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Structural decomposing of innovations and investments projects

Snezhana V. Firova[1], Olga V. Kalinina[1], Sergei E. Barykin[2]
[1] Peter the Great St. Petersburg Polytechnic University
[2] Saint-Petersburg State marine technical University

ABSTRACT

The article is devoted to the study of the process of investing and planning innovative projects. A systematization of a variety of factors influencing business models and investment aspects of innovative investment projects in their stepwise (iterative) reflection is given. Specialattention is given to the classification of innovations, a matrix of types of innovations has been developed in the process of analysis. A conceptual framework for structuring innovation and investment activities has been proposed with the goal of generalized systematization of the stages and factors of structuring innovation and investment projects. The thesis on the systemic nature of open innovation is argued and principles for evaluating the effectiveness of innovative investment projects are proposed. In the course of the study, a model for the distribution of investment sources was developed, taking into account the planned rate of return.

KEYWORDS:

innovational-investment projects, business plan, investment modelling, innovation, resources, investing.

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Innovative activity is considered to be a key condition for the national economy modernization, a required element of the transition to the modern post-industrial progress stage, as well as an obligatory attribute of market economic relations (Innovative project, 2017). In this context, innovative activity is one of the most desirable aspects of ensuring the successful functioning of economic entities. Innovative development of the national economy as a whole and industrial enterprises in particular requires changes in the content, organization, forms and methods of management of innovative projects, especially with regard to the choice of sources of financing, as well as the use of progressive and effective methods of their business planning.

The choice of financing instruments and the preparation of a business plan are complex processes, traditionally, with many iterations, especially if the business idea involves the introduction of innovations into production. In the latter case, the variability of solutions, both marketing and production (technological and/or organizational) grows sharply (Call for investors, 2018). Most often, this is due to the fact that already in the planning process the changes may be required under the influence of a wide range of external and internal factors, the degree of innovativeness of the developed project. These circumstances determine the need for theoretical analysis of the mechanisms of selection and justification of financing sources for innovative projects and activities for their business planning, which in general determines the relevance, theoretical and practical significance of the topic.

There is a connection of the organizational and economic mechanism of business planning for innovative development at the enterprise level and the corresponding mechanisms of innovative activity regulation at the state level (Noh, Siepel, Kim, 2018], which is expressed by the change in the business planning process in the company depending on the nature of organizational measures at the state level. The issues of forming a business strategy for innovation implementation were explored, they justified the expediency of innovative strategic orientation of enterprises (and, accordingly, the mechanisms of their innovative development) (Goujard, Guérin, 2018). The matrix of choice of innovations financing sources was developed in accordance with the innovative potential of the enterprise and the current demand for new products (Shishkin, 2017).

Calculation and analytical study of the structure of investment sources involves the development of methods for the effective allocation of investment resources and testing of results based on the analysis of empirical and factual information on the assessment of the contribution of innovative investment projects (IIP) to the economic development of the company. IIP is a system of interrelated goals and programs — a set of research and developmental, production and organizational, financial, commercial activities, appropriately organized, drawn up with a set of project documentation, providing an effective solution to specific scientific and technical problems. Unlike project management in general, the innovative projects management requires a deeper risk assessment and possibly venture financing (Melane-Lavado, Álvarez-Herranz, González-González, 2018).

Innovative transformation of the Russian economy is developing taking into account the conceptual directions in the world practice, which are largely influenced by the idea of increasing the innovative openness of companies) Silkina, Shevchenko, 2017, pp. 112-115).

It is possible to put forward a hypothesis about the systematic exchange of knowledge in the process of creating open innovations. The argument about the systematic exchange of knowledge in innovatively active companies was put forward by G. Chesbro, the first who divided innovations into autonomous and systemic, within the framework of the latter it is possible to create partnerships (Chesbro, Tis, 2008, pp. 176-201). The systemic nature of technological innovation involves the innovative development of related systems or products. Accordingly, it seems reasonable to centralize the management of innovation introduction, taking into account the diversity and large scale of the management object, which is cost-effective within a large corporation. In our opinion, it is the high degree of innovation process complexity that currently determines the need for systematic interaction of IIP participants (and in a broad sense — stakeholders, including IIP participants and persons under the influence of the IIP result) in the creation of open innovations. In the knowledge economy, the management structure is difficult to organize, because the hidden knowledge accumulated in the form of skills and personal achievements of experts, corporate traditions of technical culture, can not be considered separately from the individuals who bear this knowledge (employees of a particular company). For comparison: codified knowledge (specifications, recorded in industry standards and development norms) can be transferred from one organization to another within a group of companies without significant loss of information quality. In 1990, the terms "basic competence" (a combination of separate technologies and production skills that underlie the entire set of the company's product lines) and "ability to adapt and learn" (the ability to manage dealers through training and support their dealer network, sales, space planning and maintenance, as well as the ability to create a product, manifested in a continuous and simultaneous planning and testing process, going separately from the implementation) were introduced (The Knowledge-Based Economy, 1996, p. 183-217). With the advent in the 1990s of the concepts of core competencies and competition based on the abilities, particular importance began to attach to the internal factors, in particular obtained thanks to collective learning, and management skills and abilities to drive these factors. The differences between abilities and competencies are profound: basic competence focuses on technological and production experience at specific points in the value chain and can be considered with some degree of approximation as the ability to apply technological experience (Stoke D., Evans F., Shulman L., 2009, pp. 183-217).Competencies and abilities characterize the behavioral aspects of the strategy as opposed to the traditional structural model. In our opinion, the innovative investment process can be characterized by consistency, complexity of behavioral aspects manifestation arising under the influence of IIP participants cooperation (determined by the nature of interaction "investor — innovator").

In general, the systematicity property of open innovations is dictated by the essence of the knowledge economy. The term "knowledge economy" refers to developed economies that rely directly on the production, distribution and use of knowledge and information (The Knowledge-Based Economy, 1996, p. 7). At the same time, the interactive model of innovation, caused by the interaction of producers and consumers in process of the exchange of formalized and nonformalized knowledge, replaces

the traditional linear model of innovation. In our opinion, the systematicity property of open innovations should be taken into account in the models of distribution of investment resources first and foremost in the IIP.

The model of open innovations was formed in the process of overcoming negative market trends that cause a massive reduction in the time horizons for research, development, testing & engineering expenditures (Silkina, Shevchenko, 2017). Developing the model, it is possible to propose new guidelines for the allocation of investment sources for innovative projects:

- analysis of models of interaction between investors and innovative companies, taking into account the asymmetry and unverifiability of information in the evaluation of IIP;
- a higher value of improvement of business models compared to innovation in the field of product development;
- priority of investments in applied development based on external and internal ideas (from the perspective of the company);
- investments in intelligent inventions, which are the most appropriate to the business model of the company.

As the analysis of scientific literature and practice of business planning of innovative projects in domestic enterprises shows, not enough attention is paid to the specific features of the IIP. In considering methodological approaches to project evaluation, researchers tend to focus on the methods of developing separate sections of the business plan, without affecting the numerous relationships between the results of calculations in these sections and the resulting set of iterations of the planning process and especially the selection of investment resources sources.

Currently, international standards (TACIS, KPMG, EBRD, UNIDO, BFM Group) are often used for drafting business plans, which describe universal, general methods of drawing up business plans and choosing sources of financing, but are not always able to take into account the peculiarities of the innovative idea proposed for implementation.

Innovative projects are characterized by a high degree of uncertainty at all stages of their implementation, at any time a promising novelty can appear and compete with them. Even those projects that have successfully passed the stage of introduction into production can give way to competition (Anisimov, Sviridova, 2016). In the planning process the degree of project innovativeness should be taken into account, which largely determines the depth and content of research, the measures for technical preparation of production, assessment and risks leveling, as well as requirements for the project financing structure. In the process of its development of a business plan, the initial idea of an innovative project can be transformed into a different concept, characterized by a different degree of innovation, and if the latter increases, it may require additional funding, and if it decreases, then, on the contrary, resource savings (Hop, Gyazova, 2017).

To implement this approach, it's necessary to conduct a classification correlating the degree of innovativeness and technology to which such innovation can be directed, and the possibility or necessity of introduction of new technologies at it. To classify, we propose to use a table.

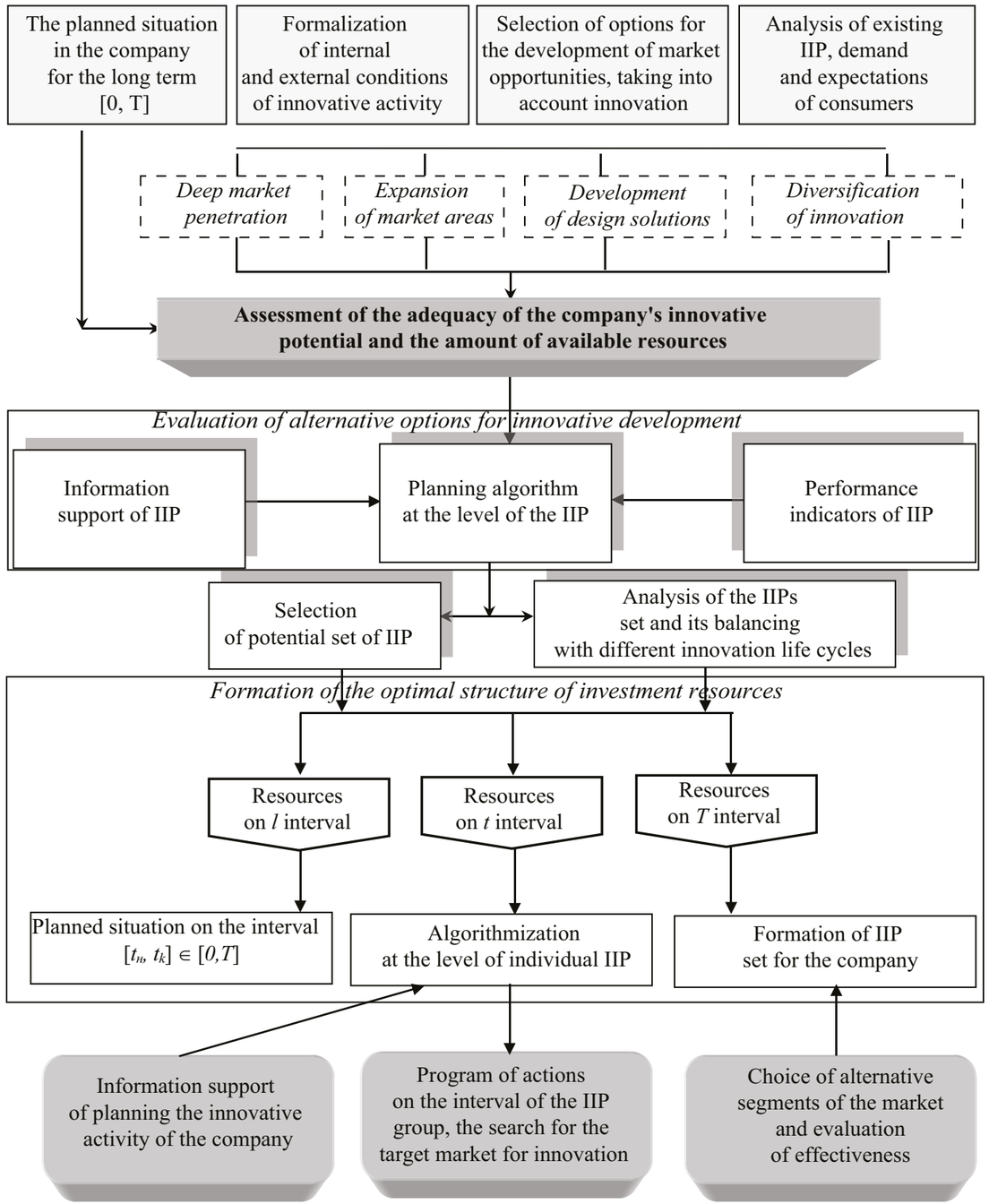
As the degree of innovativeness of the new product increases, more complex and in-depth preparation for production is required: marketing research of consumer requests; applied research; design, technological and organizational training, the selection of the necessary investment resources (5). The process of business planning requires tracking, fixing and formalization of links between diverse tasks that must be performed in the drawing of a business plan in order to reliably justify the necessary amount of financial resources (4).

In order to form a set of alternative plans for the implementation of the IIP, we introduce the basis sets:

- the set of IIPS in the amount of m, each company can potentially have IIPS from the set $A = \{A_1, A_2, \ldots, A_m\}, j \in \{1, 2, \ldots, m\}$;
- set of IIP participants (and, more broadly, stakeholders) who

Products-markets-technologies

			Market				Technology	
			Old	New			Existing	New
				New segment of old market	New for the company	Funda-mentally new		
Product	Old		Not innovative product	—	—	—	+ existing demand	+ existing specific demand
	New	For company in old segment	Modernization of the product: existing demand; existing specific demand	Modernization of the product: existing demand; existing specific demand	Modernization of the product: existing demand; existing specific demand	—	+ existing demand	+ existing specific demand
		For company in new industry	—	—	Existing demand	—	—	+
		Fundamentally new	—	—	—	New demand	—	+



A conceptual scheme of the structuring of innovative investment activity

participate directly or indirectly (s is the sequence number of the participant): $B = \{B_1, B_2, \ldots, B_s\}$, $s \in \{1, 2, \ldots, S\}$;

- the set of strategic objectives of the company (λ is the sequence number of the task) $C = \{C_1, C_2, \ldots, C_\lambda\}$, $\lambda \in \{1, 2, \ldots, \Lambda\}$.

Sets A, B, C are considered on the planning interval [0; T], divided into sets of time points t_i, i is the sequence number of the interval in which such actions should be performed D_i, where $i \in \{1, \ldots, I\}$, as the reconstruction of production, investment in innovation, investment in additional production capacity, sales promotion, etc.

A comprehensive analysis of the set of innovation projects provides an assessment from the point of view of selection the strategic positions which can be taken by the company against its competitors. For planning of IIP it is necessary to formalize information models of innovative development with structural elements: characteristics of the company, customers and competitors, evaluating the capabilities of the company, the principles of allocation of IIP implementation segments, the construction of models of innovative development and analysis of strategic information.

Based on the results of the analysis of strategic information, a variety of options for strategic plans for innovative development of the s-th company are formed using the j-th IIP: $\Delta js\lambda = \{j,s,\lambda\}$ on the planning interval [0, T], where one of the variants of the plan is a subset of the set of actions to ensure the company's entry to a new level of development $D_\Delta = \{j,s\}$ on the planning interval [0, T].

The subset $<j, s, \lambda, i, t> \{A \otimes B \otimes C \otimes D \otimes T\}$ characterizes the set of actions in the case of the IIP implementation. The decomposition of the IIP planning system can be carried out within a separate company, taking into account the requirements for the required amount of investment resources (Fig. 1).

It is advisable to consider the company as a socio-economic system, its interaction with the environment affects both the company as a whole and innovation, the properties of which change as a result of the behavior of the system in question.

The purpose of the study of the system environment is to develop ways of interaction of the company with persons interested in its development, to optimize the material and financial flow of the corporation (Barykin, 2007). In order to achieve the main goal of the company's investments in innovative technologies and products – insurance of the profitability in the long term, cash flows are of paramount importance (Kovalev, 2007).

Known models of cash reserve calculation, as a rule, do not take into account the possibility of attracting investment resources from various sources. Let's consider the possibility of attracting a certain amount of investment resources K_i, rubles from the investor i despite the fact that the total amount of resources from the i-th source at the rate of return R_i per day (recalculated in the formula by the number of days T) is equal to G_i. The investor is paid a certain percentage of the investment, RUB:

$$\sum_{i=1}^{N} TR_i K_i \le B. \quad (1)$$

The cost of attracting resources contain permanent b_{fi}, RUB per transaction, for example at the sale of the securities to the investor. The number of transactions to attract resources from the i-th Q_i source is equal to:

$$Q_i = G_i / K_i. \quad (2)$$

Consequently, the total cost of attracting financial resources are equal:

$$F_{\text{пр.д}} = \sum_{i=1}^{N} b_{fi} \frac{G_i}{K_i}. \quad (3)$$

The investor's income:

$$F_д = \sum_{i=1}^{N} \frac{R_i K_i}{2}. \quad (4)$$

Therefore, the full costs F, including the cost of raising funds and the income of the investor, will be equal to:

$$F = F_д + F_{\text{пр.д}} = \sum_{i=1}^{N} \frac{R_i K_i}{2} + \sum_{i=1}^{N} b_{fi} \frac{G_i}{K_i}. \quad (5)$$

ДТо calculate the optimal values of K_i we use the Lagrange multiplier method. The original equation — the Lagrange function — is to be written as follows:

$$F = \sum_{i=1}^{N} \frac{TR_i K_i}{2} + \sum_{i=1}^{N} b_{fi} \frac{G_i}{K_i} + \sum_{i=1}^{N} b_{vi} G_i + z\left(B - \sum_{i=1}^{N} TR_i K_i\right), \quad (6)$$

where z is an undetermined Lagrange multiplier.

Optimal values of K_i are calculated as solutions of a system including equations of the type:

$$\frac{\partial F}{\partial K_i} = 0; \frac{\partial F}{\partial z} = 0.$$

Differentiating (6) by K_i, we have: $\frac{R_i}{2} - b_{fi} \frac{G_i}{K_i^2} - zTR_i = 0$. (7)

After conversion, finding the optimal size of investments $K_{i\text{опт}}$:

$$K_{i\text{опт}} = \sqrt{\frac{2G_i b_{fi}}{TR_i(1-2z)}}. \quad (8)$$

To determine the z Lagrange multiplier let's consider the equation:

$$\frac{\partial F}{\partial z} = B - \sum_{i=1}^{N} TR_i K_i = 0. \quad (9)$$

Substituting in (9) the values of $K_{i\text{опт}}$, we obtain:

$$B - \sum_{i=1}^{N} \sqrt{\frac{2G_i b_{fi} TR_i}{(1-2z)}} = 0. \quad (10)$$

From here we find the value of the z Lagrange multiplier:

$$z = \frac{B^2 - \left(\sum_{i=1}^{N} \sqrt{2G_i b_{fi} TR_i}\right)^2}{2B^2}. \quad (11)$$

Next, we determine the frequency of Q_i replenishment from the i-th source:

$$Q_i = G_i / K_i. \quad (12)$$

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Example

Let's say that the company has the opportunity to attract three investors at the following interest rates: $R_1 = 18\%$; $R_2 = 16\%$; $R_3 = 3.65\%$ per year. During the planning period, the company plans to attract the Total amount of financial resources of G_i from i-th source: $G_1 = 419\ 648$; $G_2 = 284\ 930$; $G_3 = 455\ 968$ rubles. Fixed costs for the operation to raise funds are equal: $b_{f1} = 20.7$; $b_{f2} = 50$; $b_{f3} = 18.2$ thousand rubles for each operation.

We will determine the optimal amount of investment security from various sources, the amount of all interest payments during the year is limited to 50 000 thousand rubles.

After calculations, we obtain the optimal size of investments $K_{i\text{опт}}$: $K_1 = 104\ 912$; $K_2 = 142\ 465$; $K_3 = 227\ 984$ thousand rubles From the first source in the amount of K_1 investments are received four times, and from the second K_2 and from the third K_3 two times. The Lagrange z multiplier is 0,4954. The maximum income of investors is 740 713.2 thousand rubles.

Most of the researchers do not take into account the participation of financial resources in innovation activity, the methods of optimizing the relationship between internal and external resources of the enterprise engaged in innovation activity are not clearly defined.

Sources of investment in innovative projects can be:

- bond issue on the stock market;
- raising debt funds from financial institutions;
- additional stock issue (if the company is a public joint stock company);
- attraction of investments using crowdfunding platforms;
- attraction of investments from friendly companies.

For example, a producer of innovative products depends on the market price of flour, he needs investment in the development of software to predict the price of raw materials. In practice, the prices of finished products depend on the prices of raw materials. It is possible to attract additional friendly investors, such as a network of consumers who can buy products from intermediaries, and several companies invest their shares of the necessary investment in the development of raw materials.

Structure formation of the investment sources in innovation covers:

- structuring of internal funding sources;
- attraction of external sources of financing.

We can combine the two directions into the economic and mathematical model and consider the search for foreign investors. A similar problem is considered in relation to the calculation of the cash reserve (Shcherbakov, Barykin, 2018). The developed model allows to determine the size of the investment support of innovative investment projects of the company at the expense of attracted funds from various investors, taking into account the restrictions on the income paid to the investor.

Thus, the proposed conceptual scheme of structuring innovative investment activity allows to develop a model for calculating the cash reserve, taking into account the possibility of attraction of investment resources of different sources. The decomposition of the system of business planning of the innovative project, considered in the article, allows to minimize the risk of exclusion from the analysis of important factors of the innovative project; to provide the analysis of alternative solutions (in each section of the business plan) depending on the complex assessments of their impact on the final result; to quickly manage the process of developing the business plan and monitor the progress of work, and consequently, to increase the reliability and validity of the business idea for the implementation and implementation of the innovative investment project.

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ABOUT THE AUTHORS

Snezhana V. Firova
Candidate for a degree, Institute of Industrial Management, Economics and Trade, Peter the Great St. Petersburg Polytechnic University.
Research interests: human capital management, innovative approaches to management.
✉ E-mail: sv.firova@bk.ru

Olga V. Kalinina
Doctor of Economics, Professor of the Graduate School of Service and Trade, Peter the Great St. Petersburg Polytechnic University.
Research interests: human capital management, innovative approaches to management.
E-mail: olgakalinina@bk.ru

Sergei E. Barykin
Doctor of Economics, Associate Professor, Professor, Department of International Economics, Saint-Petersburg State marine technical University.
E-mail: sbe@list.ru