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Methodology of Financial Research by Stages of Innovation Process

Abstract. The article deals with issues related to the peculiarities of the methodology of conducting financial research at the stages of innovation process. Important in the author's approach is the formulation of the problem of forming a certain set of research methods for the stages of innovation process from the standpoint of financial results. The following methods were used in the research: dialectical method and methods of analysis and synthesis, methods of comparison and generalisations, structural and logical analysis. To achieve the set goal, namely, to determine the composition of research methods of innovation process by stages, each of which has its own specificity and may require a unique set of methods, a comparative analysis of interrelated research objects, which are the innovation process, the life cycle of the product (products, services, objects) and scientific and technical preparation of production. For the studied object – the innovation process – an analysis was made and two main research subjects, certain stages of the innovation process, were distinguished: fundamental and applied research. Complexes of research methods were formed for each of them for the first time in order to determine financial goals and objectives. It is proposed to consider the determination of the maximum amount of budget expenditures for the implementation of innovative processes as a financial goal of the research of objects of fundamental and applied research. A matrix of complexes of research methods for the stages of the innovation process with expected tasks and results of financial activity was formed. The conclusions obtained as a result of the research can be useful in practices of employees of research institutions and organisations, graduate students and students of higher educational institutions researching the problems of innovative development and implementing the stages of the innovation process

Keywords: research methods of the stages of innovation process, product life cycle, scientific and technical preparation of production, financial goals of research, questions of financial activity research

INTRODUCTION

Methodology is important for any activity. After all, it is the methodology that determines the course of the process and ultimately the result of the activity. The methodology is mentioned mainly in connection with the implementation of certain studies, as research activities require the definition of the necessary set of methods. From the chosen set of research methods depends not only the content and outcome of the process of studying a problem. The set of methods affects the composition of the research team, which can be sufficiently qualified from the standpoint of problem statement, its differentiation into research components, as well as competency to make responsible decisions

for the content and sequence of research adjustment. Thus, the methodology through a number of factors of objective and subjective nature affects the research process, its objectivity and impartiality, the final result of the study.

Recently, methodological issues are largely covered in the educational literature. The search showed a small number of publications on methodology in periodicals devoted to current pressing issues of socio-economic activity [1-3]. To some extent, classical works have exhausted the problematic issues of purely methodological research [4; 5]. Finding new common ground between methodological research is not attractive at this time, given the desire of researchers to

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work on topics that focus more on practical issues that allow them to apply for grants from corporations. Fundamental research of a theoretical nature is inferior to applied research.

Instead, attention to methodological issues should be continuous. Only from methodological principles it is possible to correctly assess the situation in business, in the financial condition of territorial communities, in the budget sphere. Research on financial relations of economic entities in the financial and credit, tax spheres should be based on well-developed, sound methods. Changes in the development of the economy, its focus on innovative projects and programs pose new challenges for researchers. In turn, researchers set scientists the task of developing effective methods of research. This means the need to turn to the principles of methodology, to new searches for such sets of already known research methods that will best meet modern demands.

One such request is financial research of the stages of the innovation process. The fact is that there have been significant changes in the economy and society recently. At the same time, these changes are global in nature and have a significant impact on the economies of all regions: Asia, Africa, North and South America, Europe and, of course, Ukraine.

Implementing a number of reforms in Ukraine, including administrative-territorial [6-8], now requires a different approach to regional finance. The finances of local communities completely depend on the success of business structures located on their territory and fill the budget with their taxes. Thus, the efficiency of enterprises to some extent depends on the right actions to sell products, and this is influenced by innovation. Achieving a positive result requires appropriate new technologies, new product designs, compliance with not only economic but also environmental requirements. Everything affects the success, the achievement of which is possible with well-constructed research, taking into account the desired and expected financial results. This requires an appropriate methodological framework for financial research of innovation processes.

Quite a number of publications have been devoted to the study of methodology problems. Mostly researchers consider these problems from a philosophical, general scientific point of view. Thus, scientists N.J. Dewasiri et al. [1] conducted a study that reveals the rationale and types of projects for the application of mixed methods approaches in financial research using the approach of systematic review of the literature. J.F. Molina-Azorin et al. [9] describe the possibilities and problems of research of mixed methods in organisational sciences. There are also publications on certain aspects of methodology, in which the authors consider certain subject areas, or special research methods. In particular, researchers S. Galletta et al. [2] focus on bibliometric analysis in the context of ESG performance identification in the banking industry. Y.L. Becker & M.R. Reinganum investigate quantitative equity investing and methodology for assessing its current condition [3].

The research of C. Hampshire [10] is also interesting. The aim of his study is to examine the understanding of

consumers from the UK on building trust and potential risks of mobile payments using several mixed methods.

Identifying the methodological basis is also deeply studied by scientists in the context of studying the patterns of the process of sustainable transformation. For example, the aim of the study of L. Chithambo & V. Tauringana [11] is to identify the influence of corporate governance mechanisms (board size, non-executive directors, concentration of ownership and shareholder action) on the level of greenhouse gases (GHG).

Instead, regarding the methodology of financial research, it should be noted a limited number of such works [12; 13]. And the number of works regarding the methodology of financial research of certain subject areas is still very small. In particular, there are no studies of such a subject area as “stages of the innovation process”.

Researching the field of innovative development of enterprises, scientists focus more on the concepts of innovation and applied aspects of innovation [14; 15]. Instead, it is important to study the methodological fundamentals of the formation of processes, particularly in the study of innovation.

The purpose of the article is to identify the peculiarities of the methodology of financial research at the stages of the innovation process, outline the composition of research methods of the innovation process by stages.

MATERIALS AND METHODS

The methodological approach is determined, to a large extent, by the purpose of the study. Thus, the purpose of our study is to identify the composition of research methods of the innovation process by stages, since each of the stages has its own specificity and may require an original set of methods.

Achieving the set goal requires consistent consideration, at least conceptually, of the composition and features of the stages of the innovation process. The sequence and composition of the stages of the innovation process are well known and recognized. Instead, there are alternative views on this issue, which requires us to note in our study what stages we are considering. Regarding the characteristics of these stages, this aspect of our study is extremely important, because such characteristics are the basis for choosing research methods for each stage. It should be emphasised that the research methods of each stage of the innovation process are aimed at obtaining answers from a financial point of view. This is important for investors, for creditors, for business owners who are borrowers of financial resources and guarantors of their return, payback, high level of profitability.

It is important to make a clear distinction from the outset between innovation process (IP) research and research of the life cycle of the product (goods, services, object – enterprise) (LCP) and scientific and technical preparation of production (STPP) as objects of scientific financial research.

This distinction is intended to clearly define the objectives for each of these objects. It is also worth noting that we take the stages of the innovation process as the subject of our research. These are the ascending axioms of our study.

The methodological and source base of the study are domestic norms and legislation on the peculiarities of the transformation of the financial sector in Ukraine [6; 7], the implementation of reforms at the state and regional levels [8]. The research materials are also based on identification of general scientific research methods, as well as the separation of research methodology in specific areas of economics in order to identify opportunities for the development of research methods in terms of financial relations. The criterion for selecting information for the study of research methods in finance was to determine the research methodology of innovation process with the aim of forming a methodological base in view of the need for financial support for R&D.

During the research the following methods were used: dialectical method and methods of analysis and synthesis – to study the peculiarities of identifying financial goals and objectives by objects and corresponding subjects of financial research; comparison and generalisation methods – analysis of the use of research methods at different stages of innovation process in the relevant applied fields; structural and logical analysis – forming the complexes of research methods of innovation process stages with the supposed tasks and results of financial activity.

RESULTS AND DISCUSSION

The research methodology involves defining the problem and the order of its study, dividing the problem into constituent issues and substantiating the methods of solving problems and, as a final desired result, solving the problem in general. In our study, such a sequence means, first, the innovation process studying according to the known division into stages. It is worth paying attention to the differences between IP as an object of study from such objects as LCP and STPP. Secondly, the need to outline the key features of each stage of the innovation process that directly influences the choice of research methods. Third, determining the composition of research methods for each stage of the innovation process.

So, as for the problem itself, it is determined based on the needs of practical activities. The problem is usually formulated by practitioners based on work experience and the need to solve specific tasks. In the theory of innovation, this approach is called the “demand pull” hypothesis. Another approach – the hypothesis of “technological push” is based on the logic of science, on the autonomy of this development [4; 5]. Therefore, quite often theorists formulate the problem based on a sequence of logical or mathematical dependencies, and even intuitively. The formulation of the problem “methodology of financial research at the stages of the innovation

process” is caused by research needs in the field of innovation development. However, there are also practical needs to address these issues. They are determined by the problems of sustainable development, circular economy in the context of accelerated implementation of innovative projects, products, restructuring of enterprises and entire industries. This requires a meticulous and sufficiently qualified assessment of financial needs and associated risks, as noted by the authors of publications [16; 17]. Research on innovation processes in terms of sustainable development and transformation now constitute a whole new layer of research [18; 19], as they highlight the principles of scientific and technical work in the context of ensuring the transition of countries to the principles of sustainable development [20-22]. The works of scientists are devoted to this issue [23-25].

There is no need to search for special approaches or methods to divide the selected problem into constituent parts in the context of study as the stages of the innovation process are generally recognised [26; 27]. However, the need for clarifying the difference between the objects of research: “innovation process”, “LCP” and “STPP” remains unresolved. Consider their differences as objects of financial research.

Proper identification of the object and subject of research is an important aspect of financial research. From these perspectives, current review of financial research methodology requires the separation of these objects from each other. Innovation process, product life cycle (goods, services, object, including innovation), and scientific and technical preparation of production have their components, structures, cyclical implementation.

In the context of research, an important step in considering the product life cycle was the publication of N. Kurgan and J. Volkovska on the calculation of the cost of a new type of product by stages of the life cycle in the system of management accounting [13]. From a methodological point of view, it is important to identify research questions and try to solve the problem of estimating the cost of work at each stage of the product life cycle. We do not set the task of considering the cost of estimating the stages of LCP. From the standpoint of study, the emergence of scientific and practical work is important, the purpose of which is to assess the value of each stage in multi-stage processes. After all, study is also devoted to the attempt to form certain sets of methods for evaluating certain stages of the multi-stage innovation process.

Scientific and technical preparation of production (STPP) is sufficiently researched and includes generally accepted components: scientific preparation, economic preparation, design and technological preparation, organisational preparation.

The study of the components of each of the objects is the study of certain objects, smaller in content than the object. Each object and each subject of research has its own purpose and/or task. This methodological approach can be represented in Table 1.

Table 1. Financial goals and objectives by objects and corresponding subjects of financial research

| Objects of basic and applied research | Subjects of basic and applied research | Financial objectives of basic and applied research | Goals of financial research in basic and applied research |
|--|--|---|---|
| Innovation process (IP) | Basic research; Applied research; Experimental production; Testing of prototypes; Initial serial production; Diffusion (spread) | Determining the maximum amount of budget expenditures for the implementation of IP | Determining the amount of expenditures from state programs for the development of the national economy at individual stages of IP |
| Product life cycle (LCP) | Development; Introduction stage; Growth stage; Maturity stage or sustainable production (use) of the product; Decline of consumption (use) and production of the product; Product disposal | Determining the deadline for product production in order to avoid losses and bankruptcy | Determining the amount of costs for individual stages of LCP and comparing their total value with potential income before the decline |
| Scientific and technical preparation of production (STPP) | Scientific preparation; Economic preparation; Design and technological preparation; Organisational preparation | Determining the maximum cost of STPP | Determining the amount of costs for individual stages of STPP |

Source: own research

It is common knowledge that the innovation process includes the process of scientific and technical preparation of production with the following stages of innovation, and at the end of the product life cycle (product, service, object) stage of utilisation of tangible elements of technology used.

Scientific and technical preparation is a process that is implemented directly at the enterprise. The services of the enterprise are carried out either independently or through outsourcing, on a cooperative basis with other enterprises and organisations, the processes of scientific and design and technological preparation of production. Regarding economic and organisational preparation, the company's services must independently assess and plan all stages of STPP, including assessing the necessary financial resources for outsourcing.

The product life cycle is of great importance for understanding the prospects of production of goods, provision of services, establishment of the enterprise. Therefore, the marketing department of the company must forecast the appropriate periods of growth and sustainable production to obtain maximum revenue from the sale of each product. Timely determination of the moment of the beginning of decline should help to avoid unprofitability of production of a separate product and to prevent bankruptcy of the enterprise. These requirements determine the deadline for the production of specific products in diversified enterprises.

The innovation process is quite broad and we should not talk only about the level of the enterprise. The innovation process covers enterprises of a certain type of economic activity – industry, and therefore at the same time affects the economy of the region and the state and is influenced

by regional and state authorities and management. In particular, basic and applied research have such an affect. After all, even world-class corporations often use the financial resources of the state and relevant powerful research institutions to obtain the necessary scientific results for innovative development. This explains why budget funding is important for the innovation process implementating. At the same time, depending on the priorities, financial resources can be attracted from state or local budgets. However, as our previous research on this issue shows, it is unlikely that such funding from a single local community will be directed. Rather, this applies to the regional budget.

We directly study the innovation process. Taknig into account the importance of budget funding, only a comprehensive approach to studying the preconditions for this process will allow one to choose the right version of state economic policy for a particular type of economic activity. The best option of economic policy is the basis of effective production, implementation of the production process, and then its termination and utilisation of technological means, which will contribute to economic efficiency at all stages of the life cycle, both products and enterprises. Only a comprehensive analysis, study of the features of each stage will allow to obtain the right, economically and environmentally sound technical and organisational solutions that will meet the principles of the circular economy and sustainable development in the region and country.

From the point of view of investors, the financial aspects of the innovation process are important. It is clear that the sale of products or services should bring the appropriate financial result. As a rule, the answer to the question

of the feasibility of production and sale of products (services) is given by marketing research. They relate to the consumer needs of individual markets, the volume of production of certain modifications of goods, the peculiarities of service provision and many other aspects. Comparing the potential results of future sales with the costs of preparation and implementation of the production process provides answers to questions about the effectiveness of investing, investing in a particular innovation project.

Instead, the evaluation of individual stages of the innovation process remains an important issue. After all, investing begins with basic research, continues with applied research, research production, testing of prototypes, which requires a long period and significant funds. For example, the requirement of clinical trials, pharmaceutical industry is characterised as complex, time-consuming and financially costly. It is also necessary to emphasise the need in a number of cases of parallel development of technologies of basic processes and research of technological processes of future utilisation of used products, materials, structural elements of technological equipment and facilities. An example of this is nuclear power, which has not yet developed effective and safe methods of decommissioning facilities that have expired.

This requires the choice of certain research methods that will most adequately reflect the specifics of each stage of the innovation process. Of course, the choice of research methods should be based on sound typology. In turn, the typology must be determined by objective criteria. And objectivity itself must follow from scientifically sound logic.

Let's start by defining the criteria that should serve as a typology of research methods. The logical method for determining these criteria allows us to formulate two criteria. The first criterion is the adequacy of the group's reflection of research methods of a particular activity, including the above mentioned components, namely: basic and applied research, experimental development (experimental production and testing of prototypes), initial mass production, diffusion (distribution). Analysis of the nature of these components of the innovation process for the choice of methods for their study allows us to conclude about some technological similarities between experimental and initial mass production. To some extent, these productions repeat the versions of applied research, where they develop, improve and test technological techniques and processes. Thus, we conclude about the possibility of the application of the same set of research methods for applied research, experimental production and testing of prototypes (experimental developments), as well as the initial serial production.

Diffusion can be considered somewhat separately. If we consider this process in terms of the transfer of waste technology to a network of corporate enterprises (including those located in different countries), the main issue will be the feasibility of scaling production. In other words, the efficiency from the point of view of the producer of more

products with reference to specific climatic conditions, aesthetic and cultural preferences of the population of a particular region. And in the case of manufacturing the means of production features not only the use of equipment, but also the environmental consequences of technology, their compliance with local standards and requirements. It is clear that marketing methods should be used to assess this situation.

The second criterion is compliance with the financial goals and objectives of the research objects of basic and applied research. Above we have substantiated and selected for such purposes the determination of the maximum amount of budget expenditures for the innovation process implementing and the determination of expenditures on state programs for the development of the national economy at individual stages of this development.

Approaches have already been developed concerning the classification of sets of research methods for the needs of current financial research, based on the division of research into prospective and current, identified different areas of these types of research [12]. Using the matrix approach developed, will form the features of the typology for the the stages of the innovation process financial studying. To this end, will consider each stage in terms of the possibility and feasibility of using specific research methods.

Studying the stage of fundamental research from the point of view of funding should be based primarily on the logic of the development of a particular scientific field. Almost all possible methods should be used for this purpose. Theoretical methods are the basis of fundamental research, as they allow to formulate the axioms, hypotheses necessary for scientific activity, to make generalisations based on the results of systems analysis. Empirical methods are important from the standpoint of obtaining experimental data and the ability to further model both production and financial and economic processes. The combination of these methods will determine the directions of development and shape public policy on certain types of economic activity. On the basis of the received estimations it becomes possible to define schemes of financing of scientific activity.

Empirical methods of observation and description are important at the stages of applied research, experimental production and testing of prototypes, which allow further use of theoretical methods of generalisation and systems analysis, as well as general methods of analysis and analogy. This set of methods may allow the results of applied research to draw a conclusion about the potential effectiveness of the developed innovation in comparison with analogues of other manufacturers. Of course, it is possible to compare, provided that the information required for comparison is available in the conditions of careful protection of trade secrets by each of the competitors.

The typology of research methods of stages of the innovation process with the expected tasks and results of financial activities are shown in Table 2.

Table 2. Matrix of forming the complexes of research methods of innovation process stages with the supposed tasks and results of financial activity

| Group of methods | Research methods | Compliance of research methods | | | | | | | |
|-------------------------------------|------------------|---|---|---|---|---|---|---|--|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Empirical methods | Observations | | | | | | | | |
| | Description | | | | | | | | |
| | Comparison | | | | | | | | |
| | Experiment | | | | | | | | |
| | Modeling | | | | | | | | |
| Theoretical methods | Axiomatic | | | | | | | Basic research and, as a result, determining the state policy on a particular type of economic activity and funding schemes for scientific activities | |
| | Hypothetical | | | | | | | | |
| | Generalisations | Applied research, research production and testing of prototypes and, as a result, the opportunity to draw conclusions about the financial potential of innovation and the possibility and feasibility of financing innovation development from state or regional programs | | | | | | | |
| | System analysis | | | | | | | | |
| Theoretical general logical methods | Analysis | Applied research, research production and testing of prototypes and, as a result, the opportunity to draw conclusions about the financial potential of innovation and the possibility and feasibility of financing innovation development from state or regional programs | | | | | | | |
| | Analogy | | | | | | | | |

Source: own research

The study of publications on methodological topics, which was conducted from the standpoint of the stages of the innovation process, revealed certain “white spots” on methodological approaches. It was found, in particular, that the publications on methodology are mostly contained in the educational literature and relate mainly to general issues of a classical nature. That is, well-known interpretations of the composition, characteristics and examples of the usage of research methods are presented. Instead, there is little research that would reveal the peculiarities of the use of research methods in certain subject areas.

This situation, in our opinion, can be explained by the following circumstances. First, methodological issues, apparently, continue to be dealt with by specialists in the field of philosophy, who do not have deep enough knowledge in other areas of human activity. Secondly, at the same time, specialists from different fields of economic activity do not undertake research on methodology in their subject areas, relying entirely on the already known postulates of philosophical science. These two conclusions also apply to financial science, where methodological problems in a special sense are practically not considered. Third, complex socio-economic processes require researchers to have significant in-depth knowledge of both the subject area and the relevant methodological framework. However, there have been studies of such a complex process as the product life cycle, where the authors have studied the calculation of costs at certain stages of LCP. This is a significant step both in the practical direction to solve the problem of compiling the cost of individual works, and in the direction of the very formulation of the problem of research and cost estimation of the stages of LCP.

CONCLUSIONS

Research on the innovation process which is also complex, has certain stages, and therefore requires a special metho-

dological approach. The analysis of publications revealed different approaches and models by which the innovation process is differentiated. Researchers in comparison of these different approaches have substantiated the choice of a linear model of the innovation process that has been used by many researchers. The stages of the innovation process were considered from these positions. For the first time a set of methods for the stages of basic and applied research was formed. Instead, for the needs of the proposed methodological approach, the similarity with the applied stages of the research is substantiated experimental development (experimental production and testing of prototypes), the initial mass production. Also for the first time it is proposed to consider the definition of the maximum amount of budget expenditures for the implementation of innovation processes as a financial goal of the study of basic and applied research. And as a task of financial research of basic and applied researches it is offered to define volumes of expenses of the state programs of development of national economy at separate stages of innovation process.

The matrix of forming the complexes of research methods of innovation process stages with the supposed tasks and results of financial activity formed for the first time has allowed to specify set of methods of research of basic and applied researches. The result of basic research should be the definition of state policy on a particular type of economic activity and funding schemes for scientific activities. And the result of applied research should be the ability to conclude about the financial potential of innovation and the possibility and feasibility of financing innovation development from state or regional programs.

The publication of results can be useful for researching the problems of innovation development, the implementation of stages of the innovation process.

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Методологія фінансових досліджень за етапами інноваційного процесу

Анотація. У статті розглядаються питання, пов’язані з особливостями методології проведення фінансових досліджень на етапах інноваційного процесу. Важливою в авторському підході є постановка проблеми формування певного комплексу методів дослідження етапів інноваційного процесу з позицій фінансових результатів. У дослідженні були використані такі методи: діалектичний метод та методи аналізу та синтезу, методи порівняння та узагальнень, структурно-логічний аналіз. Для досягнення поставленої мети, а саме визначення складу методів дослідження інноваційного процесу за етапами, кожен з яких має свою специфіку і може вимагати оригінального набору методів, здійснено порівняльне аналізування взаємопов’язаних об’єктів дослідження, якими є інноваційний процес, життєвий цикл продукту (виробу, послуги, об’єкта), науково-технічна підготовка виробництва. Для досліджуваного об’єкта – інноваційного процесу, – зроблено аналіз і виокремлено два головних предмети дослідження, якими є певні етапи інноваційного процесу: фундаментальні і прикладні дослідження. Для кожного з них вперше з метою визначення фінансових цілей і завдань сформовано комплекси методів дослідження. Запропоновано розглядати визначення граничного обсягу бюджетних витрат на реалізацію інноваційних процесів як фінансову ціль дослідження об’єктів фундаментальних і прикладних досліджень. Сформована матриця комплексів методів дослідження етапів інноваційного процесу з передбачуваними завданнями та результатами фінансової діяльності. Отримані за результатами дослідження висновки можуть бути корисними для практичних працівників дослідних установ та організацій, аспірантів і студентів закладів вищої освіти при дослідженнях проблем інноваційного розвитку, реалізації етапів інноваційного процесу

Ключові слова: методи дослідження етапів інноваційного процесу, життєвий цикл продукту, науково-технічна підготовка виробництва, фінансові цілі дослідження, питання дослідження фінансової діяльності