

**ISCKMC 2020****International Scientific Congress «KNOWLEDGE, MAN AND CIVILIZATION»****MODEL OF THE OPTIMAL DISTRIBUTION OF STATE  
SUPPORT FOR AN INNOVATIVE PROJECT**

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**Abstract**

Current legal regulations and business practices in the Russian Federation show a constant change in the requirements for forms of state support for investment projects. As a result, participants in the implementation of projects, both commercial organizations and public authorities, face the problem of coordinating private and public interests. A feature of the current stage of innovative development is the fact that the creation and production of high-tech products are carried out by a combination of innovative enterprises and organizations that are participants in one or more innovative projects. In these circumstances, it becomes necessary to make a decision on the effective distribution of state support among the participants of an innovation project. The study presents a model for making such a decision based on the dynamic programming method. In it, the authors have taken into account the conditions that ensure a balance of interests of enterprises and public authorities, which together act as participants in network interaction in the implementation of an investment project. The result obtained in solving this task will have a significant impact on the dynamics and efficiency of innovative development, both of the enterprises themselves and their regions of location. This will ultimately have a positive impact on the standard of living in the region and increase its investment attractiveness.

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*Keywords:* Dynamic programming, innovative project, state support



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## 1. Introduction

Programs of state support for business, including those aimed at the production of high-tech products, currently implemented, contain a significant number of forms and ways to stimulate innovation.

Based on the conclusions obtained as a result of previous studies (Erygin & Sahakyan, 2012), it is safe to say that the choice of forms of stimulating innovative activity of a commercial organization is formed on the basis of the results of solving the following tasks:

- Defining the class of incentive forms.
- The size distribution of the stimulus at budget levels.
- Determining the optimal ratio of the volume of innovation incentives provided on a returnable and non-returnable basis, depending on the capital structure and stage of the innovation process.
- The choice of forms of stimulating innovation.

Based on the opinion of leading economists and practitioners of innovation management (Krotkova et al., 2016; Khairullina, 2012; Qian & Olsen, 2020; Urumov, 2017), the authors believe that the main criteria necessary for evaluating the effectiveness of state support are the following:

- Target criteria.
- External and environmental criteria.
- scientific and technical criteria.
- Commercial criteria.
- Production criteria.
- Market criteria.
- Criteria of the investor.
- Criteria for regional features of the project implementation.

The problem of determining the optimal ratio of the volume of innovation incentives provided on a non-refundable basis remains the least studied.

In the first method, the sources of financing are budget allocations, state subsidies, funds from extra-budgetary funds, investors' own funds, as well as funds raised by them (financing through the issue of shares).

The second method uses borrowed funds from financial and credit institutions, raising funds through the issuance of bond loans, and co-financing by individuals (krautinvesting), which is possible when implemented primarily on the basis of small innovative enterprises.

The most frequently raised questions include the choice of forms of stimulating innovation. The form of stimulating innovation activity is understood as the internal organization of its content, which is determined by the composition of the stimulating subjects.

The following criteria are used to select the forms that are provided on a non - refundable basis:

- Target criteria and conditions for selecting projects to participate in the competition for a particular form of incentive.
- Budget efficiency of the implemented incentives.

However, when selecting forms that are provided on a return basis, additional criteria must be introduced, such as:

- The period for which the incentive form is provided.
- The cost of resources provided as incentives.

At the same time, world experience shows that at the present stage of innovative development, the state is trying to find forms that ensure the return of state support initially provided on an irrevocable basis (Gershman, 2020).

Another task in providing comprehensive support for innovative projects is the need to take into account the network approach. When evaluating an innovation project in advance, all participants must understand whether they are satisfied with the planned financial result or not. Often, network participants, when implementing an innovative project, as a result, get different results for the invested efforts and capital, which does not meet their expectations. In this case, support should be provided in a comprehensive manner, taking into account the interests of all network participants.

## **2. Problem Statement**

Unfortunately, the existing forms of incentives offered by the state do not give the proper effect in practice, since they do not fully take into account the need to implement a network approach when making a decision on providing state support for the implementation of an innovative project. This is due to the fact that in the production of high-tech products, there is a need to involve the innovative potential of both small and medium-sized and large innovative enterprises that form a complex cooperative network along with the objects of innovative infrastructure. Thus, there is another rather difficult task – the distribution of state support among the participants of the cooperative network implementing an innovative project. This should take into account the limited budget resources allocated for these purposes, as well as the need to avoid breaking cooperative ties while achieving budget efficiency of the state resources involved.

## **3. Research Questions**

The choice of forms and methods of stimulating the production of high-tech products should ensure efficiency in the implementation of innovative projects for the production of high-tech products. As a result, you need to understand and evaluate the following parameters for network participants:

- Commercial efficiency necessary for the implementation of business processes for the production of high-tech products.
- A set of business processes for the production of high-tech products that are transferred to subjects of innovative activity at various levels, including objects of innovative infrastructure that have the necessary competencies for their more effective implementation.

- Order portfolio of potential participants in the innovative process of manufacturing high-tech products.
- Economic feasibility of current and investment costs for the implementation of business process portfolios.
- The volume of investment in the development of innovative infrastructure.

#### 4. Purpose of the Study

The purpose of this work is to determine the optimal distribution of a limited amount of state support for participants of an innovative project implemented in the form of network interaction.

#### 5. Research Methods

The preliminary calculations used financial analysis methods related to the calculation of the budget efficiency of innovative projects. The method of dynamic programming is used as an optimization method.

#### 6. Findings

For each of the  $n$  project participants, the budget effect  $g_i(x) (i = \overline{1, n})$  is known, depending on the amount  $X$  of state support determined for it (table 1). It is necessary to distribute limited state support funds among project  $C$  participants so that the budget efficiency of their use is maximum  $f_n(C)$ . For convenience, we will break down the distribution process into steps. As the  $n$ -th step, we will take the provision of state support funds to  $n$  project participants.  $C$  – reserve of funds not provided. Parameters of "step control"  $x_1, x_2, \dots, x_n$  – means of state support provided by participants. The gain at step  $n$  is determined by the increase in the budget effect  $g_n(x)$  from the  $n$  – th project participant, depending on the support tools  $x$  (step control) provided to it.

To determine the optimal distribution of state support, we will use the recurrent ratio shown below (1):

$$f_n(C) = \max[g_n(x) + f_{n-1}(C-X)], \quad (1)$$

where  $f_{n-1}(C-X)$  is the maximum value of the increase in the budget effect at the previous step ( $n-1$ ), when distributing the amount of state support  $C_{(n-1)} = C - x_n$  between ( $n-1$ ) participants,  $0 \leq x \leq C$ .

Table 01 shows the amount of budget revenues in the form of tax and non-tax payments from each of the  $n$  participants, depending on the amount of state support provided to them ( $X$ ).

**Table 1.** Amount of budget revenues

Funds C, thous.c.u.	Budget receipts from network members			
	1	2	3	4
	$g_1(x)$	$g_2(x)$	$g_3(x)$	$g_4(x)$
1500	720	750	730	790
3000	1500	1650	1600	1800
4500	2400	2100	2250	2260
6000	3500	3600	3850	3800
7500	4000	4000	4200	4100

Further, the distribution of state support funds between project participants at each step is presented in tabular form (table 02-05).

**Table 2.** Distribution of funds in the first step

Funds C, thous.c.u.	X						$f_1(C)$	$X_1(C)$
	0	1500	3000	4500	6000	7500		
1500	-	720+0					720	1500
3000	-		1500+0				1500	3000
4500	-			2400+0			2400	4500
6000	-				3500+0		3500	6000
7500	-					4000+0	4000	7500

**Table 3.** Distribution of funds in the second step

Funds C, thous.c.u.	X						$f_2(C)$	$X_2(C)$
	0	1500	3000	4500	6000	7500		
1500	0+720	750+0	-	-	-	-	750	1500
3000	0+1500	750+720	1650+0	-	-	-	1650	1650
4500	0+2400	750+1500	1650+720	2100+0	-	-	2400	0
6000	0+3500	750+2400	1650+1500	2100+720	3600+0	-	3600	6000
7500	0+4000	750+3500	1650+2400	2100+1500	3600+720	4000+0	4320	6000

**Table 4.** Distribution of funds in the third step

Funds C, thous.c.u.	X						$f_3(C)$	$X_3(C)$
	0	1500	3000	4500	6000	7500		
1500	0+750	730+0	-	-	-	-	750	0
3000	0+1650	730+750	1600+0	-	-	-	1650	0
4500	0+2400	730+1650	1600+750	2250+0	-	-	2400	0
6000	0+3600	730+2400	1600+1650	2250+750	3850+0	-	3850	6000
7500	0+4320	730+3600	1600+2400	2250+1650	3850+750	4200+0	4600	6000

**Table 5.** Distribution of funds in the fourth step

Funds C, thous.c.u.	X						$f_4(C)$	$X_4(C)$
	0	1500	3000	4500	6000	7500		
1500	0+750	790+0	-	-	-	-	790	1500
3000	0+1650	790+750	1800+0	-	-	-	1800	3000
4500	0+2400	790+1650	1800+750	2260+0	-	-	2550	3000
6000	0+3850	790+2400	1800+1650	2260+750	3800+0	-	3800	6000
7500	0+4600	790+3850	1800+2400	2260+1650	3800+750	4100+0	4640	1500

The results of solving the proposed dynamic programming problem allow us to conclude that the maximum budget effect is achieved by providing the fourth and third participants with state support in the amount of 1500 and 6000 thousand c.u., respectively. At the same time, the condition related to ensuring the commercial efficiency of all project participants must be met. If this condition is not met, the implementation of the project carries the risk of bankruptcy of the relevant participants with the subsequent violation of cooperation and the inability to ensure the return on state support provided, as well as the occurrence of losses for all participants in the cooperative network.

## 7. Conclusion

The proposed model allows us to determine only the optimal amount of state support for each of the participants of the innovation project. At the same time, the form of such support is agreed with each of the project participants. In this situation, it is important to find an effective solution related to determining the conditions for providing support: on a refundable or non-refundable basis. This decision can be obtained by evaluating and comparing the actual and optimal capital structure of these participants. If there is insufficient equity, the decision is made in favor of forms provided on a non-refundable basis. Conversely, if there is an excess amount of equity, state support is provided on a returnable basis. At the same time, the capital structure, taking into account state support provided in the recommended forms, should be as close as possible to the optimal value.

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