Государственное и муниципальное управление. Ученые записки. 2022. № 3. С. 32–40
State and Municipal Management. Scholar Notes. 2022;(3):32–40

Problems of Management

Original article

RESEARCH ON FACTOR IDENTIFICATION OF CHINESE INTERSTATE PROJECT RISK MANAGEMENT

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Abstract. The problem of large interstate projects managing is of particular relevance in the context of investment cooperation expansion between states, the implementation of programs for interstate transport and other infrastructure construction. The growth in the number and volume of interstate investment projects creates a special layer of tasks management associated with the risks of their implementation, and insufficient accounting and errors in eliminating risks can lead to significant economic and reputational losses. Chinese international engineering enterprises have accumulated valuable experience in the implementation of a significant number of interstate projects. However, due to the complex and constantly changing foreign environment, Chinese enterprises face difficulties in implementing these projects, including due to the poor understanding of the risks concept and insufficient risk management technologies. The purpose of the study is to identify the factors and stages of the implementation of China's interstate projects that are most vulnerable to risks and propose measures to minimize them based on the concept of risk diversification by the project life cycle stages, developing general principles of risk management and a system of specific project risks. An analysis of the results of the implementation of a number of large completed investment projects of the PRC based on the author's methodology made it possible to formulate the conclusion that for an interstate project, the priority attention of the authorities should be focused on minimizing the risks of the construction stage. The second risky stage is the turnover and startup stage. For government authorities and participating companies, the authors formulate a number of practical recommendations on technologies for large interstate projects risks minimizing.

Keywords: interstate project, risk management, project life cycle, risk identification, risk factors system, risk management technologies

For citation: Yevchenko N. N., Wang Xiaohan. Research on factor identification of Chinese interstate project risk management. *State and Municipal Management. Scholar Notes.* 2022;(3):32–40. (In Russ.). https://doi.org/10.22394/2079-1690-2022-1-3-32-40

Проблемы управления

Научная статья
УДК 338.24
doi: 10.22394/2079-1690-2022-1-3-32-40

ИССЛЕДОВАНИЕ ФАКТОРОВ УПРАВЛЕНИЯ РИСКАМИ В МЕЖГОСУДАРСТВЕННЫХ ПРОЕКТАХ КИТАЯ

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Аннотация. Проблематика управления крупными межгосударственными проектами обретает особую актуальность в условиях расширения инвестиционного сотрудничества государств, реализации программ создания межгосударственной транспортной и иной инфраструктуры. Рост числа и объемов межгосударственных инвестиционных проектов создает особый

пласт управленческих задач, связанный с рисками их выполнения, а недостаточный учет и ошибки в элиминировании рисков могут привести к существенным экономическим и репутационным потерям. Китайские международные инжиниринговые предприятия накопили ценный опыт реализации значительного числа межгосударственных объектов. Однако из-за сложной и постоянно меняющейся зарубежной среды китайские предприятия сталкиваются с трудностями в реализации данных проектов, в том числе, в силу слабой изученности концепции рисков и недостаточных технологий управления ими. Цель исследования – выявить наиболее уязвимые для рисков факторы и этапы реализации межгосударственных проектов Китая и предложить меры по их минимизации на основе концепции диверсификации рисков по стадиям жизненного цикла проекта, развивая общие принципы управления рисками и систему специфических проектных рисков. Анализ результатов реализации ряда крупных завершенных инвестиционных проектов КНР на основе авторской методики позволил сформулировать вывод о том, что для межгосударственного проекта приоритетное внимание органов управления следует сосредоточить на минимизации рисков строительства объекта. Второй рисковой стадией является этап оборота и стартапа. Для государственных органов управления и компаний-участников авторы формулируют ряд практических рекомендаций по технологиям минимизации рисков реализации крупных межгосударственных проектов.

Ключевые слова: межгосударственный проект, управление рисками, жизненный цикл проекта, идентификация рисков, система факторов риска, технологии управления рисками

Для цитирования: Евченко Н. Н., Ван Сяохань. Исследование факторов управления рисками в межгосударственных проектах Китая // Государственное и муниципальное управление. Ученые записки. 2022. № 3. С. 32–40. https://doi.org/10.22394/2079-1690-2022-1-3-32-40

Introduction

As Chinese international engineering enterprises practice the Belt and Road Initiative (BRI), the enterprises are shifting their main targets for market development and project execution overseas. Interstate projects have become an important manifestation of China's economic development. Chinese international engineering enterprise's construction capacity and level in some areas have reached a world-class level, laying a good foundation for Chinese enterprises to realize the overseas strategy as Fig. 1 shows.

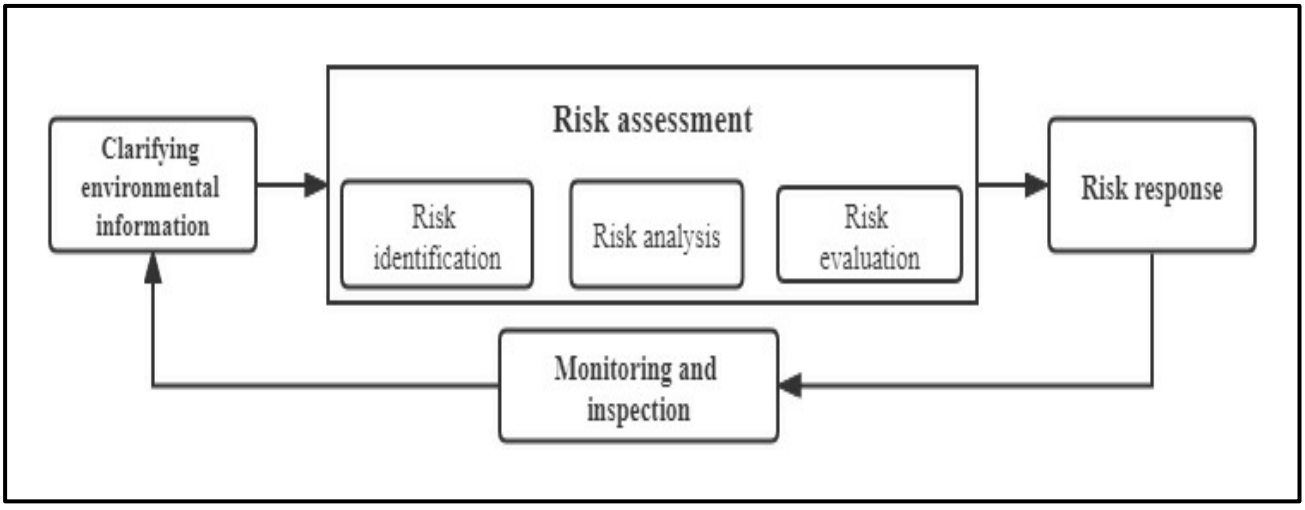

Fig. 1. Risk management cycle: basic structure and process[1]

In Shuoqing W.'s opinion [2], risk management should be dynamically distributed in all phases of the project life cycle. Researchers have been working on more scientific methods of risk identification.

[1] Compiled by the authors based on [1]

The authors Bing L. [3] et al. identified and classified project risks into three categories: internal, project, and external risks, based on the sources and attributes of the risks.

The authors Gholamreza D. et al. [4] identified and classified project risks into financial, policy and political, technical, weather and environmental, contractual, design, and construction areas.

The authors Hastak M. et al. [5] developed an international engineering risk assessment model by integrating project macro-level, market-level, and project-level risk factors according to the different levels to which the risks belong.

Interstate project risk identification content and process

The list of risk factors for China's interstate projects is sorted out and includes the following two aspects. The authors identify the general list of international engineering risks through literature research. Further case studies were used to gather risk factors for implemented (completed) and performed China's interstate projects.

1. Literature identification of risk factors in China's international engineering projects

The literature selected by the authors is scholars or practitioners in the relevant fields in China and abroad. The literature identifies risk factors from a full life cycle perspective of interstate projects. The identifying general risk factors for interstate projects through the literature studies helps to create a list of risk factors and a provide clear risk breakdown structure.

Guangning Z. et al. classified project risk factors into external risk, design risk, procurement risk, construction risk, project management risk, and safety, environmental and health (HSE) risk [6].

Lin P. used hierarchical analysis to divide the second level of risk factors into a schedule, cost, quality, and safety. The third level is divided into political, natural, economic, and technical indicators [7].

The author Qiang L. et al. constructed a dynamic model of interstate project whole life cycle risk management based on the different characteristics of risks in each stage of the interstate project life cycle. Twenty-three risk factors are divided into five life cycle stages in the case study [8].

Chuang L. categorized 27 risk factor indicators into 9 categories such as political, economic, sociocultural, natural, managerial, and technological for hierarchy analysis [9].

Eskander R.F.A. classifies 37 risk factors into acts of god, physical, economic, political, design and construction risk hierarchy [10].

As shown in Table 1, summarizes the list of literature studies that examine risk management involving international engineering projects.

Table 1 – List of literature research on risk identification of international engineering projects[1]

	Years	Characteristic	Source
1	2017, 2012	Industry specifics - energy carriers, energy	[7], [14]
2	2019, 2020	Industry specifics - transport infrastructure (railway)	[8], [12]
3	2017, 2019, 2019	Research of risks in the project life cycle system	[11], [6], [8]
4	2012, 2015, 2018, 2018, 2019	Decision-making technologies in risk management of international projects	[14], [15, [10], [13], [9]

An analysis of the data in Table 1 shows that with the start of the «One Belt One Road» project (2017), the number of scientific publications on risks for industry and logistics international projects has increased, and research has begun on risks in the project life cycle system.

[1] Compiled by the authors.

Thus, the analysis of literary sources on the risk management of the implementation of investment projects of authors from China showed, in general, the lack of a systematic approach in building a clear system that would become risk management technologies for management. It is especially important to develop such a system for interstate projects, the costs of which significantly exceed the costs of domestic projects.

It should be noted that international projects have a significantly more pronounced risky nature, which actualizes the creation of risk management technologies specifically for such projects. The authors believe that such a technology should be based not only on a comprehensive analysis of the current ongoing projects, but also be formed taking into account the database of minor and significant risk cases of unsuccessful international investment projects.

2. Case studies of China's successful and failed international engineering projects

Chinese international engineering enterprises have accumulated valuable successful experiences and failed lessons in numerous interstate projects. Therefore, in combination with specific interstate project cases, risk factors closely related to Chinese international engineering enterprises can be identified as a supplement to the list of risk factors identified in the literature in the field of practice.

Table 2 – Risk factors of interstate projects in China's successful and failed international engineering projects[1]

Number	Project Name	Project Location	Project Result
1	An oilfield offshore platform manufacturing project	Southeast Asia	The Subcontractor project duration was extended by 4 months. General Contractor fails to complete one-third of the contract work within the construction period. Termination of the contract by the owner. Losses of up to US$18 million.
2	China-Myanmar Oil and Gas Pipeline Project	South Asia	The project was completed on schedule and is a pioneering project of China's BRI in Myanmar.
3	Mecca light-rail project	West Asia	During the construction of the project, it was discovered that the actual amount of work was significantly higher than the amount of work anticipated at the time of contracting. The project ultimately resulted in a huge loss of about US$630 million for the Chinese contractor.
4	A power engineering project	South Asia	Completed on schedule and highly praised by the local government.
5	A2 freeway project	Central Europe	The project contractor decided to abandon the project to avoid greater losses. As a result, the project owner issued a US$271 million claim.
6	A power station expansion project	Africa	The owner suspended the contract due to a serious delay in the construction schedule.
7	A power station project	South Asia	Blind bidding, inadequate research, failure to communicate with the owner.
8	A subway project	West Asia	Project schedule delayed.
9	A coal mining project	South Asia	Project completion and handover on schedule.
10	A bridge construction project	South Asia	Completed on schedule and highly evaluated by the government.
11	Long-distance crude oil product pipeline project	Africa	The contractor's procurement costs have increased significantly, reducing the profitability of the project.
12	A surface oil field water injection project	Africa	The contractor pay millions of dollars in additional procurement cost.

[1] Developed and compiled by the authors

13	A natural gas pipeline project	South Asia	Project schedule delayed.
14	A hydro-power station project	Africa	The project was completed on time, gaining a reputation and market for the contractor.
15	A thermal power plant project	Southeast Asia	The project schedule is delayed and costs are exceeded, but the quality of the project meets the owner's requirements.
16	Natural gas pipeline cross-border section shield project	Eastern Europe	The project was completed on schedule and the contractor summarized and formed several core technologies.
17	A high-speed rail project	South America	The contractor suffered a huge loss of bid cost.

Through the analysis of key risk factors of the 17 cases in Table 2, it is concluded that the risk factors of Chinese interstate projects are mainly concentrated in the following aspects.

1. *Political risk.* For example, in case 2, Myanmar politics is in transition and there are numerous contradictions and risk factors. Creating uncertainty for the project. In case 17, only three days after the contractor won the bid, the project site government changed its mind and canceled the bid.

2. *Socio-cultural risk.* For example, in case 2, there are frequent military conflicts in northern Myanmar, through which the project passes. Cultural differences, religious differences, linguistic diversity, customary taboos, and lack of labor motivation pose risks to the smooth implementation of the project. In case 3, project construction required passage through an Islamic holy site, an area closed to non-Muslim personnel. Re-recruiting Muslim engineers resulted in project delays and increased costs.

3. *Natural risk.* For example, in case 1, the contractor and subcontractors underestimated the complexity of the weather and marine environment at the project site, creating unforeseen difficulties for construction. In case 3, the local weather is hot, dry, and sandy, and access to fresh water is difficult, which seriously affects the normal construction of the project. In case 16, the equipment shield machine needed to be shipped back to China before the river froze over, otherwise, the schedule would have been delayed by at least 3 months. Strict schedule requirements were imposed on the contractor.

4. *Economic risk.* For example, in case 3, the project contract currency is the Saudi currency, and exchange rate fluctuations during the life of the project have caused some degree of loss to the project. In case 7, the local currency depreciated significantly during the life of the project, but the contract provided for the payment of rupees to the contractor to settle at a constant price. The contractor suffered a significant exchange loss.

5. *Legal risk.* For example, in case 8, the duration of the project encounters a change in tax policy in the country where the project is located, and the government requires a significant increase in the individual income tax rate for foreign corporations and individuals in its territory. Contractors' project profits are significantly impaired. In case 7, the contractor did not research the construction industry laws and regulations in the country where the project was located in advance. It was not clear that night blasting operations were not allowed in the country, which affected the project construction schedule.

6. *Owner risk.* For example, in case 1, the project owner has a strict HSE management system, while the contractor's HSE management level has a gap with international standards. The contractor's HSE workflow was not approved by the owner, resulting in several suspensions of construction.

7. Design risk. For example, in case 3, the owner appointed an international firm at the project site to perform the design work, resulting in a delay in the design *schedule and further shortening the project duration.*

8. *Consulting supervision risk.* For example, in case 6, the consulting engineer is directly appointed by the owner and makes some unreasonable decisions. In case 9, the British consultant hired by the owner was unfamiliar with Chinese standards, which brought resistance to the acceptance phase.

9. *Subcontractor risk.* For example, in case 10, the actual capacity of the subcontractor does not match its qualification, and the construction process cannot meet the requirements of the project supervisor.

10. *Procurement management risk.* For example, in case 11, when the contractor purchased raw material, the price increased by an average of 40,56% over the bid budget. In case 12, the contractor's lack of understanding of the owner's bid document criteria led to a later increase in the number of certain valves purchased from 15 to 314. In case 13, contractors lose actual control over materials and equipment, resulting in a series of risk events such as equipment transportation damage and customs clearance delays.

11. *Site management risk.* For example, in case 10, the project construction was severely disturbed by local residents. Equipment and materials could not be delivered to the site in time, and the construction schedule was seriously delayed.

12. *Health and Safety Executive (HSE) risk.* For example, in case 1, the owner's HSE management requirements were extremely strict. In practice, the contractor did not follow the procedures carefully. There was even an accident in which employees smoked on board and started an indoor fire. In case 15, the project had a large number of personnel and a large workload of intersecting mechanical equipment installation, which posed a greater threat to the safety and health of personnel.

13. *Financial management risk.* For example, in case 9, the contractor did not take into account the problem of project arrears when preparing the plan for the use of funds. The owner's failure to make timely progress payments caused a shortage of liquidity for the contractor, resulting in the suspension of the project.

14. *Organizational personnel risk.* For example, in case 1, the hired foreign project manager was not able to communicate directly with Chinese personnel because he was not familiar with the background and culture of the Chinese company. The contractor paid him a salary equivalent to dozens of times that of the Chinese project manager but failed to secure rights and benefits for the contractor. The subcontractor project manager was able to make full use of the good communication mechanism to gain the trust and support of the owner, which eventually turned the subcontractor into a profit. In case 2, the translator hired by the contractor had difficulty mastering multiple ethnic languages, and it was difficult to avoid ethnic conflicts in the selection of personnel. It caused great difficulties in the daily communication of the project and the coordination and communication with the local government.

15. *Contract risk.* For example, in case 3, poorly defined contract scope, unreasonable pricing methods, and unclear design standard provisions can have serious negative impacts on contract execution. In Case 5, the contractor underbid for a variety of reasons and was a significant factor in the eventual termination of the project.

After analyzing the cases in Table 2, the following characteristics of the risk factors faced by Chinese contractors in interstate projects were summarized.

A. Chinese contractors have relatively limited design capabilities and lack Chinese standards with international standards and recognition strength. More project owners choose international design companies for project design, and contractors have insufficient ability to integrate project design resources. Chinese engineering industry standards are limited to petrochemicals, railroads, and other fields, and are not well recognized internationally.

B. Project bidding errors are a major constraint on the contractor's ability to select projects. Contractors are interested in blindly expanding their international business volume in pursuit of performance. Or making blind bidding decisions by placing more emphasis on the political significance of the project, which ultimately leads to project losses.

C. The shortage of interstate project management talent in China virtually raises costs for contractors. Professional talents for various types of interstate projects, and the training of language talents need to be improved.

D. The stability of the political and social environment in the project country is a prerequisite for the success of the project. China has a lot of interstate projects in countries with relatively unstable politics and backward economic development. The external environment in such countries brings more uncertainty to the project.

List of China's typical project risk factors for international engineering projects

Through literature research, the author identified a list of risk factors underlying interstate projects. A large number of cases were also used to identify representative risk factors in the field of international engineering projects in China. After synthesis, the list of China's typical project risk factors is obtained as shown in Table 3.

Finally, the occurrence of risk factors in each phase of the project life-cycle was categorized and summarized through interviews with international engineering project experts. As a life cycle of projects, 4 stages are distinguished: I – represent the feasibility stage of the project life-cycle. II – represents the project planning and design stage. Ⅲ – represents the construction stage, and Ⅳ – represents the turnover and startup stage.

Table 3 – List of China's typical interstate project risk factors[1]

Risk factor category	Risk factor indicators	Main stages to occur
Political risk	Political instability risk	Ⅰ Ⅱ Ⅲ Ⅳ
	International relations risk	Ⅰ Ⅱ Ⅲ Ⅳ
	Government intervention risk	Ⅱ Ⅲ Ⅳ
Legal risk	Risk of inadequate law and regulation	Ⅰ Ⅱ Ⅲ Ⅳ
	Legal and policy changes and differences	Ⅱ Ⅲ Ⅳ
Natural risk	Natural force majeure risk	Ⅲ Ⅳ
	Adverse natural conditions risk	Ⅱ Ⅲ Ⅳ
Socio-cultural risk	Social security risk	Ⅱ Ⅲ Ⅳ
	Cultural differences risk	Ⅰ Ⅱ Ⅲ Ⅳ
Economic risk	Macroeconomic risk	Ⅰ Ⅱ Ⅲ
	Exchange rate risk	Ⅱ Ⅲ Ⅳ
	Price fluctuation risk	Ⅱ Ⅲ Ⅳ
	Interest rate fluctuation risk	Ⅱ Ⅲ Ⅳ
Management risk	Organizational personnel risk	Ⅱ Ⅲ Ⅳ
	Site management risk	Ⅱ Ⅲ Ⅳ
	Procurement management risk	Ⅱ Ⅲ Ⅳ
	HSE management risk	Ⅱ Ⅲ Ⅳ
	Financial management risk	Ⅰ Ⅱ Ⅲ Ⅳ
	Owner's risk	Ⅱ Ⅲ Ⅳ
	Consulting supervision risk	Ⅲ Ⅳ
Behavioral risk	Design risk	Ⅰ Ⅱ Ⅲ
	Supplier risk	Ⅱ Ⅲ Ⅳ
	Subcontractor risk	Ⅱ Ⅲ Ⅳ
Operational risk	Bidding risk	Ⅰ Ⅱ
	Contract risk	Ⅰ Ⅱ Ⅲ Ⅳ
	Insurance risk	Ⅱ Ⅲ Ⅳ
	Claim risk	Ⅲ Ⅳ
	Transfer risk	Ⅳ
Technology risk	Technical standard risk	Ⅰ Ⅱ Ⅲ
	Risk of using new technology	Ⅱ Ⅲ Ⅳ

The distribution of each project risk factor indicator over the project life-cycle is shown in Figure 2.

As shown in Figure 2, there are 10 risk factors occur during the feasibility phase of a project. The project risk factors gradually increase with the owner's investment and the contractor's work. The most significant (maximum) risk occurring phase is the project construction phase. Therefore, project formulation, feasibility studies, strategic design, and approval are not the primary (priority) components of interstate project risk management.

[1] Developed and compiled by the authors.

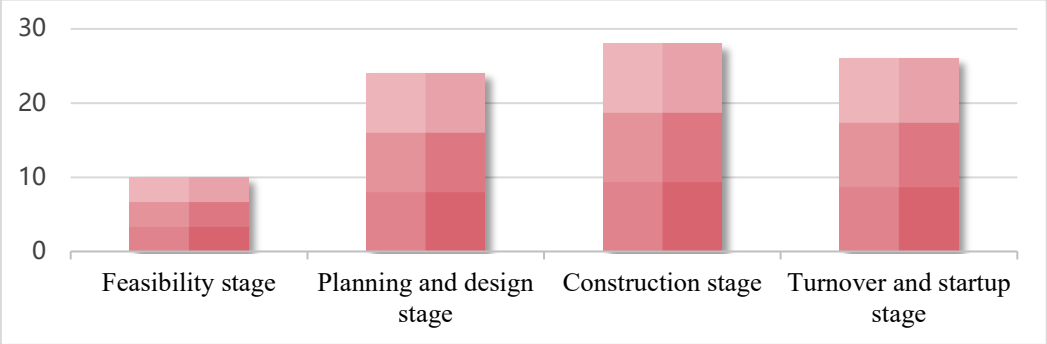

Fig. 2. Distribution of risk factors over the project life cycle[1]

Project construction phase risk management should be given top priority. Although the project phase I faces the least amount of realistic risks if combined with case studies and experience. Considering the potential risk factors comprehensively, can reduce the probability of risk occurrence in phases II, III, and IV to a certain extent. Therefore, the efficiency of risk management for stage I is relatively high.

Conclusion

As international engineering projects involve a wider range of fields, the requirements for project management are gradually increasing. Based on the current development status of international engineering projects in China, the authors put forward the following suggestions for project management enhancement.

1. It is important to establish a professional and experienced project management team, conduct regular professional training, hire experienced foreign experts in the project field, or cooperate with other project management organizations. During project implementation, all personnel should continuously identify and update the list of risksб based on the bottom-up principal.

2. It is important to encourage enterprises to make a reasonable choice of project markets.

3. On a national scale, it is necessary to create a database of international projects risks. This will allow quantification of design data indicators and provide scientific advice to international engineering firms and teams.

4. In order to minimize management risks and redistribute some project risks, the contractor may wish to form a consortium with local or high-value contractors to bid.

5. Before entering the international market, it is advisable for a company to comprehensively study and analyze the technical feasibility of the project, the financial capacity of the owner, as well as national stability, international relations, relevant policies and regulations, public order and security, religious customs, natural environment, and market conditions within the project area.

6. It is important for the contractor to fully understand the content of the tender documents before submitting a bid. The process of signing a contract also requires special attention. Once a contract has been signed, it is important to focus on managing communications for its implementation/changes.

7. A separate problem, not addressed in this article, is the task of insuring the risks of international projects. This problem sometimes turns into a separate task of choosing a company - a reliable insurance partner – and purchasing insurance.

Thus, following the dialectic of the research transition from the general to the particular, the authors believe that in the study and creation of a risk management system for an international project, a clear system should be built:

- the first stage is the identification of the most general conditions, areas and features of the project implementation;
- the second stage of building a more detailed, deployed risk management system is the identification of stages and elements of the structure of the project life cycle;
- the third stage in diagnosing and clarifying the direction of building the most complete risk system is the definition, comprehensive study, scientific assessment and prioritization of risk factors linked to the project life cycle.

[1] Developed and compiled by the authors.

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Вклад авторов: все авторы сделали эквивалентный вклад в подготовку публикации. Авторы заявляют об отсутствии конфликта интересов.

Contribution of the authors: the authors contributed equally to this article. The authors declare no conflicts of interests.

Статья поступила в редакцию 15.08.2022; одобрена после рецензирования 30.08.2022; принята к публикации 01.09.2022.
The article was submitted 15.08.2022; approved after reviewing 30.08.2022; accepted for publication 01.09.2022.