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**THE INNOVATION REGULATOR AS A CONTROLLING COMPONENT  
OF THE MANAGEMENT SYSTEM**

**Abstract.** The article reveals the role aspect of controlling in a management system and substantiates the introduction of an innovation regulator into its structure, contains an author's proposal regarding the adaptation of the concepts of «innovation controlling» and «innovation regulator of the controlling system» at the same time revealing their substance, and includes the proposed economic and mathematical model for evaluating the controlling efficiency on the basis of the innovation regulator.

**Keywords:** innovation regulator, entrepreneurial sector, controlling, innovation controlling, controlling functions, innovation tool, management system, optimality criterion, economic and mathematical model, target function, controlling efficiency, innovative product.

**Problem statement in general.** In the activities of the present-day companies, controlling occupies a fairly prominent position provided there is efficient management in place. Crisis phenomena in the economy of the country have a negative impact on the activities of business entities, and the processes of timely verification of the strategic objectives and tactical rules of their adaptation are becoming ever more relevant as a result. The idea of engaging controlling in managerial cycles is not new, but it needs to be updated on the basis of an innovation regulator. Of course, each representative of the entrepreneurial sector forms his/her

management strategy drawing on his/her own point of view, but it is impossible to predict various financial and economic events without a viable and efficient controlling system.

The controlling system efficiency should be enhanced by an innovation regulator, which by its substance can be represented from the point of view of those criteria that are of greatest interest to the top management of the company. On the other hand, the innovation regulator can look like an economic tool that can ensure fairly good quality shaping of an information resource for making managerial decisions. Modern era proves that the changing financial and economic conditions affecting business environment can be considered as one of the key levers that indicates the expediency and necessity of improving controlling and, on its basis, the managerial unit as a whole. Certainly, the question arises, within which controlling is effected both concerning the time criterion and the scale of its implementation. In our case, the issue is as follows: controlling should enhance its own quality threshold on the basis of the introduction of such an innovation regulator, which will ensure the synthesis of the main information flows and will provide another piece of fairly important meaningfulness to those financial and economic events that arose at the company. In addition, the passive attitude of the representatives of the entrepreneurial sector in attracting the promising results of scientific research and methods of mathematical treatment of economic processes leads to the lack of possibilities of conducting adequate actions to improve the managerial and control levers by the top management of the company. Precisely this state of affairs in the activities of the entrepreneurial sector led to the selection of the research area and emphasized the relevance of the problem set.

#### **Analysis of the relevant research and publications of recent years.**

Problematic, theoretical and applied issues of controlling and its role in the business sector have been reflected in the papers by the leading economists, scientists and specialists who are involved in adaptation of controlling tools in various branches of the country's economy. It would be fair to note that the subject of controlling is not new, however monographs by some scientists show that there are still various ways to improve controlling. We believe that the promising results of scientific research of the following foreign and domestic scholars deserve attention: L. V. Balabanov, O. O. Gasilo [1], O. D. Gudzynskyi, M. M. Aksentyuk, O. M. Demenin [2], D. Han [3], P. V. Yegorov, L. D. Smirnov [4], O. M. Kolodizev, I. M. Chmutova, K. M. Azizov [5], V. V. Prokhorov, L. S. Martyushev, N. Y. Petrusyevych [6], S. V. Ivakhnenkov, O. V. Melykh [7], T. Mann, E. Meyer [8], A. Dailey [9], etc. In the scientific papers by the above-mentioned authors, the essential aspect of controlling, the mechanism of its conduct, the features of developing individual stages in the study of the behaviour of controlling objects are revealed quite substantially, however the communication of

controlling with innovation tools is virtually not shown.

In turn, the subject of innovation tools has quite often come up in recent years in various scientific papers both from the point of view of improvement mechanisms and from the point of view of the development and adaptation of innovation projects. But with all due respect to the work of scientists, the issue of controlling combined with the innovation toolkit has found limited coverage. In particular, quite interesting results of scientific research in the segment of innovation of various types are contained in the monographic studies of the following scientists: O. I. Datsiy, M. V. Haman, N. V. Datsiy [10], M. Y. Rogoza, K. Y. Vergal [11], V. G. Fedorenko, L. I. Fedulova [12], Y. Y. Burennikov, N. V. Polischyuk, V. O. Yarmolenko [13], V. M. Heyets, V. P. Seminozhenko [14], etc. The researchers reveal the influence of the innovation toolkit on the overall economic processes in the country, on the activities of business entities, on the operating procedures of using innovations in managerial cycles, however in most cases the issue of controlling does not find an active demand in conducting the above type of scientific research.

Drawing on the above, we therefore believe that the research area chosen is relevant enough, and has its own prospects.

**Selecting previously unsolved parts of the general problem** It was proved that as a tool for managing complex industrial systems controlling has been used since the 1930s by companies of the industrialized countries, and during that time has proved its efficiency by the fact that it allows adapting the activities of a company to the increasingly complicated and ever more dynamic market conditions. However, the introduction of efficient controlling, we believe, should take place with the innovation regulator taken into account, which regulator will provide in the future timely correction of the shortcomings that reduce the efficiency of the managerial decisions made. The above-mentioned problem has not been researched in-depth by the scientific community, and has not been sufficiently discussed by specialists who are involved in the adaptation of controlling tools. As a result, the managerial decisions that can potentially more efficiently provide the business sector with a sufficient level of competitiveness and performance actually have an inadequately high level. Taking into account such a state of affairs, we consider it necessary to adapt an economic and mathematical model into the controlling process, which model should be based on an innovation regulator.

#### **Objective of the article.**

With regard to revealing the problem, the scientific research is aimed at:

- defining the role of the innovation regulator in the process of controlling, which is adapted in managerial cycles;
- providing the author's point of view on the substantive characteristics of the concepts of «innovation controlling» and «innovation regulator of the controlling

system»;

- developing an economic and mathematical model for evaluating the efficiency of controlling on the basis of the innovation regulator.

### **Presentation of the main research material.**

Controlling acts as a basis for shaping of an information flow in the management system, because it must ensure that adequate decisions are made that are basically close to the real state of affairs at the company. In this regard, the relevance of the issues of efficient controlling remains high enough.

The research conducted has shown that the introduction of controlling by the representatives of the entrepreneurial sector is conditioned by:

- The need for the information support and the coordination of the planning system;

- The synchronization of various types of accounting, analysis of deviations and their control;

- The informational and methodological support for management and making managerial decisions;

- Maintaining risk management at the appropriate level.

Practical activities of the present-day companies show that in most cases controlling services are an integral part of the system of internal control at the company, and are oriented towards informational-and-analytical, methodological and consultative support of the activities of the top management. It is this approach that allows the top management of a company to respond adequately to market changes and to make efficient managerial decisions quickly.

As a rule, the most important functions of controlling include: planning; control, regulation and analysis of managerial decisions. In particular, the latter function involves collection of more meaningful data for controlling, developing toolkit for planning, monitoring and making managerial decisions at a company. However, at present, it is not sufficient for the specialists of the controlling service to confine themselves to existing know-how for making truly adequate managerial decisions.

We believe that modern controlling cannot be efficient unless the representatives of the top management of the entrepreneurial sector engage existing promising results of scientific research and use more modern methods of processing information resources. From this standpoint and at the initial stage, specialists of the business sector need a clear understanding of the substantive meaning of the controlling process, i. e. the understanding of the fact on the basis of what conceptual apparatus certain managerial actions will be executed. In our view, it is appropriate to adapt the concept of «innovation controlling» into the system of the business sector controlling. In this regard, we should remind the reader that the very term «controlling» combines two substances:

- controlling as a management principle;
- controlling as a tool

It is known that the word «controlling» derives from the English phrase «to control», i. e. «to regulate», «to manage», «to conduct», however scientists expand the meaning of this category depending on the problem to be solved. We believe that a fairly substantive and meaningful description of controlling as a conceptual category is given in the writings of German scientists. Thus, in the research papers of the German scientist D. Han [3], controlling is treated as an integrated system of information support, planning and control. T. Mann, E. Meyer [8] and A. Dailey [9], in turn, treat controlling as a concept of information and management, and focus their attention mainly on planning, accounting, analyzing and monitoring marginal income, thereby characterizing controlling as a cost and performance management system.

It has been proved that one of the main tasks of controlling is the qualified definition of the acceptable range of deviation. All deviations within that range should be recorded and eliminated. That is because the overall indices of the stability of work of the business sector's representatives, their financial sustainability and their status on the supply and demand market, their competitiveness and liquidity are the indicator of successful management. Taking into consideration the above, we believe that revealing the substance of controlling as a conceptual category should take into account the aspect of corrective actions. This state of affairs has led to the need of revising the substantive characteristics of the said concept. Besides, in our view, it is appropriate to introduce an innovation component into the concept name, i. e. we propose the introduction of the term «innovation controlling». From the point of view of the substance characteristics, the following interpretation of the concept was proposed: the process of evaluating the components of the management system with the innovation regulator and the directions for that system's improvement taken into account. In our opinion, that approach has several advantages:

- Firstly, the substantive meaning of the controlling system is maintained. The components of the management system typically include planning of activities of representatives of the business sector, accounting procedures that shape the information flow on the basis of factual data, analytical study of the behavior of the key criteria for the activities of representatives of the business sector, corrective actions based on the results of analytical assessment and control over the implementation of projected and planned indicators;

- Secondly, an evaluation process involving all parts of the management system is engaged. Without its participation, the very concept of controlling loses some meaning, and does not ensure the attainment of the objective set for it;

- Thirdly, an innovation regulator is introduced, i. e. a tool that is capable of

ensuring the accumulation of the information, which would serve as a basis for making well-considered and efficient decisions. In addition, it is the innovation regulator that becomes the factor of work in the controlling service from the point of view of corrective actions regarding the key criteria for evaluating the activities of the management system units;

- Fourthly, the main objective is specified and the expediency of controlling with relation to the improvement of the management system is emphasized.

Definitely, the study would be incomplete if we ignored the concept definition of «innovation regulator of the controlling system». In our opinion, this is a corrective tool that is capable of ensuring the adaptation of innovation into the process of controlling the management system. Such an approach can be substantiated in the following way: the whole aspect of the components of the process under investigation is maintained, viz. the corrective tool is switched on, which, in our opinion, should take the leading place in the controlling processes, as it is the medium for the accumulation of realistic information; a significant role is given to innovation as a representative of the evaluation process, its obligatory use as a regulator of financial and economic events investigated by controlling tools is emphasized; the focus is on controlling not a single object, but all units of the management system.

We believe that in order to improve the controlling process for the system of management of the representatives of the entrepreneurial sector under the current difficult conditions of their functioning, it is necessary to attract and adapt economic and mathematical methods that are capable of influencing the qualitative segment of the information flow, which will become the basis for managerial decision making. In our case, the economic and mathematical model should provide a basic resource represented by the innovation regulator of the management system controlling process.

As a rule, the application of this or that mathematical method in the economic analysis, which serves as part of the process of controlling the management system, is based on the methodology of economic and mathematical modeling. That being the case, the type of economic and mathematical method is chosen on the basis of optimality: optimization or non-optimization one. In our case, it is appropriate to use the optimization method, since it involves solving the problem set on the basis of the optimality criterion. We suggest determining the innovation regulator with the changes in the principal indicators of the activity of the representatives of the entrepreneurial sector taken into account, viz. the criterion of optimality must include: the largest revenue from product sales, the lowest production costs and profit maximization. That approach was chosen with relation to the expediency of introducing innovations into the system of management of the key criteria for the

activities of business sector representatives, such as net income, costs and profit. Taken together, those criteria serve as a basis for a management system covered by controlling. We believe that the innovation regulator must show the aggregate of the information flow as per those criteria, which are the basis for controlling, regardless of an individual component of the management unit.

Based on the results of the practical activity of the representatives of the entrepreneurial sector, it can be argued that the management system is represented by the managerial cycles, the net income from sales of products, the management of the cost of sales and the profit from the sale of products, i. e. the gross profit. On the whole, controlling covers all the above management units, which indicates the need to develop substantive innovation regulators for each of the specified management units, and drawing on that, we propose the development of a comprehensive criterion for evaluating the efficiency of controlling based on the innovation regulator. The classical mathematical models built on the basis of the optimality criterion will serve as the groundwork for the development. Consequently, the equation of the target function for the optimality criterion called «the largest net innovation income from the product sales» will look as follows:

$$\mathbf{IY}_i = \sum \mathbf{IY}_j \times \mathbf{X}_j \rightarrow \mathbf{max}. \quad (1)$$

Each component of the target function for the optimality criterion «the largest net innovation income from the product sales» is responsible for a clearly defined segment. Thus,  $(IY_i)$ , i. e. the net income from the innovation, equals the total for the net income from the investment  $(IY_j)$ , which was expected to be obtained from the manufacture of a unit of innovative products of the  $j^{\text{th}}$  type, and the amount of the innovative products actually produced  $(X_j)$ .

In turn, the equation of the target function for the criterion of optimality of the innovation level of cost minimization will look as follows:

$$\mathbf{IW}_i = \sum \mathbf{IW}_j \times \mathbf{X}_j \rightarrow \mathbf{min} \quad (2)$$

This economic and mathematical model demonstrates the target function for the criterion of optimality for the innovative level of cost minimization  $(IW_i)$ , which equals the total for the revised innovation costs, which are supposed to be incurred for the manufacture of a unit of the products of the  $j^{\text{th}}$  type  $(IW_j)$  and the amount of the innovative products actually produced  $(X_j)$ .

The indicator of the efficiency of the above economic and mathematical models is the criterion of optimality for the maximization of profit, which is supposed to be derived from the implementation of measures to obtain the innovative value within the net income and the innovative value within the cost of production for a unit of the products of the  $j^{\text{th}}$  type. Consequently, we believe that the equation of the target function with the criterion for the maximization of profit taken into account may look as follows:

$$\mathbf{IP}_i = \sum \mathbf{IP}_j \times \mathbf{X}_j \rightarrow \mathbf{max}. \quad (3)$$

The above-mentioned algorithm of the target function with the criterion of maximization of the amount of profit from the innovation ( $IP_i$ ) taken into account equals the total for the planned income from the investment ( $IP_j$ ), which was supposed to be obtained from the manufacture of a unit of the products of the  $j^{\text{th}}$  type, and the planned amount of the innovative products to be produced ( $X_j$ ).

We believe that during controlling the management system, the economic and mathematical models indicated above can become innovation regulators capable of improving the research result. On the whole, an economic and mathematical model for evaluating the efficiency of controlling on the basis of an innovation regulator may look as follows:

$$\mathbf{IK}_i = \sum \mathbf{IZ}_j (\mathbf{IY}_i ; \mathbf{IW}_i) \rightarrow (\mathbf{IP}_i) \rightarrow \mathbf{max}. \quad (4)$$

or

$$\mathbf{IK}_i = \sum \mathbf{IZ}_j \rightarrow \mathbf{max}. \quad (5)$$

The development of an economic and mathematical model for evaluating the efficiency of controlling on the basis of the innovation regulator ( $IK_i$ ) envisaged the involvement of a set of innovation measures ( $IZ_j$ ) regarding the manufacture of an innovative product of the  $j^{\text{th}}$  type with the innovation regulators, which are represented by the ( $IY_i ; IW_i ; IP_i$ ) criteria, taken into account. We believe that the above criterion will provide an opportunity not only to increase and expand the information flow based on the results of the evaluation of the management system by the controlling tools, but also to bring a positive result into the system of making managerial decisions.

**Conclusions** Based on the results of the study, a number of conclusions can be drawn. Firstly, controlling the system of management of representatives of the entrepreneurial sector needs to be updated by activating the process of implementation of the promising results of scientific research that can enhance the controlling efficiency. Secondly, the top management of a company should provide conditions for the introduction of innovation regulators into the controlling processes, which will enhance the quality level of shaping of information flow that will be the basis for making managerial decisions. Thirdly, for the specialists of the companies conducting the management system controlling, it is proposed to use a more substantive conceptual apparatus, which would include the interpretation of the categories of «innovation controlling» and «innovation regulator of the controlling system». The consequence of the use of those categories will be a more in-depth understanding of the meaning of the controlling process, which will be based on innovative developments. Fourthly, the controlling process should be carried out taking into account economic and mathematical models that are capable of synthesizing more quality information for managerial decisions. Fifthly, the

economic and mathematical model developed for evaluating the efficiency of controlling on the basis of an innovation regulator can become an additional piece of leverage to improve the process of controlling the system of management of representatives of the business sector, since it is capable of providing in-depth assessment of each of the key criteria (net income, cost of sales, profit) from their own standpoint based on the innovation regulator and, on the whole, capable of shaping an information platform for making managerial decisions that are closer to the realistic conditions of the development of a company.

**Conclusions and prospects of further research.** Taking into account the above, we propose changing the approach to the process of controlling the system of management of representatives of the entrepreneurial sector by improving the conceptual apparatus and by adapting the method of economic and mathematical modeling. Applied calculations regarding the innovation regulators of the proposed economic and mathematical model for controlling efficiency should become the area of subsequent research, which will help provide the possibility for reinforcing and substantiating key features in solving the problem set.

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