development and implementation of a regulatory decision.

Keywords: Innovation Activity, Strategic Management, Alternative, Cost Optimization, Capital Intensity.

JEL Classifications: M5, Q2

INTRODUCTION

The use of innovations makes it possible to increase with high probability the life expectancy of both the enterprise as a whole and the technologies used and the engineering products offered. Also, the use of innovations by the enterprise makes it possible to secure stable positions in the market, to reduce the cost of manufactured products and services rendered, to increase the volume of sales.

The innovation development of the organization is often accompanied by the use of energy-saving equipment, new materials that are better in quality than traditional ones, automation of technological processes of manufacturing finished products. Innovations help the

enterprise to optimize costs, achieve a reduction in the market price of goods and services. That is, an enterprise that innovates is more likely to gain a high level of competitiveness than other enterprises.

The effectiveness of the formation and informative evaluation of the enterprise innovation activity management system depends on how well the management methods chosen adequately reflect the circumstances that have emerged under the influence of the general economic laws and economic development laws of the organization. Scientific substantiation of the provisions, on the basis of which the managers of enterprises should make the formation and evaluation of the innovation activity management system, will contribute to the rational decision making both during the creation of innovation activity management systems and during their improvement.

The purpose of the work is to formulate theoretical foundations and methodological-practical recommendations for the construction and evaluation of the enterprise innovation activity management system.

REVIEW OF PREVIOUS STUDIES

Thus, studies have shown that from the standpoint of a systematic approach in management, the innovation activity management system is a set of interrelated elements that ensure the integrity of this system, with inherent relationships with each other and the external environment, aimed at achieving the goals of activity on the principles of optimization of risks, costs and operating results (Adobor, 2020; Aghion et al., 2015).

A systematic approach to innovation activity management is used to accomplish these priority tasks:

Setting clear goals for the functioning of the innovation activity management system, which should be updated over time and not contradict the overall goals of the enterprise (Biggeri et al., 2017; Machová et al., 2016);

Determination of quantitative and qualitative parameters that express the goals of the system: size of profit, volume of sales of products (services), market share, enhancement of image and competitiveness of the enterprise as a whole (Pan et al., 2018; Mudambi et al., 2018);

Choosing the best ways of achieving goals (Børing, 2017; Fuertes et al., 2020);

Disseminating reliable information in a short period of time (Mudambi et al., 2018);

Rapid adaptation of the system elements to changes in the internal and external environment of the innovation activity management system and the organization as a whole (Buckley & Tian, 2017);

Providing direct correlation and feedback to identify and eliminate deviations in innovation activity and prevent such deviations (Goldman & Casey, 2020; Etges et al., 2017).

When performing the above tasks, there implemented the possibility of a clear division of functions between the subjects and objects of the innovation activity management system, determining the responsibility of managers for their decisions, objective evaluation of the work of all structural elements of the enterprise innovation activity management system, choosing the optimal way to achieve the goals of innovation activity.

Also, the performance of these tasks will provide the maximum perception of innovations by the organization (technical, technological, economic, organizational, managerial) and will allow to adapt to the external environment, which is an integral part of the efficiency and success of innovative activity of the enterprise.

METHODOLOGY

The following research methods are used in the article: systematization and generalization, induction and deduction - during the identification of components of the enterprise innovation activity management system and definition of conceptual principles of the formation and evaluation of enterprise innovation activity management systems; method of expert assessments and index method - during the creation of a set of indicators that characterize the efficiency of the innovation activity management system of machine-building enterprises, analysis of the effectiveness of systems of innovation activity management of machine-building enterprises and the evaluation of factors that affect the management of innovation activity.

In the course of the study there were examined and analyzed the materials of enterprises with experience in formation and evaluation of the enterprise innovative activity management system, as well as the materials of scientific sources reflecting the preliminary studies on this subject.

RESULTS AND DISCUSSIONS

To eliminate obstacles in the functioning of the innovation activity management system, which were identified during the analysis of the state of this management system, various regulatory decisions is used. The study of scientific literature makes it possible to form the following characteristics of regulatory decisions: the focus on overcoming the identified problem or certain deviations of actual values of the indicators from the expected values; availability of information array analysis; availability of documentation; identifying executors of these decisions; making regulatory decisions by the management subject within its competence.

Summing up the above methods of making collective decisions based on individual adjustments, it should be said that the problem of the correctness of determining intervals between individual adjustments remains open.

In addition to the indicators of consistency of the positions of the management subjects, you can also use the coefficient of concordance for strict and non-strict adjustments, etc.

Now let's examine an example of analyzing the choice of an alternative of four conditional options (a, b, c, d) at Farlep Invest PJSC. Let these alternatives analyze 10 management subjects using a three-level scale (Table 1).

Table 1
INDIVIDUAL ADJUSTMENTS FOR THE FOUR ALTERNATIVES, EVALUATED BY 10 EXPERTS OF FARLEP INVEST PJSC

Individual adjustments	Number of experts			
	4	**3**	**2**	**1**
The best	a	b	c	d
Second in importance	c-d	a	a	c
Third in importance	b	c-d	d	a-b
The worst	-	-	b	-

Note: Author's calculations

Let's analyze the choice of an alternative based on the rule of majority vote. Based on Table 1, we see that the alternative *"a"* has garnered the most votes, so it should be selected as a priority.

In turn, according to the rule of J. de Borda, we determine the sum of places for each

alternative. First, we assume that for equal alternatives the serial number is taken as the arithmetic mean of two adjacent numbers (Table 2).

Table 2
DETERMINATION OF COLLECTIVE ADJUSTMENT ACCORDING TO THE RULE OF DE BORDA IN THE INNOVATION ACTIVITY MANAGEMENT SYSTEM OF FARLEP INVEST PJSC

Alternatives	4	3	2	1	Sum of places
a	1	2	2	3.5	17.5
b	3	1	4	3.5	13.5
c	3	3.5	1	2	26.5
d	3	3.5	3	1	29.5
Control sum of places	10	10	10	10	87

Note: Author's calculations

Thus, based on the calculation of the sum of places the following collective subordination can be given: $b \succ a \succ c \succ d$.

Table 3 provides data for the analysis of individual adjustment in the innovation activity management system of Farlep Invest PJSC based on pair wise comparisons.

Table 3
PAIRWISE COMPARISONS OF INDIVIDUAL ADJUSTMENT OF FARLEP INVEST PJSC

Pair of alternatives	The number of experts who suppose that there is a further relationship between the pairs under study			Final conclusion
	$\succ$	$\prec$	$\approx$	
a, b	6	3	1	$a \succ$ b
a, c	7	3	0	$a \succ c$
a, d	9	1	0	$a \succ d$
b, c	3	1	0	$b \succ c$
b, d	3	7	0	$d \succ b$
c, d	2	1	7	$c \approx d$

Thus, based on the pairwise comparison method the following collective subordination can be given: $a \succ d \succ b \succ c$. As you can see, in this case, the conclusion, in comparison with the method of J. de Borda, is quite unexpected. The opposite results indicate a significant inconsistency in the positions of management subjects and demonstrate the disadvantages of these methods. It should be noted that the alternatives *a* and *b*, which are characterized by the highest weight, can still be separated.

The studies conducted allow to state that it is sometimes advisable to calculate a value function which, with its growth, reflects an increase of the predominance:

$$s_j = f(z^j) = \frac{k - n_j}{k - 1},\ j = \overline{1, \overline{n}} \tag{1}$$

If the opinion of each management subject is considered equal, then the value of the alternatives can be calculated as the sum of individual orderings:

$$S = \sum_{i=1}^{n} u_{ji} = \sum_{i=1}^{m} \frac{k - n_{ij}}{k - 1} \tag{2}$$

Where n_{ij} - position of the appropriate alternative in the individual ordering of the relevant management subject

It is also possible to use individual value functions, called intervals. At the same time, the multiplicative value function is often used:

$$g_j = \prod_{i=1}^{n} g_{ij} \quad (3)$$

Where g_{ij} - relative estimates of the value of the identified alternative by the defined management subject.

It is possible to determine relative estimates with the help of the method of T. Saaty or using the following formula:

$$g_{ij} = 1 + s_{ij} \times (m_i - 1) \quad (4)$$

Where n_i - parameter describing how many times the best alternative outweighs the worst one. If each of the management subjects is equal, then all these parameters must be equal. We give estimates of values based on interval and relative scales (Table 4).

Table 4
COMPARATIVE ESTIMATES OF ALTERNATIVES BASED ON INTERVAL AND RELATIVE SCALES IN THE INNOVATION ACTIVITY MANAGEMENT SYSTEM OF FARLEP INVEST PJSC

Alternatives	Interval scale					Relative scale				
	The estimate in the ordering determined by a certain number of experts				s_j	The estimate in the ordering determined by a certain number of experts				g_j
	4	3	2	1		4	3	2	1	
a	1	0.75	0.75	0.17	7.92	2	1.75	1.75	1.17	171.99
b	0.33	1	0	0.17	4.49	1.33	2	1	1.17	74.69
c	0.33	0.17	1	0.75	4.58	1.33	1.17	2	1.75	130.71
d	0.33	0.17	0.33	1	3.49	1.33	1.17	1.33	2	99.34

Note: Author's calculations

As can be seen from Table 4, the interval and relative scale estimates are slightly higher for the alternative *"c"* than for the alternative *"d"*, which contradicts the results obtained by the method of pairwise comparisons.

Now let's analyze the level of weight of the four identified elements using the method of J. Kemeny. So, in this case, the ordering will be median $\begin{pmatrix} b \\ a \\ c-d \end{pmatrix}$. There are also grounds to state that the weight of the elements *"c"* and *"d"* are the same. The elements *"a"* and *"b"* should be considered the most important, with the element *"b"* being more important, since it is considered to be the best by most of the methods described in this example.

As you can see, the above methods of determining collective ordering on the basis of individual orderings are not universal and can give differing results. This is due to the

uncertainty of the management subjects regarding the weight of individual alternatives.

The methods of *"majority vote"* and J de Borda have a significant advantage – ease of use, but in practice they can be characterized by uncertainty of results, provided that there is no unequivocal certainty of management subjects with regard to individual orderings.

The pairwise ordering method should be used when previous methods have not given unambiguous results. Collective ordering can be clearly established on the basis of this method, but under certain conditions, this ordering may differ from those obtained as a result of using the methods of J. de Borda and *"majority vote"*. It is advisable to use the pairwise comparison method when there is no unequivocal confidence between experts.

The interval and relative estimation method should be considered to be a derivative of the method of J. de Borda, since the weighted predominance table calculated on the basis of the rule of J. de Borda is used to determine these estimates. Therefore, the disadvantages of the method of J. de Borda are transferred to this method. The advantage of this method is that on its basis it is possible to distinguish the best alternative from the worst alternative using the ascending scale, while in the method of J. de Borda the descending scale is used.

RECOMMENDATIONS

The development of enterprise innovation activity management is influenced by the implementation by managers of a set of organizational measures aimed at increasing the level of creativity in solving management and engineering-technological problems and ensuring an increase in the number of product and technological innovations, the expected consequences of which is to increase the level of competitiveness of finished products. The expected economic and management changes, as a sign of the development of the enterprise management system, can occur as a result of creation of a subsystem of management of innovation activity or formation of temporary working group for making creative decisions and implementation of innovative projects. The choice of one of these alternatives or a combination of them depends on both objective and subjective factors, in particular the size of the enterprise, its specialization, the complexity of technological processes, the number of nomenclature and assortment units of finished products, the vision of business leaders, the level of intellectual potential of management subjects, etc.

Nevertheless, the key parameter in deciding whether to choose a particular method of development of innovative activity in the enterprise is the power of its management system, and the determining criterion is the informativeness of the compared capacities of sets.

CONCLUSIONS

The conducted studies on the choice of the best alternative in the innovation activity management system of Farlep Invest PJSC showed that the method of J. Kemeny is the most weighted one since it is based on the table of distances between individual orderings. This method is most appropriate when there is no clear ordering of the alternatives under study among the management subjects. Nevertheless, a significant disadvantage of this method is that when the number of alternatives is 4 or more, the distance table will be extremely cumbersome, making it difficult to use the method in practice. The advantage of this method over all others is that it is built on a ready-made table of *"solutions"* of collective orderings, which provides all the probable variants, so under all conditions a clear collective ordering will always be found.

As objective collective ordering as possible can only be found when the results of the polling will be analyzed using all existing methods. If the predominance of one of the alternatives is clearly expressed, then this will be *"visible"* based on the use of each of the following methods. If management subjects have doubts, then all methods will show differing results, on the basis of which it will be possible to create the most rational collective ordering. However, when management subjects have doubts, in order to obtain the correct answer about the predominance of the alternatives under study, it is necessary to change the selection criteria for the group of persons involved in the regulatory and decision-making process, to increase their number, to invite management subjects, which are specialists in other fields, etc.

It was argued that in the process of developing solutions in the enterprise innovation activity management system, the most problematic stage is the stage of collegial choice of the best solution from a number of alternatives.

The proposed methodical approach to making decisions on the choice of the method of development of innovative activity in the enterprise, as well as its further regulation is cumulative in nature. That is, when choosing the best solution, it allows taking into account the position of each management subject involved in its development, which eliminates the disadvantages of the traditional approaches used in forming collegial decisions.

The use of the proposed approach implies: calculating the coefficients that characterize the enterprise innovation activity management system; synthesis of the obtained results, their evaluation and interpretation; decomposition of factor and performance indicators, which provided the obtained results, based on the identification of the topological space; application of factor analysis of the results of evaluation of the enterprise innovation activity management system based on identification of the metric space; identifying opportunities for neutralization.

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