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Modeling of Options of Providing Entrepreneurship Entities Competitiveness on The Basis of Innovation Clusters Development

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Abstract

On the basis of application of mathematical methods modeling of options of providing of innovation cluster development, which is based on decision making between absolutely alternative options of realization of strategy of development of innovation clusters is carried out in the work. The root tree of alternatives implementation at each stage of substantiation of the strategy of innovation clusters development is presented.

Keywords: innovation cluster, modeling, choice options, mathematical methods.

Introduction

Formation of innovation clusters is a difficult task because it requires large investments in a certain region, involvement of an institute of education and science, and formation of a zone of fiscal and

accounting preferences. The main purpose of creating clusters is to reformat existing material flows and create the conditions for successful business. Therefore, financial problems, accounting issues and taxes remain a problem which, in a context of legislative instability, begins to adversely affect the results of their activities.

Thus, cluster support can be based on the use of direct and indirect factors. In either the first or the second case, a particular region or group of companies receives economic preferences that require analytical justification. Therefore, it is advisable to formulate a system for tracking the results of cluster participants and to draw conclusions about possible changes in their support strategy. Given this, it is relevant to develop tools for modeling options to support the development of innovation clusters.

The purpose of the Research

Based on the application of mathematical methods to perform modeling of options for providing the innovation cluster development, based on the decision between absolutely alternatives for the implementation of the strategy for the innovation clusters development**.**

Modeling of Options for Providing of Innovation Cluster Development

Achieving this goal can be based on the use of subjective or mathematical approaches. The first one involves a group of methods based on a survey of experts, leading experts, scientists on the choice of strategy steps to support a particular cluster, as well as the formation of options for tactical solutions for solving certain problems that may arise during the implementation stages of the planned strategy. The implementation of this approach can occur without forming a specific theoretical basis, since its main idea is to create a new innovation cluster by using the experience of third parties. The disadvantage of this approach is its cost and duration, and experts may not agree on a strategy, which will mean continuing to poll and attract more respondents.

Another group of approaches to developing tools for modeling innovation clusters support options is mathematical statistics and discrete mathematics. Its advantage is the objectivity of the results, because it uses only abstract tools, which, when properly formulated the task always allows to obtain unambiguous and reasonable results. The disadvantage is that in the formation of a mathematical problem important details can be omitted, which under certain conditions can be significant. In addition, the results of the mathematical solution are based on retrospective data that are no longer relevant at the time of implementation of the innovation cluster support strategy, and therefore the application of mathematical methods is based on a certain error, which must be taken into account in the formation of strategic, tactical and operational decisions.

Considering the pros and cons of the above, this research will be of greater scientific importance if the solution to the problem of modeling clusters of innovation cluster development is based on the use of mathematical methods that have not yet been used to simulate cluster support options and the use of which can have significant applied value, since their implementation is significantly cheaper and shorter in time.

We begin describing the proposed solution by presenting the output of the mathematical problem. The key issue with this problem is choosing a particular option. Based on the general scientific principles, it can be assumed that under any circumstances, the entrepreneur has a certain set of solutions, all of which are characterized by two definite and one indeterminate parameter. Determinate parameters can be attributed to time and cost, and undetermined - the result of costs incurred, which can be measured by profit, sales, or taking into account the problem, the number of business entities in a particular region, the level of wages ect. This parameter should be considered indeterminate because at the time of planning it is not known yet, but it can be predicted with some accuracy.

Based on the above assumptions, the options available at some stage in the implementation of the cluster support strategy can be presented in the form of vectors:

$$C = \begin{bmatrix} c_1 \\ c_2 \\ \dots \\ c_N \end{bmatrix}; T = \begin{bmatrix} t_1 \\ t_2 \\ \dots \\ t_N \end{bmatrix}; R = \begin{bmatrix} r_1 \\ r_2 \\ \dots \\ r_N \end{bmatrix}, \quad (1)$$

Where C,T, R respectively, are the vectors of the input values of the parameters of cost, time and result.

The values of vectors (1) will change at each stage of strategy implementation. All of these options are alternative because they are just about supporting an innovation cluster. Provided that it is advisable to implement measures from several options, a separate tactical plan can be created that will include the implementation of several measures, of course, if the specifics of their implementation allow it.

The «result» parameter can be described on a number of indicators, since usually when designing an innovation cluster support strategy, the aim is to increase the competitiveness of its participants, which can be described by the use of many indicators. It is advisable to select one or more indicators to describe the result based on the situational approach and taking into account the features of the cluster and the region where it is located. Based on the logic of the task, it can be described based on the following expression:

$$R = f(C,T). \quad (2)$$

As can be seen from expression (2), the result should always be considered as a function of the time and money spent, written in vector form. Since during the implementation of any action plan, its result is always influenced by certain factors that may not be taken into account in the modeling stage, then the function (1) is correct only with regard to the error. Thus, the algebraic function (2), during the implementation of a certain stage of the innovation cluster support strategy, can be represented as follows:

$$r_i = f(c_i, t_i), \quad (3)$$

where i - the index of the selected option at a certain stage of implementation of the strategy support of innovation cluster development.

Functional congruence (3) describes a generalized way of solving a particular scientific problem only approximately. The kind of functional congruence depends on the nature of the relationship between the studied values. However, since these are economic systems whose elements are thinking entities and which behavior is often irrational, it can be assumed that it is more appropriate to use nonlinear models when modeling the behavior of economic systems. Among the broad range of possible mathematical functions that can be taken as a basis, should be selected those that meet the following requirements: a function suitable for describing accelerated or delayed changes in time; the values of the function are defined on a plane from zero to infinity; the function is easy to put into practice.

Let's consider a simulation method based on deciding between completely alternative options for implementing an innovation cluster development strategy. In this case, at each stage, the decision will be made to choose from several alternatives that are not planned to be implemented in parallel. This leads to the fact that the process of implementing a complete strategy at the stage of its development can be described in the form of a certain «tree» known in the theory of discrete mathematics as a graph. An example is shown in Fig. 1.

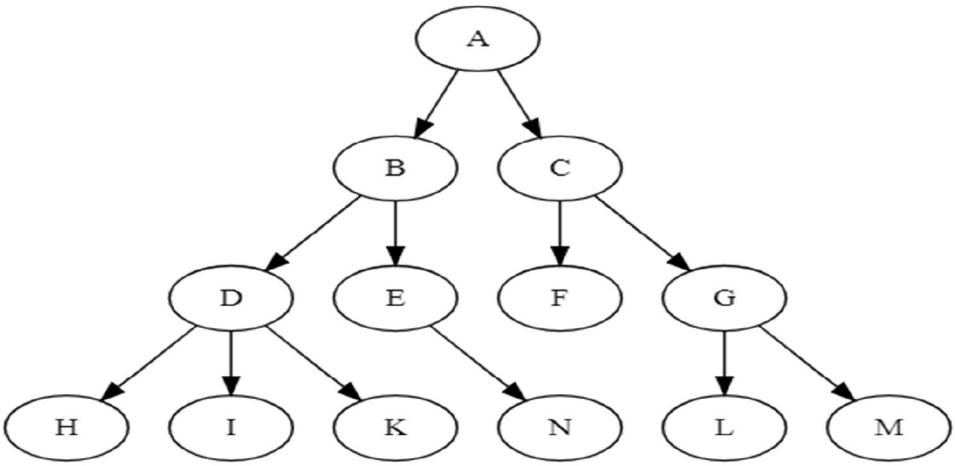

Fig. 1: An example of a graph of implementation of alternative options at each stage of implementation of the innovation clusters development strategy

The type of graphs shown in Fig. 1 is known in the theory of discrete mathematics as the root tree. Such a graph always has one root, or vertex, from which all «branches» emerge. Deciding which option «A» or «B» is the best is based on taking into account up-to-date information and identifying which option is cheaper and shorter in time. In order to avoid the two-sided conclusions that arise when the cheapening of one of the options leads to an increase in the duration of its implementation in practice, a functional congruence (3) should be applied, on the basis of which one can conclude which option is more optimal. Moreover, at each of the stages of the passage of the graph, it is advisable to take into account all future steps. Although there is at least one optimal path for the graph to pass, it is not necessary to state that the future strategy is determined, since it is advisable to take into account new relevant information and adjust the equation to obtain more accurate information about determining the optimal variant at each of the stages of the graph.

Let's write the optimization problem at each stage of decision making as follows:

$$\begin{cases} r = f(c,t), c \in C; t \in T; \\ r \to \min(\max). \end{cases} \Rightarrow$$

$$\begin{cases} r = a_0 c^{a_1} t^{a_2}, c \in C; t \in T; \\ r \to \min(\max), \end{cases} \quad (4)$$

where a_0, a_1, a_2 - power coefficients, part. units C - the vector of values of the implementation cost of each of the options at a certain stage of the graph; T - vector of values of the realization duration of each of options at a certain stage r - an indicator on the basis of which the result of passing a certain stage is measured.

Thus, the choice between individual options for implementing the strategy of innovation cluster development at each stage of substantiation of this strategy can be described on the basis of a graph with an unlimited number of ways to achieve an acceptable result, and based on mathematical modeling it is possible to make a decision on the choice of one or the other option on a particular during the passage of the graph. This process should take place with constant updating of information and restructuring of the power equation, which will increase its accuracy and statistical significance.

As a result, it is possible to achieve the optimum result in the implementation of the innovation cluster development strategy based on this approach.

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