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DEVELOPMENT OF MATHEMATICAL MODELS OPTIMIZING THE PROCESS OF CREATING INNOVATION PRODUCTION

Abstract. The authors analyzed the conditions and procedures for applying the economic-mathematical model at various stages of the generation and implementation of innovations. In their opinion, in order to gain a leading position in world markets and the country's development, it is necessary to have priority rights to create advanced technologies that limit leading countries in order to avoid competition. They protect the domestic markets, downloading their own products, while actively fighting for the external, which includes a potentially capacious market in Kazakhstan. However, the activation of innovation activity directly depends on the growth of competitiveness, due to the fact that the creation of innovative products, the introduction of new technologies, the expansion of the range of products with improved consumer properties lead to the ability to compete with foreign products, both on the domestic and external markets.

Keywords: innovations, competition, efficiency of innovative activity, managerial decisions, economic-mathematical model.

Introduction. In accordance with the policy of the President of the Republic of Kazakhstan N.Nazarbayev, an innovative type of economy is being formed in the country. An appropriate innovative infrastructure is being created to develop management systems for new innovative structures, including various management mechanisms to improve production efficiency. One of such mechanisms is the economic and mathematical modeling of the activity of innovative enterprises [1].

The study of innovative development involves, first of all, consideration of such concepts as the innovation process and its components, innovations and their classification, innovative design and its characteristics. Analyzing the essence of these economic categories it is possible to define the modern concept of implementing innovative development of economic entities.

Analyzing the existing definitions of the category "innovation" we proposed a new definition of the concept of "innovation" - this is the final stage of the innovation process, characterized by a positive result of introducing novelty into production with the subsequent obtaining the necessary economic, environmental or social effect.

This definition will help to protect innovations from processes that do not give the desired effect, and can be applied to any improvements and new developments in the production and organizational areas of the enterprise [2].

Table 1 - The main content and properties of innovations

Category	Stage	Content	Properties
Innovation	Introductory	Patent, invention, discovery, new methodology, etc.	Availabilityofnovelty
Innovation	Intermediate	Introduction of innovation, its use	The need and materialization of novelty
Innovation	Final	Disseminationofinnovation	Diffusion of novelty, obtaining the necessary effect

Innovative activity begins on the basis of research, development and (or) design works, which create a reserve for the innovation cycle. As a result of these works there is an innovation that becomes an

innovation in the form of a method, product or service. Such a complex nature of innovation, a variety of applications, methods of use and its versatility require the classification of innovations necessary to identify the type of innovation and the degree of its impact on the effectiveness of production. Let's consider the existing classification of innovations of domestic and foreign scientists.

Description of the process of multicriteria optimization of increasing the efficiency of the organization's innovation activity (MOPEID)

Determination and construction of possible objective-criterion functions	Level of profitability of innovation activity → max
	The share of the profit received from the sale of new products in the total amount of profit → max
	Relative growth of the market value of the organization in comparison with the relative growth of the industry market → max

Possible components of the system of restrictions: (BCCO)

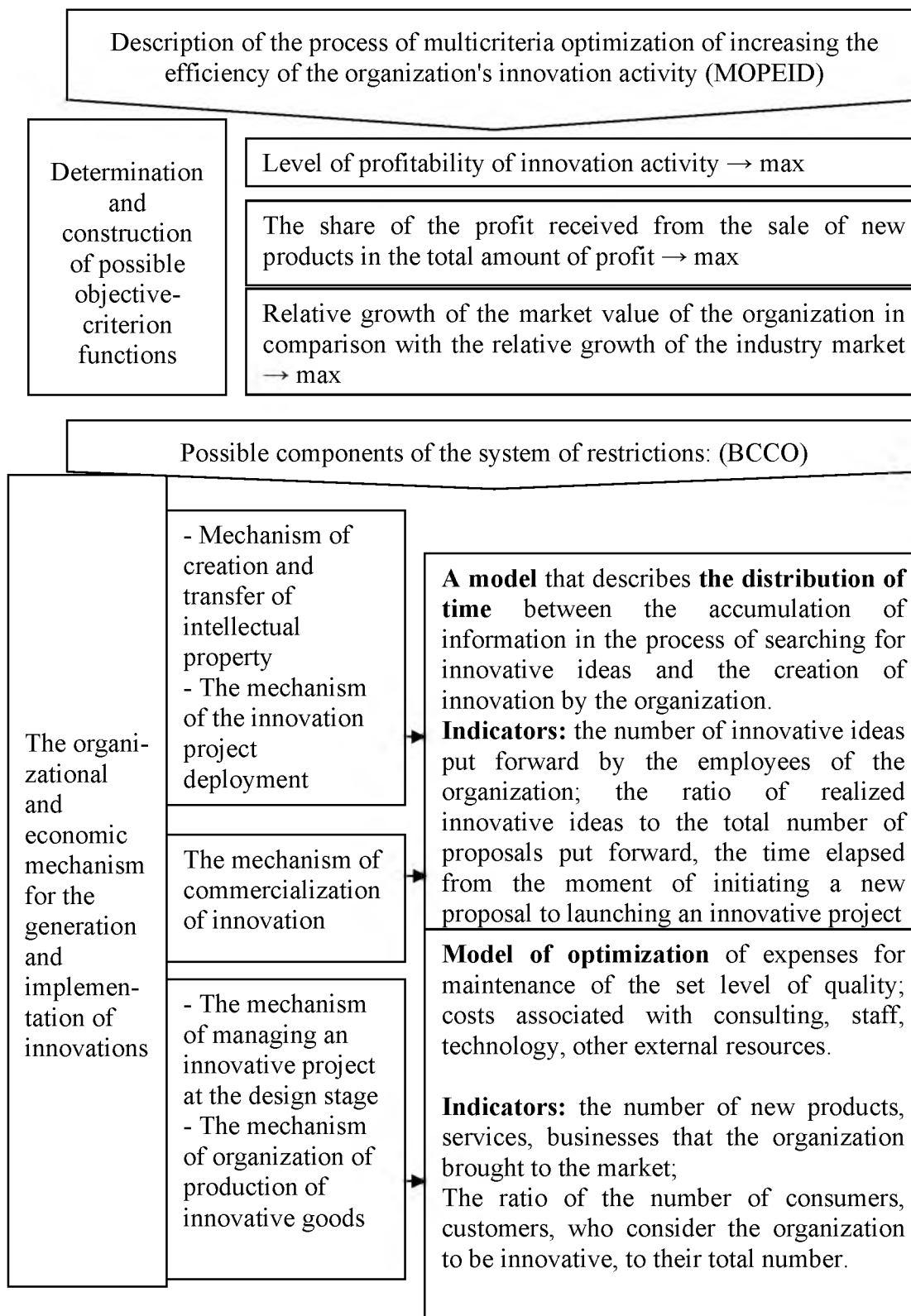| The organizational and economic mechanism for the generation and implementation of innovations | - Mechanism of creation and transfer of intellectual property
- The mechanism of the innovation project deployment | A model that describes the distribution of time between the accumulation of information in the process of searching for innovative ideas and the creation of innovation by the organization.
Indicators: the number of innovative ideas put forward by the employees of the organization; the ratio of realized innovative ideas to the total number of proposals put forward, the time elapsed from the moment of initiating a new proposal to launching an innovative project |
| | The mechanism of commercialization of innovation | Model of optimization of expenses for maintenance of the set level of quality; costs associated with consulting, staff, technology, other external resources.

Indicators: the number of new products, services, businesses that the organization brought to the market;
The ratio of the number of consumers, customers, who consider the organization to be innovative, to their total number. |
| | - The mechanism of managing an innovative project at the design stage
- The mechanism of organization of production of innovative goods | |

Figure 1 - Description of the multicriteria task of increasing the efficiency of the organization's innovation activity

When formalizing the economic and mathematical model of making managerial decisions to improve the efficiency of the organization's innovation activity, it is natural to assume that the goals of innovation development, the specifics of innovation activity, the capabilities of organizations can differ substantially from one another [3]. The profitability of innovation, striving for maximum, can serve as a target function of the task of increasing the efficiency of the organization's innovation activity. The target function can be the share of profit from the sale of new products in the total amount of profit for the last years, also striving for maximum.

A cumulative increase in efficiency would be expedient in this case to be considered as a vector function, and the task of increasing the efficiency of the organization's innovation activity as a multi-criterial one, pursuing the goals of increasing the profitability of innovation activity, increasing the amount of profit received from the sale of new products in the total volume of profit and increasing the organization's cost compared with industry average indicators [4, 5].

The first criterion of optimality will be, respectively, the maximum value of profitability of innovation activity, the second - the maximum value of the share of profit received from the sale of new products in total profit, the third - the maximum relative growth of the market value of the company compared to the relative growth of the industrial market in recent years. The maximum value of the objective function in each case must be achieved in the economic space represented by constraints.

In the practical solution of such a task, in each specific case, priority should be given to the objective functions, taking into account the corresponding limitations. After this, we can proceed to consider the next most important objective function. Separately, if necessary, the task of optimizing the costs of innovation activity can be solved.

A model describing the distribution of time between the accumulation of information in the process of searching for innovative ideas and the creation of innovation can be used to draw up a system of constraints to the above multi-criteria optimization problem [6].

The results of the study can be schematically represented as follows (Fig. 1).

Conclusion. Thus, the essence of the methodology for constructing a generalized economic and mathematical model for multi-criteria optimization of making managerial decisions to improve the efficiency of the organization's innovation activity was briefly described.

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ИННОВАЦИЯЛЫҚ ӨНІМДІ ҚҰРУ ПРОЦЕСІН ОҢТАЙЛАНДЫРУДЫҢ МАТЕМАТИКАЛЫҚ МОДЕЛІН ДАЙЫНДАУ

Аннотация. Мақалада инновацияларды жасау мен енгізудің әр түрлі кезеңдерінде экономикалық-математикалық модельдерді қолдану шарттары мен тәртібі талданды. Олардың пікірлері бойынша әлемдік нарықта және ел дамуында жетекші орынға не болу мақсатында бәсекелестікті болдырмау үшін озық

технологияларды жасауда басым құқыққа ие болуы керек. Олар өз өнімдерін жүктей отырып ішкі нарықты қорғайды және сонымен қатар сыртқы нарықта белсенді күрес жүргізеді, оған Қазақстанның кең нарығы жатады. Инновациялық қызметті жандандыру бәсекеге қабілеттіктің өсуіне тікелей байланысты. Осыған орай, жаңа өнімдерді құру, жаңа технологияларды енгізу, жақсартылған тұтынушылық қасиеттері бар өнімдер ассортиментін кеңейту ішкі және сыртқы нарықтарда шетелдік өнімдермен бәсекелесуге мүмкіндік береді.

Түйін сөздер: инновациялар, бәсекелестік, инновациялық қызметтің тиімділігі, басқару шешімдері, экономикалық және математикалық модель.

УДК 316.422;330

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РАЗРАБОТКА МАТЕМАТИЧЕСКИХ МОДЕЛЕЙ ОПТИМИЗАЦИИ ПРОЦЕССА СОЗДАНИЯ ИННОВАЦИОННОЙ ПРОДУКЦИИ

Аннотация. Авторами в статье были проанализированы условия и процедуры применения экономико-математической модели на различных стадиях генерирования и реализации инноваций. По их мнению, для завоевания лидирующих позиций на мировых рынках и развития страны, необходимо обладать приоритет-ными правами на создание передовых технологии, которыми ограничивают лидирующие страны во избежание конкуренции. Они ограждают внутренние рынки, загружая собственной продукцией, при этом активно борются за внешние, к которым относится и потенциально емкий рынок Казахстана. Однако, акти-визация инновационной деятельности прямо пропорционально зависит от роста конкурентоспо-собности, в связи с тем, что создание инновационной продукции, внедрение новейших технологий, расширение спектра выпускаемой продукции с усовершенствованными потребительскими свойствами приводят к способности соперничать с зарубежной продукцией, как на внутреннем, так и на внешнем рынках.

Ключевые слова: инновации, конкуренция, разработка, управленческие решения, экономико-матема-тическая модель.

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