

## **ABSTRACT**

### **Dissertation for the Degree of Doctor of Philosophy (PhD) in Project Management**

**Olzhas Bagdauletovich Kenjaliyev**

### **Critical Success Factors of Technology and Scientific Research Commercialization Projects: A Study of the Kazakhstani Experience**

#### **Relevance of the Research and Formulation of the Problem**

The economic development of any state in the modern world implies the maximum use of innovative technologies, the expansion of the introduction of new technologies, and the improvement of forms of commercialization of scientific developments through the stimulation of innovation activity by combining science, education and business. Based on the need for sustainable development and strengthening the competitive economy of the Republic of Kazakhstan to overcome global challenges, there is a growing need for breakthrough science-intensive projects, expressed in high results of scientific and scientific-technical activities (hereinafter - RND).

The current Head of State Kassym-Jomart Tokayev in the Address to the People of Kazakhstan notes: "The situation in science requires special attention. Without it, we will not be able to ensure the progress of the nation". In the subsequent Address to the People of Kazakhstan of September 1, 2020, the President of the Republic of Kazakhstan announces the need to adopt a separate program document on the scientific and technological development of the country, the primary task of which should be to attract science to solve applied problems of the national level. It should also be noted that in the Address of the President of the Republic of Kazakhstan K-Zh.K. Tokayev of September 1, 2021 "Unity of the people and systemic reforms - a solid foundation for the prosperity of the country" the special importance of scientific development was emphasized.

Thus, the vital need for the development of science and the introduction of RND results into production and business is emphasized. However, achieving these goals is difficult without a high level of the share of commercialization of RND results from the total number of research and development projects. According to the adopted Concept of Development of Science of the Republic of Kazakhstan for 2022-2026 (hereinafter - the Concept), the share of commercialized projects from the total number of completed, applied, research and development works should increase from 26% to 37% by 2026.

The Concept also notes that one of the key roles in achieving these indicators, along with the cooperation of the main elements of the model: education-science-production, the development of the innovation ecosystem and measures of state support for the commercialization of RND, is the need for effective managers of RND commercialization projects.

Taking into account the high level of the state's interest in the development of science with the subsequent commercialization of RND and the achievement of the goals outlined in the Concept, it should also be borne in mind the key role of the development of science, technology and innovation in achieving the Sustainable

Development Goals (SDGs) of the UN. The Inter-agency Task Force of the United Nations on Science, Technology and Innovation for the SDGs notes the support of RND commercialization as one of the main measures to achieve the SDGs.

### **Research Background and Rationale**

Various aspects of the innovative development of the country, the problems of commercialization of technologies and the interaction of science with production have been studied in the works of foreign and domestic scientists. Among them are the scientific works of domestic scientists such as Abdygapaerov S., Alimbaev A., Baimuratov U., Satpaeva Z., Salykova L., Zhuparova A.S., Alibekova G.Zh., Tsevovoi A. F., Gabdulin A.S., Nurulla A.A., Turgunbaev B. et al.

Among foreign scientists Pinto J., Slavin D., Morris P., Huff G., Wateridge J., Turner J., Muller R., De Wit A., Belut A., Daniel D.R., Covin J., Annie M. Warren, Islam M. and others scientists have thoroughly examined the theoretical aspects of the influence of critical success factors on direct project management. The most significant contribution to the coverage of this issue was made by researchers Pinto J. and Slavin D., who empirically proved the existence of the essence of critical success factors of the project.

### **Research Problem**

Existing scientific literature identifies several factors for the successful commercialization of research and development projects. Organizational aspects such as the team, teamwork, technology transfer strategy, relations between industry and universities, as well as the personal characteristics of leaders and researchers, such as management skills and team characteristics, are emphasized by researchers.

In light of the changing role of universities in global processes and the need to evaluate management tools, the task of researching commercialization factors remains relevant. Recent studies in the field of commercialization of scientific research (CSFs) emphasize the diversity of factors that can vary in different regions and have different configurations. For example, studies on how technology transfer professionals overcome the "Valley of Death" point to the effectiveness of project management tools and techniques, but such findings require further empirical verification.

The application of universal success factors for all types of projects is an ineffective approach, as success factors should be determined taking into account the specific context. Therefore, the literature suggests investigating commercialization factors, taking into account the triple relationship between universities, industry, and government.

### **Goal and Objectives of the Research**

The goal of the research is a comprehensive study of the impact of critical success factors (CSFs) on the effectiveness of technology commercialization projects. Evaluation of the relevance and effectiveness of critical success factors in the Kazakhstani context of their specifics, including strategies, methods and approaches adapted to achieve commercialization goals. Analysis of the aspect of interaction of CSFs with the context and external environment of the project, the specifics of project management of commercialization, the specifics of adaptation of CSFs to the conditions of Kazakhstan, as well as the qualifications and competencies

of project managers. Development of a conceptual model of technology commercialization for evaluation and optimization of the role of CSFs in the successful implementation of innovations.

In order to achieve this goal, the following tasks have been identified:

- To investigate the theoretical foundations of critical success factors of the project, relevant in the context of technology commercialization, using the method of systematic literature review.
- To study and systematize the criteria for the success of a commercialization project with the subsequent development of a conceptual model.
- To identify and assess the relevance of critical success factors in the conditions of the Republic of Kazakhstan.
- To determine the role and place of influence of innovative culture on the successful implementation of commercialization projects.
- To identify criteria and conditions that have a positive impact on the development of technology commercialization projects.
- Based on the identified dependencies, to develop recommendations for improving approaches to the implementation of technology commercialization projects at the macroeconomic level.

**The subject of the research** is the characteristics and antecedents of projects for the commercialization of the results of scientific and scientific-technical activity, initiated by the scientific and research community and financed by the state for the purposes of scientific and innovative development of the Republic of Kazakhstan.

**The object of the research** is the management of projects financed by the system of state support for innovation, technology transfer and commercialization of the results of scientific and scientific-technical activity of the Republic of Kazakhstan.

**The context of the research** is the system of state support and financing of innovations, commercialization of projects of the results of scientific and scientific-technical activity.

**The theoretical and methodological basis of the research** is based on a comprehensive analysis of foreign and domestic scientific works dedicated to the study of critical success factors in project management and technology commercialization processes. Within the framework of the research, a bibliographic analysis was applied, based on the data sampling strategy through a specially developed method of selecting keywords. A systematic literature review was conducted to comprehensively study and synthesize existing data on critical success factors in project management, empirical data were obtained through a survey of respondents.

**The scientific novelty of the research** lies in the fact that the process of commercialization or technology transfer has been poorly covered in the context of project management and the influence of critical success factors of the project. In this research work, the technology commercialization process is already considered as a single project, including team management, stakeholders and sales.

The following definitions were proposed to classify and evaluate the involvement of a business partner in a project: "pusher", "client", "scout", "comrade"

and "fellow traveler". A vision of the commercialization project was also proposed as a set of two elements: "Scientific and innovative potential" and "Project team management".

### **Research Hypothesis and Research Questions.**

As a result of the consideration and study of various sources in this direction, the following hypothesis was formulated: "The main critical success factors of R&D commercialization projects in Kazakhstan are the presence of a key business partner who is actually involved in the project and the presence of a competent team with knowledge in the field of project management." The following five research questions were also put forward:

1. What critical success factors are relevant in the conditions and specifics of Kazakhstan?
2. How is success in technology commercialization projects interpreted by project managers?
3. What is the perception of the development of an innovative culture in technology commercialization projects?
4. What is the role of a business partner in the specifics of implementing commercialization projects?
5. What specific features characterize the management of commercialization projects?

### **Theoretical Significance of the Research Results.**

The results of the study complement the concept of the "Triple Helix" (interaction within the framework of the Industry-Academic Environment-State model), namely, they contribute to the understanding of the picture of the involvement of the business environment in the implementation of commercialization projects. The results of the study can also be used as educational materials in the specialties "Project Management" and "Innovation Management".

### **Practical Significance of the Research.**

The results of the study are a useful addition for practical application, both by scientists and by commercialization specialists, technology brokers, and various consulting companies. Practical recommendations for interaction with a business partner will be useful in matters of establishing communications, closer cooperation, and increasing the productivity of interaction between partners. The Kazakh experience in commercialization, studied within the framework of this study, will also be useful for state grantors of commercialization projects as a guideline for selecting the most promising commercialization projects.

### **Provisions Submitted for Defense.**

1. It was proved that the real involvement of a business partner in the processes of implementing commercialization projects and the presence of an experienced project team with project management skills are key critical factors for the successful commercialization of the results of scientific and scientific-technical activity.

2. Relevant critical success factors of the project were identified, which affect the successful commercialization of the project. These factors are: "Established business processes", "Knowledge in the field of project management of the project team", "Support for a research or educational organization", "The presence of a business partner involved in the project."

3. A system and map for classifying business partners has been developed, according to the nature of their contribution, in the direct implementation of the project and the level of their involvement in the commercialization process.

4. The author's vision of the classification of business partners is proposed, according to the nature of their contribution to the implementation of the commercialization project: "Pusher", "Client", "Scout", "Comrade", "Fellow traveler."

5. The concept of a commercialization project as a set of two elements was studied: "Scientific and innovative potential", "Project team management."

6. The author's set of criteria has been proposed, defining and evaluating the success of commercialization projects.

### **Correspondence to the Directions of Development of Science or State Programs**

The topic of the dissertation corresponds to the priority direction of development of science for 2023-2025, according to the priority "Research in the field of social and humanitarian sciences".

The dissertation was carried out within the framework of grant financing AP05131146- "Education, science, production: barriers to commercialization of capital-intensive scientific developments" and program-targeted financing BR21882292- "Integrated development of a sustainable construction industry: innovative technologies, production optimization, effective use of resources and creation of a technological park" with the support of the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan.

**Approval of Research Results.** During the period of the work, 11 scientific articles and reports were published, including: 2 articles on the topic "Conditions to facilitate commercialization of R & D in case of Kazakhstan" and "Motivating factors of innovative research activities and barriers to R&D in Kazakhstan" included in an international scientific journal, included in the Scopus database;

Three articles in peer-reviewed publications recommended by the KKSEN on the topics "Problems of research development and education in Kazakhstan", "Review of problems in the management of projects for the commercialization of capital-intensive scientific developments", "General characteristics of the system "education - science - production"";

One report at international conferences on the topic "Modern tools for the commercialization of capital-intensive research";

The results of the research were included in the monograph "Problems of commercialization in the system: education, science, production in the Republic of Kazakhstan".

### **Structure and Volume of the Dissertation.**

The dissertation consists of an introduction, 3 chapters, a conclusion, a list of references and appendices. The volume of the dissertation is 151 pages of typewritten text, 32 tables, 25 figures, 152 sources in the list of references.

### **Main Content of the Dissertation.**

The introduction justifies the relevance of the chosen topic, formulates the object and subject of the research, reveals the theoretical and methodological basis, and also outlines the main provisions submitted for defense.

The first chapter provides a comprehensive analysis of existing approaches to the study of critical success factors (CSFs) of commercialization projects. Within the framework of the literature review, previous studies devoted to this problem are studied, and a bibliometric analysis of scientific literature on the topic of project management is carried out. With the help of the systematic literature review method, generally accepted CSFs of commercialization projects are identified.

The second chapter is devoted to the collection and processing of empirical data obtained through questionnaires of respondents and in-depth interviews with specialists. Generally accepted CSFs of commercialization projects are tested for relevance using the binary logistic regression method. For a deeper understanding of CSFs, in-depth interviews with specialists are conducted, the results of which are processed using the thematic analysis method using the MAXQDA software product.

The third chapter of the dissertation considers issues of effective management of technology commercialization projects in conditions of close cooperation with the industry. Business cases of successful commercialization projects are analyzed, and the application of open innovations as a critical success factor of the project is also investigated. A project commercialization strategy is developed based on a conceptual model based on the principle of closer interaction between science and industry.

In conclusion, the results of the dissertation research are summarized, the main conclusions and results are formulated, and recommendations for their practical application are given.