DOI: https://doi.org/10.33216/2222-3428-2023-24-16
UDC 005.4: 001.89

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MODEL OF PROJECT-ORIENTED MANAGEMENT OF SCIENTIFIC ACTIVITY OF HIGHER EDUCATION INSTITUTIONS WITHIN INNOVATIVE PROGRAMS

It is proved that there is an effective socioeconomic development driver of the state considering carrying out the innovative activity. It is the implementation of the research project products into practice with the commercialization of the scientific results. The reasons for the negative trends in the commercialization of the results of research projects in Ukraine are the lack of funding and the organizational reason. It is impossible to achieve results in the field of scientific research and their introduction into production without changing the management system of research activities of higher education based on the use of a scientifically based methodology of project-oriented management. The purpose of the article is to develop a model of project-oriented management of scientific activities of higher education in the implementation of innovative programs. The subject of the research is the methods and models of managing research projects within the framework of innovative programs for the development of higher education. The following research tasks will be set: analysis of the world and national experience in the implementation of innovative activities with the identification of the scientific component, determination of the role of higher education institutions in the implementation of research projects, identification of participants involved in innovative activities, development of a conceptual model of project-oriented management of higher education in the framework of the innovative programs. Results – based on the analysis of global and national trends in the development of innovative activities, it was found that the application of the methodology of project management of scientific activities will increase the efficiency of the commercialization of products of research projects. In the work, based on the methodology of project and program management, the concepts of research, innovative project, an innovative program and a portfolio of research projects are clarified. It is proposed to use the triple helix model in the implementation of innovative programs through the complex interaction of the university, business structures and government bodies, considering the strategic goals of each stakeholder. It is proposed to consider the scientific activity of higher education as the implementation of a portfolio of research projects, which made it possible to develop a conceptual model of project-oriented management of the scientific activity of the university within innovative programs.
Keywords: *research project, innovative program, higher education institutions, portfolio of research projects*

Research relevance. An analysis of numerous studies conducted by domestic and foreign experts showed that the main driver of the socioeconomic development of society is innovation.

At the international level, the governments of almost all countries of Western Europe have formed the structural elements and mechanisms of innovation policy, as well as adopted programs to stimulate and develop innovation, aimed at disseminating innovation both at the national and global levels.

An effective atmosphere for innovative development has been created in Germany, France, UK, which allowed them to become leaders in innovative development in Europe.

In the states that are leaders in the innovation sphere, there are the largest financial flows and a significant concentration of the most profitable industries for the production of innovative products with the highest value-added content in the price of the innovative product. The technological cycle of environmentally intensive and resource-intensive production of innovative products or projects is taken out of the state.

The relevance of the study is determined by the intensification of scientific research, the development of the latest innovative technologies, the development of world markets for innovative products of research projects and international cooperation considering the interaction between science and business, which becomes a strategic model of economic growth for the state.

Problem setting. The interaction of stakeholders in the implementation of research projects according to the University-State-Business model determines the effectiveness of economic growth.

There are three important properties of the research project [1]:

– scientific and technical novelty;

– industrial applicability;

– commercial feasibility (the ability to satisfy market demand and bring profit to the manufacturer).

The absence of any of them negatively affects the research results of universities and the benefits for the state and business structures.

Insufficient research into the implementation of project management methods for scientific activities of higher education institutions requires the development of effective models for managing research projects at universities considering possible risks that may arise at all stages of the project life cycle, as part of the implementation of innovative programs for the development of scientific activities with the effective interaction of all its participants.

State programs to reform the system of financing and management of research and technical activities do not sufficiently consider the real situation in Ukrainian science and the role of universities in it, which occupy a leading position among scientific organizations and determine the development of research in Ukraine. Despite this, the programs do not fully provide for the development of the university sector of science.

Theoretical analysis of research. There are a lot of definitions in the scientific literature of innovation. It is defined as the transformation of potential scientific and technological progress into real, embodied in new products and technologies [2-5]. There are many definitions of the concept of innovation in the literature.

Each project is an innovation, and innovation for the majority is an inconvenience and a threat to yesterday's success. Innovation is the result of innovative activity, which has been implemented in the form of a new or improved product. Therefore, before the implementation of the project, it is necessary to enlist the support of a top manager and analyze who are the key project managers, and whether these people have the necessary competencies [6].

Innovation is a change in the course of which a new experience, a new state of the system, and a new paradigm of management and development are formed [7].

Innovation is a process of change characterized by the creation of measurable value. The state of the system in which the innovation is implemented is characterized by a high degree of uncertainty, so it is necessary to correlate the risks with the benefits that can be obtained as a result of implementation [8].

Innovative projects are projects implemented in a poorly formalized environment and characterized by a high degree of uncertainty. The distinctive features of innovative projects are multicriteria, novelty, competitiveness, priority, and value [9-12].

Foreign scientists refer to the following provisions to the factors of competitiveness of universities. L. Armstrong refers to the factors of competitiveness of higher education the close connection between scientific research and teaching, the institutional excellence of a university institution, an effective system for managing organizational changes and the development of a modern system of distance learning for students [13].

J. Lombardi believes that a high level of internal academic quality in universities is achieved by developing an effective management system and attracting the best professors, researchers and talented students [14].

Take recognizes that ensuring the research competitiveness of universities is possible by attracting state funds (grants) for research and investing in the development of university infrastructure (libraries and information systems, modern computer networks, etc.) [15].

Other scientists consider as factors of competitiveness of universities their belonging to a group of countries with the world's dominant educational and scientific systems, the availability of sufficient resources and a better international reputation in comparison with other institutions, the experience gained in successful international activities in the field of education and science, the supporting role of the state in attracting foreign professors and students[16], high-performance activities in the field of research and attracting talented students by universities[17].

The issue of considering risks affecting the activities of higher education institutions, including the implementation of research projects during the introduction of martial law, was studied in [18].

As for the development of innovative mechanisms for the implementation of social interaction between participants in state projects, these issues are considered in [19]. Trends in the sustainable development of various areas of regional development, including the scientific and innovative components, are reflected in the works [20, 21].

In recent years, many countries have been using forms of stimulating innovation, consisting of financing and taxing high-risk projects, contractual research with global companies, and allocating funds to maintain the material and technical base of production [22-25].

In Germany, they are called "indirect specific assistance" - a combination of direct and indirect state support for innovative companies participating in the implementation of state scientific and technical programs [26].

The issues of application of the project risk-based approach in the management of scientific activities of higher education institutions in the implementation of innovative programs are covered in the works [27-30].

The purpose of the article is to develop a model of project-oriented management of scientific activities of higher education within innovative programs.

The objectives of the research consist of an analysis of international and national trends in the development of innovation activity, a study of the role of universities in the implementation of innovative programs, the identification of stakeholders of innovative programs, the development of a model for managing university research projects, taking into account the interaction of all participants in innovation activity at the level of higher education, government and business. -structures.

Presentation of the main material of research. There are three main models of state management of the innovative development of the state economic system: American, European and Asian [31].

The main idea of the American model (Fig. 1, 2) is to ensure the country's ability to translate innovations into highly competitive goods and services, thanks to:

– creating a favorable tax environment;

– long-term state support for research and development work in advanced areas of science and technology;

– formation of an experienced partner for the expansion of production and commercialization of industrial innovations;

– creating a favorable investment climate for enhancing the innovative activity of business structures;

– formation of industrial clusters and stimulation of the development of venture entrepreneurship, etc.

If we characterize the US innovation system as a whole, we should dwell on the decisive role of universities.

The American model of innovative development provides for comprehensive work for the result of about 150 universities. A lot of US universities rank first in world rankings because the bulk of research is concentrated there.

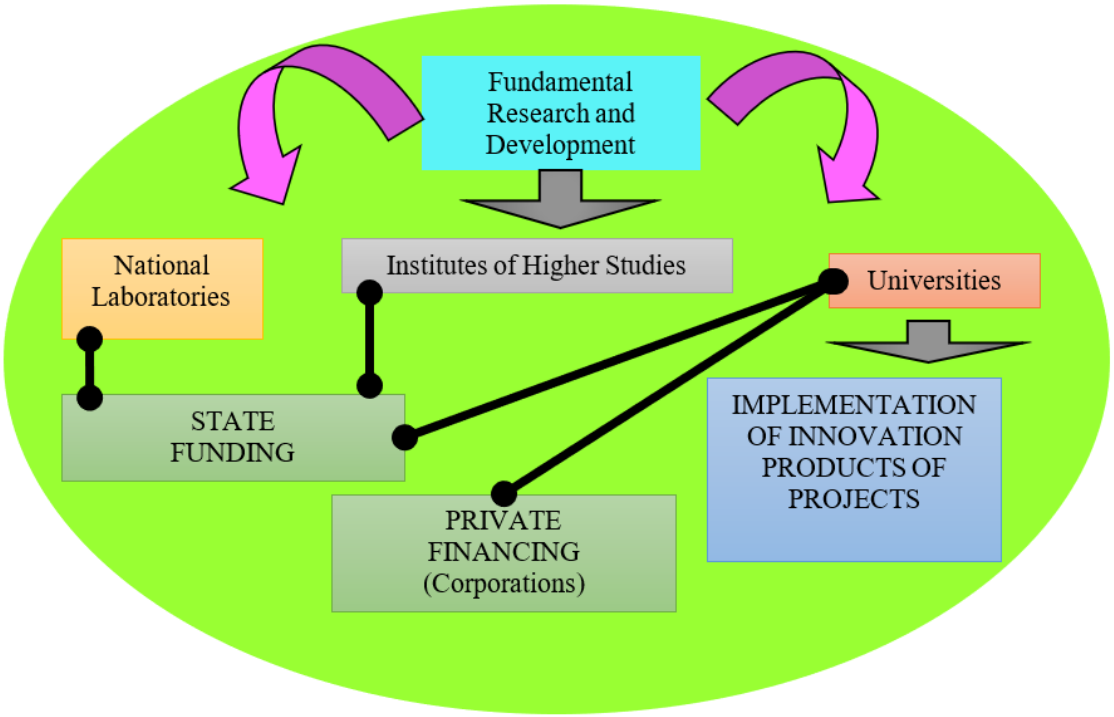

Figure 1 - The American Model of innovation development (Fundamental Research)

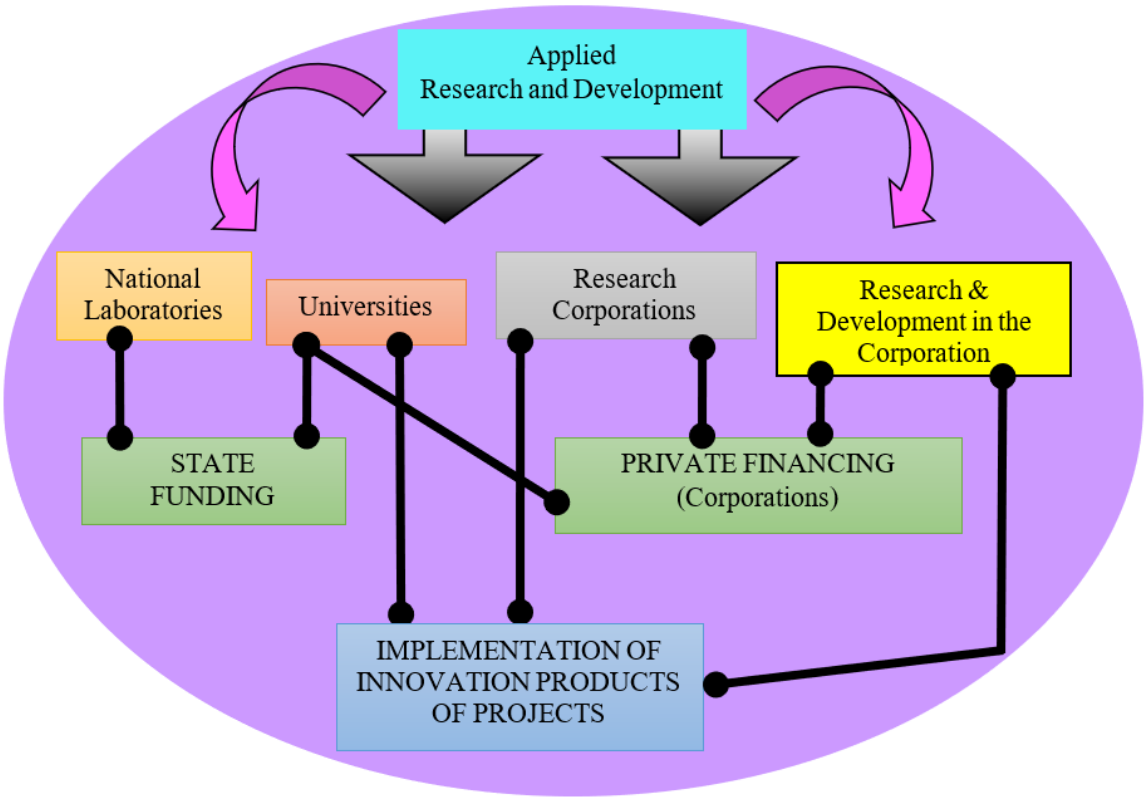

Figure 2 - The American Model of innovation development (Applied Research)

Technology transfer in the United States is carried out by creating large research units within companies, and universities also introduce innovations into production with the help of venture capital companies.

In the United States, the most important long-term strategic socio-economic priority is the implementation of a scientific and technological policy that provides support for basic research and the transfer of technologies to production, as well as the regulation of ownership of innovations.

There is one of the effective ways to solve this problem that consists of the acceleration the development of the research sphere using the project and program-target method.

The creation in the United States of the Silicon Valley high-tech center at Stanford University, which unites key American corporations specializing in modern electronic and information technologies is an example of the effective carrying out the innovative project.

The European model (Fig. 3) is aimed at ensuring the ability of society to generate highly innovative activity to improve the quality of life through the use of state guarantees for the assimilation of a new innovative culture by society as a strategic resource for the development of the economic system, the formation of a flexible system of support for small and medium-sized enterprises by stimulating the development of venture entrepreneurship, the spread of microcredit, the creation of business incubators, the expansion of budget allocations for the development of innovative business activities and the reduction of taxes on innovative investments[32].

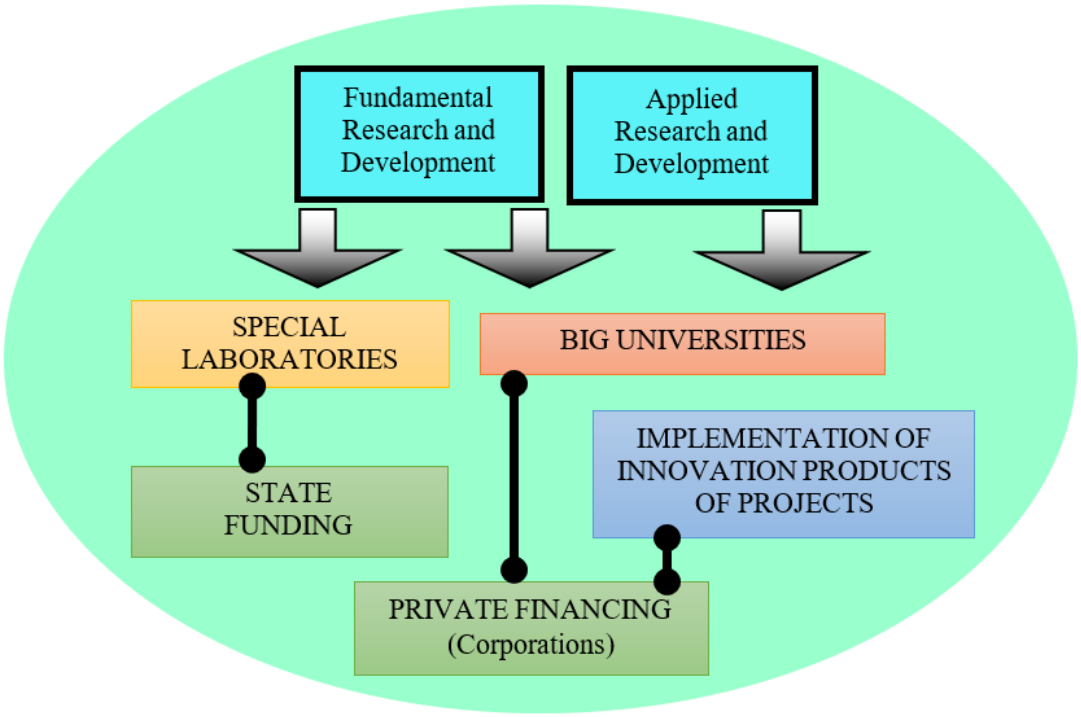

Figure 3 - European Model of innovative development

In the European model, a high level of development of fundamental science is traced and financed in the overwhelming majority by state bodies.

In every country, some universities can solve a certain scientific problem, depending on their specialization.

The level of development of fundamental research makes it possible to have a high level of research and educational activity in universities, providing training of highly qualified personnel with constant interaction between the international scientific elite and talented youth of the countries in which these institutions are located.

Applied research is carried out in most projects through grants and joint projects with large transnational corporations, and small and medium-sized businesses.

In many European countries, there are so-called "research and production incubators" or "business incubators". In such incubators, future commercially attractive inventions go from an idea to the manufacture of competitive products that are in high demand on the world market.

These incubators combine universities, research and production centers, lawyers and managers, and venture capital firms into a single link. The main form of providing budgetary funds is the provision of gratuitous subsidies and grants for pilot projects on a competitive basis.

The Asian model (Fig. 4) is focused on choosing the most effective technologies for obtaining high economic results in the national and world markets due to: the stimulation of export-oriented innovation activities, subsidizing national exporters, providing tax incentives, implementing targeted development programs with fairly strict control of foreign capital by the state [33].

The research role of universities is less important compared to the role of research laboratories of the largest Japanese corporations because the country's national innovation system is not largely focused on fundamental knowledge.

The American model is focused on creating favorable conditions for mutually beneficial contacts between business entities in the course of building their innovative potential.

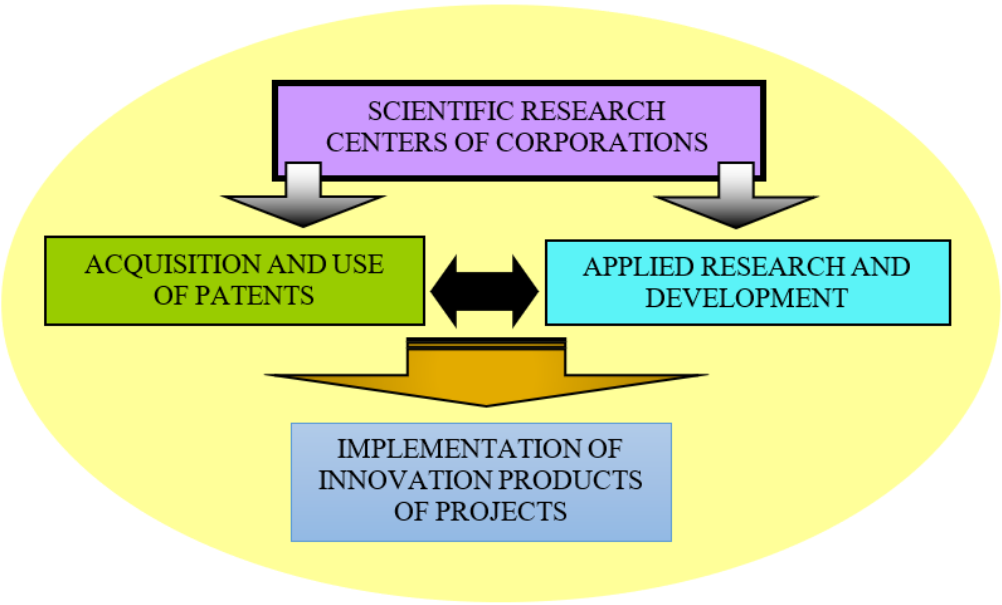

Figure 4 - Asian Model of innovation development

At the same time, the European and Asian models emphasize the direct participation of the state in the innovation process, which acts as an active financial partner and influences (within the European model) the formation of the intellectual component of small innovative potentials.

The fundamental basis of the conceptual model for managing the scientific activities of institutions of higher education is the methodology for managing projects, portfolios and programs, according to which the scientific activities of higher educational institutions are implemented through the portfolio of research projects.

Let's refine the definition. A research project is a set of coordinated and managed activities implemented by higher education and aimed at obtaining new scientific results with limited time and resources.

Portfolio of research projects - a set of research projects and other works that are limited by the available resources of the higher education institution and are aimed at effectively achieving its goals.

An innovation program is a set of projects with a common goal of obtaining a socioeconomic effect from the implementation of the innovative product.

As a strategic goal of higher education, many experts recommend using the competitiveness of services provided by universities. At the international level, many world rankings take this indicator into account, but at present there is no single methodology that would allow considering all areas of higher education, providing both high-quality training of specialists and effective implementation of research activities.

In Ukraine, the use of project-oriented mechanisms of interaction between the university, the state and business in the framework of the implementation of innovative programs faces huge problems, because the state does not have the finances to create its own Silicon Valley.

It is also worth noting that funding for science in Ukraine is not enough. Currently, this factor is explained by the redirection of funds from the state budget of Ukraine to the needs of military units in connection with martial law in Ukraine.

There is quite an important scientific potential for Ukrainian researchers who can effectively solve urgent problems following the priority areas for the development of research projects.

In Ukraine, the issue of developing their own "Silicon Valleys" has been raised repeatedly, but so far the projects have not been implemented.

As for the world experience, the European model for the development of innovative infrastructure is based on public investment and subsidies and is aimed primarily at creating new jobs.

In Asian countries, such infrastructure is being developed through the creation of technopolis (Japan), technoparks (India), and various types of innovative structures with state financial support (China).

The US innovation infrastructure development model is less oriented towards public funding and functions primarily due to the investment of interested firms.

In Ukraine, there are such types of innovative models of economic development as [34]:

– Model “Natural Resources – Production – Money (without high-tech production);

– Model “Converting of money for research into knowledge – Converting of knowledge into innovation – Converting of innovation into a commodity – Money;

– Innovation model (the production stage is extracted from the model).

The second model of economic innovative reproduction is the most effective considering the practical experience.

The first and third models dominate without a high level of innovative products in Ukraine.

It is necessary to focus on the formation of an innovative development model by:

- direct measures at the national and regional levels carried out with direct budget financing, which will help improve the characteristics of the research potential in higher education institutions;
- the implementation by the subjects of the national economy of innovative activities and investments of innovative orientation in a competitive market, increasing the supply of innovative products;
- an increase in the demand of subjects of the national economy and population for innovative products or research projects, the creation of favorable conditions for the commercialization of innovative products and the life of the citizens considering the results of innovative programs.

To improve the efficiency of the commercialization of innovative products it is necessary to use the world experience of carrying out the research activity considering the project and program methodology in the state's innovative development.

International practice proves the expediency of using the triple helix model with the stakeholders consisting of universities, business companies and state organizations in carrying out the research projects within the innovative programs (Fig. 5).

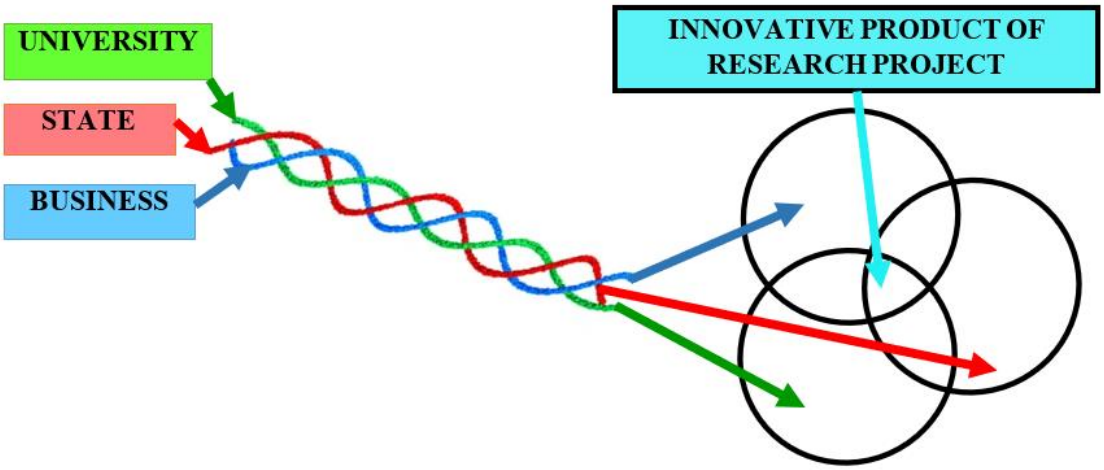

Figure 5 - Triple spiral model of research activity management within the framework of innovative programs

At the same time, the acquired knowledge, technologies, and results arising from the implementation of research projects by higher education institutions, business structures and the state interact with each other.

In this model, the university, in the presence of the traditional role of educational training of specialists, performs new functions - when conducting scientific research, it establishes cooperation and interaction with government and business structures to further commercialize the results of research projects (innovative products) obtained during the implementation of innovative programs.

The basic principle of the triple helix model is the consideration of higher education as a key object of innovation.

Considering the demand for innovative products for research projects is one of the basic advantages of this approach.

The triple helix model provides a stable connection between government authorities, business structures interested in the innovative product of the project and universities in the framework of scientific research.

The strategic goals of each of the participants in the innovation program are considered in the research.

Stakeholders of the innovation program form a triple spiral system of "University-Business-State". It combines the interacting processes of implementation of research projects, commercialization of innovative products and state regulation implementation.

If we consider the stage of conducting scientific activities by the university, it should be noted that a certain set of research projects begins with the implementation in the case of the implementation of an innovative program.

It should be emphasized that the strategic goal of higher education within the innovation program is to include research projects in the portfolio. The competitiveness of the university will be increased as a result of the implementation of research projects. Based on this statement, higher education will manage a portfolio of research projects, which will allow the effective achievement of the strategic goals of the organization (and all stakeholders of the innovation program) considering resources and setting goal priorities (Fig. 6).

In this case, it becomes possible to receive profit from the commercialization of the results from the implementation of the research projects portfolio, and dividends from patenting a project product already received as a result of scientific activities, which can be directed to new research projects of universities in the future.

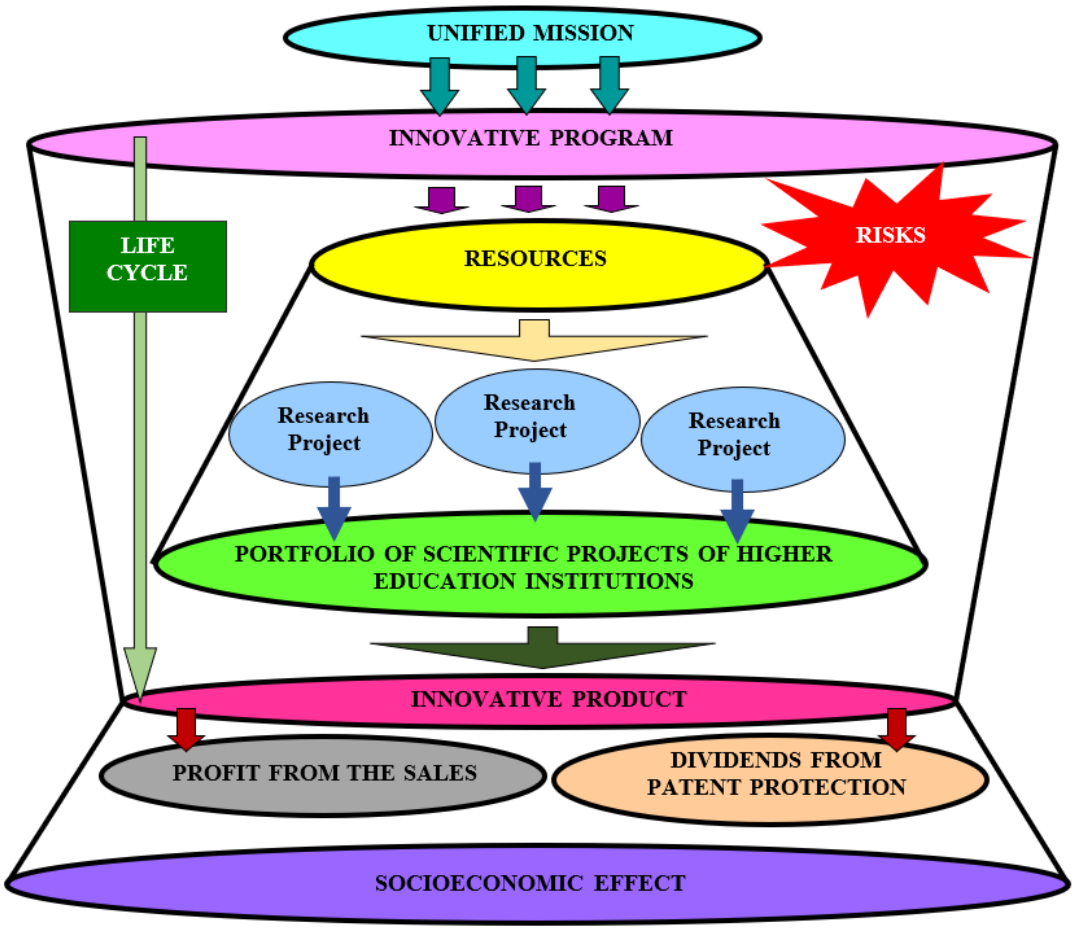

Figure 6 - The conceptual model for managing research projects in higher education

Summing up the above information, it can be argued that the institution of higher education forms and manages a portfolio of research projects with the aim of commercialization of innovative products considering the goals of all stakeholders (university, state, business).

At the same time, the research projects are part of the innovation program. Considering the above information, the research project of the higher educational institutions should be considered an integral part of the innovation program, as well as the portfolio of research projects.

The main goal of the innovation program is to receive the socioeconomic effect from the realization of the results of the research project considering the profit from the sale of innovative products and dividends from the patent protection of the new result.

Conclusions. The paper studies international and national models of innovation activity management and establishes the need to use a project-oriented approach to the management of scientific activity.

Based on the project and program management methodology, the definitions of a research project, a portfolio of research projects, and an innovative program have been clarified.

The study identifies the stakeholders of the innovation program - the university, business structures, the state, and defines the strategic goals of each participant.

It is proposed to use the model of the triple helix "University-Business-State" in the framework of project-oriented management of scientific activities in the implementation of innovative programs, which will effectively use scientific, educational, industrial and human resources, which will ensure high-intensity and flexible balance in the development of the state innovation system. the effectiveness of commercialization of the results of research projects carried out in higher educational institutions.

A conceptual model for managing research projects of higher education has been developed and it has been established that the university forms and manages a portfolio of research projects included in the innovation program, the mission of which is to obtain a socioeconomic effect from the implementation of an innovative product.

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На основі аналізу міжнародного та українського досвіду було доведено, що інноваційна діяльність є основним драйвером соціально-економічного розвитку суспільства. Причинами негативних тенденцій у впровадженні результатів наукових проектів в Україні є недостатність фінансування та організаційна причина. Без зміни системи управління науковою діяльністю закладів вищої освіти на основі використання науково-обгрунтованої методології проектно-орієнтованого управління досягти результатів в сфері наукових досліджень та їх впровадження у виробництво неможливо. Метою статті є розробка моделі проектно-орієнтованого управління науковою діяльністю закладів вищої освіти при реалізації інноваційних програм. Предметом дослідження є методи і моделі управління науковими проектами в рамках інноваційних програм розвитку закладу вищої освіти. Були поставлені наступні задачі дослідження – аналіз світового і національного досвіду виконання інноваційної діяльності з ідентифікацією наукової складової, визначення ролі закладів вищої освіти при реалізації наукових проектів, встановлення учасників, які беруть участь у здійсненні інноваційної діяльності, розробка концептуальної моделі проектно-орієнтованого управління закладом вищої освіти в рамках реалізації інноваційних програм. Були отримані наступні результати – на основі аналізу світових та національних тенденцій розвитку інноваційної діяльності було встановлено, що застосування методології проектного управління науковою діяльністю дозволить підвищити ефективність впровадження результатів інноваційних проектів (комерціалізації продуктів наукових проектів). В роботі на основі методології управління проектами та програмами були уточнені поняття наукового, інноваційного проекту, інноваційної програми та портфелю наукових проектів. Запропоновано використовувати модель потрійної спіралі при реалізації інноваційних програм шляхом комплексної взаємодії університету, бізнесових структур та державних органів з урахуванням стратегічних цілей кожного стейкхолдера. Запропоновано розглядати наукову діяльність закладу вищої освіти як реалізацію портфелю наукових проектів, яка дала змогу розробити концептуальну модель проектно-орієнтованого управління науковою діяльністю університету в рамках виконання інноваційних програм.
Ключові слова: *науковий проект, інноваційна програма, заклад вищої освіти, портфель наукових проектів*

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