MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY STATE UNIVERSITY
OLEG BALATSKYI ACADEMIC AND RESEARCH INSTITUTE OF FINANCE,
ECONOMICS AND MANAGEMENT
DEPARTMENT OF FINANCE AND ENTREPRENEURSHIP

APPROVED FOR DEFENSE
by the Head of the Department, Prof.
_____V. M. Boronos
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MASTER`S THESIS

ON THE TOPIC:

Public-private partnership in the investment sphere

Master`s Educational Qualification Level
Specialty 072 "Finance, Banking and Insurance"

Scientific Supervisor: _____   L. L. Hrytsenko
(signature)

Student: _____   O. I. Tverezovska
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Group: F.m – 91/1an

Sumy 2020

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TASK
to the master thesis

Student of the group F.m – 91/1an Oleg Balatskyi Academic and research institute of finance, economics and management specialty 072 "Finance, Banking and Insurance".
Tverezovska Oleksandra Ihorivna

Theme of the work: Public-private partnership in the investment sphere

Approved by order of SSU №1878-III from «08» December 2020 year.
Deadline for submission of completed work by the student «15» December 2020 year.

Initial data for the work: regulations and legislation, materials of state statistical reporting, departmental regulations, instructions and thesis, materials of monographs, periodicals, textbooks and manuals, scientific works of domestic and foreign scientists.

Contents of the main part of the work (a list of issues to be developed): to study the essence of public-private partnership; analyze the classification of the main of partnership between public sector and business; to determine the role of PPP projects` implementation in public policy; to define the evaluation of PPP projects and peculiarities of projects` risks; to evaluate the sustainability risks; make an sectoral-level analysis of PPP projects in the world; asses the problems and define perspective directions of implementation of PPP projects in Ukraine.

Date of issue of the task: «06» November 2020 year.

Supervisor of the work: Dr. (Economics), Professor of the department of finance and entrepreneurship   Larysa Hrytsenko   _____
                                                                                                                                        (signature)

The task is accepted for execution «06» November 2020 year   _____
                                                                                                                                        (student`s signature)

ABSTRACT

Master thesis: the total amount of work without references and appendixes – 47 p., 13 tables, 8 figures, 41 resources.

**The purpose of the master`s thesis** is to analyze the theoretical and methodological principles of PPP as a form of cooperation between the state and business in the investment field as well as to analyze the infrastructure projects` risk management.

Object of study - processes of partnership between the public and private sectors in the context of the implementation of state policy of national economy development considering project risk management.

Subject of study – methodological aspects and practical tools for the analysis of PPP projects in the investment sphere.

Research methods. In the process of research PPP and implementation of the tasks, the following methods were used: data synthesis, the method of comparative analysis, general scientific and analytical methods, sectoral-analysis expert-grading method, abstract-logical, statistical analysis, method of logical generalization and financial-mathematical method.

The practical significance of the results. The methodological and scientific-methodical provisions developed in the work can be implemented as sections of courses and practical classes of the following disciplines: "Financial risk management", "Public-private partnership", and have already been tested in the I International, scientific-practical conference "Aviation, industry, society" [16], in the XXVIII International scientific-practical conference "Information technologies: science, technology, education, health. MicroCAD-2020" [14], in the International scientific and practical conference "Social-economic challenges" [15], in the International Scientific Journal "Mechanism of Economic Regulation" [17].

Factual basis of work consists of scientific works of domestic and foreign scholars on the issue of public-private partnership, analytical and statistical materials that reflect the essence of the phenomenon of PPP, laws and regulations, annual reports of World Economic Forum.

Structure of work. The main part of the final master thesis consists of three sections. The first section examines the theoretical principles of the public-private partnership in the investment sphere. The second section analyzes the PPP project in infrastructure field using the sectoral-level analysis of projects` implementation in the world and analysis of project from risk management perspective. In the third section problems of PPP projects` implementation in Ukraine are defined after analysis the level of public-private partnership in our country as well as perspective directions of PPP projects development are proposed.

PUBLIC-PRIVATE PARTNERSHIP, INVESTMENTS; INFRASTRUCTURE PROJECTS; RISK MANAGEMENT; PMBOK; FCEM; FMECA.

CONTENT

INTRODUCTION

**The relevance of the topic of the master`s thesis.** At the current stage of the economy`s development there is a significant increase of investment from the public and private sectors due to the deepening of the crisis. At the same time, infrastructure development remains one of the important components of creating a favorable climate for economic growth. Nowadays, a number of problems are connected with the obsolescence of fixed assets in almost all areas of economic activity, with physical and moral deterioration of equipment, with lack of investment in infrastructure and lack of budget funding for infrastructure investment and innovation projects, etc.

Therefore, there is a necessity to find qualitatively new tools and mechanisms for investment development of economy, especially in Ukraine, new forms and methods of investment cooperation between the state and business on the basis of public-private partnership (hereinafter - PPP), as well as improving risk management system.

On this assumption, the effective interaction between the state and the private sector in PPP together with well-organized risk management system will allow investing in the development of production capacity, accelerate industrial growth, expand domestic and foreign markets, improve the quality of goods, works and services, improve public services, improve investment attractiveness and business activity. All this makes relevant research on determining the principles of PPP and analyzing PPP project`s from the risk management perspective for the future successful implementation in Ukraine, which can be a key factor in the positive changing situation in investment sphere.

Among domestic and foreign scientists, the following scientists have made a significant contribution to the development of methodology and practice for solving these problems: N. Babiak [3], L. Bai [4], Y. Li.[4], Q. Du.[4], Y. Xu [4], I. Brailovskyi [5], A. Dehtiar [6], T. Dukes [8], B. Schmidt [8], L. Fedulova [12], L. Lipol [19], V. Lykhachev [20], A. Mitskan [22], K. Pavliuk [25], M. Poliakova [27], L. Shemaieva [31], V. Varnavkyi [37], L. Zhaden [41], S. Naumenkova [24], A. Mytnyk [23], M. Azanov[20]. Hrytsenko L. [13] and others.

At the same time, the analysis of the scientific literature on the research topic allows us to state that a number of theoretical and applied problems in determining the main directions of PPP project distribution and mechanisms of their implementation remain unresolved. Thus, the deficit of public finances and high wear and tear of production and social infrastructure as well as the low level of PPP project of implementation in the infrastructure sphere in Ukraine and undeveloped system of risk management determined the relevance of the study, its purpose, objectives and content.

**The purpose of the master`s thesis** is to analyze the theoretical and methodological principles of PPP as a form of cooperation between the state and business in the investment field as well as to analyze the infrastructure projects` risk management.

Objectives of the study, which are set and resolved to achieve the goal of work are the following:

- to reflect the essence of the concept of "public-private partnership";
- to explore the classification of forms and models of partnership between public and private sectors;
- to define the place and role of PPP projects in the implementation of state policy of economic development;
- to analyze the PPP project in the infrastructure field;
- to make sectoral-level analysis of PPP infrastructure projects implementation in the world;
- to analyze PPP infrastructure projects from the risk management perspectives;
- to identify problems and propose perspective direction of PPP project implementation in Ukraine.

Object of study - processes of partnership between the public and private sectors in the context of the implementation of state policy of national economy development considering project risk management.

Subject of study – methodological aspects and practical tools for the analysis of PPP projects in the investment sphere.

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Structure of work. The main part of the final master thesis consists of three sections. The first section examines the theoretical principles of the public-private partnership in the investment sphere, as well as essence of the term "public-private partnership". The classification of form and models of partnership between business and public sector are also defined. Moreover, the place and role of PPP projects in the implementation of state policy of economic development are studied.

The second section analyzes the PPP project in infrastructure field using the sectoral-level analysis of projects` implementation in the world and analysis of project from risk management perspective.

In the third section problems of PPP projects` implementation in Ukraine are defined after analysis the level of public-private partnership in our country as well as perspective directions of PPP projects development are proposed.

Factual basis of work consists of scientific works of domestic and foreign scholars on the issue of public-private partnership, analytical and statistical materials that reflect the essence of the phenomenon of PPP, laws and regulations, annual reports of World Economic Forum.

The practical significance of the results. The methodological and scientific-methodical provisions developed in the work can be implemented as sections of courses and practical classes of the following disciplines: "Financial risk management", "Public-private partnership", and have already been tested in the I International, scientific-practical conference "Aviation, industry, society" (Kremenchuk, Ukraine) (thesis) [16], in the XXVIII International scientific-practical conference "Information technologies: science, technology, education, health. MicroCAD-2020" (Kharkiv, Ukraine) (thesis) [14], in the International scientific and practical conference "Social-economic challenges" (Sumy, Ukraine) (thesis) [15], in the International Scientific Journal "Mechanism of Economic Regulation" (Ukraine) (article) [17].

1 THEORETICAL PRINCIPLES OF THE PUBLIC-PRIVATE PARTNERSHIP IN THE INVESTMENT SPHERE

1.1 The essence of the concept of "public-private partnership"

Public-private partnership is considered to be mentioned as an ancient phenomenon due to the fact that it wasn`t studied enough seriously by researches until the late 1980s years (the year when PPP was widely implemented in countries` (developing, as well as developing) management and public processes.

Nowadays reforming the state investment policy in the context of intensifying the interaction between the public and private sectors that characterized by partnership formation between state and business. In the modern sense, the PPP is an effective and perspective tool for economic and social development at the regional and local levels, a means of raising funds for projects where authorities try to maintain control and establish cooperation with investors. During such cooperation, better technical and economic indicators and business results are achieved, exactly as state resources and communal property are used more efficiently.

As a rule, in the world practice, the term "public-private partnership" is considered in two senses: "first, it is a system of relations between state and business, which is widely used as a tool of national, international, regional, urban and municipal development; secondly, these are specific projects implemented jointly by state authorities and private companies at state and municipal property facilities" [38]. In highly developed countries, the term "public-private partnership" implies schemes of project implementation, a wide range of business models and relationships in any use of resources of the private sector (capital, know-how, managers` experience) for satisfaction social needs (roads, communications, real estate, etc.) [20].

However, we acknowledge that there are considerable discussions among researchers as to the unified definition of the term of "public-private partnership". In the Table 1.1 the most widely spread specifications are analyzed.

Table 1.1 - Methodical approaches to the interpretation of the essence of PPP

Author, source	Definition	Notes (definition analysis)
PPP as institution		
Varnavskyi V. [37]	"PPP is an institutional and organizational alliance between the state and business aimed to implement national and international, large-scale and local, but always socially significant projects in a wide range of activities: from the development of strategically important industries and research and development to public services".	This definition demonstrates PPP in the segment of cooperation, in which the state and the private sector jointly implement socially significant projects based on an agreement on the division of tasks and risks.
Poliakova O. [27]	"PPP is a public institution that includes a set of formal and informal rules, within which a joint activity of public authorities and the private sector on the basis of a set of alternatives is used with an aim to satisfy needs of society".	This interpretation already gives the concept of the features of a social institution limiting the framework in which this form of interaction between the state and business should function.

Table 1.1 (Continuation)

PPP as a form of cooperation		
Law of Ukraine "On Public-Private Partnership" [1]	"PPP characterizes cooperation between the state of Ukraine, the Autonomous Republic of Crimea, territorial communities represented by the relevant state authorities and local governments (state partners) and legal entities, except on the basis of the agreement in the order established by this Law and other legislative acts".	This statement is more formal, which has legislative force in Ukraine.
United Nations Economic Commission for Europe [36]	"PPP is a cooperation established to provide funding, planning, construction and operation of facilities and the provision of public services".	Such definition proposed by UNECE demonstrate that four elements of cooperation (funding, planning, construction and operation) are an essential characteristic of that relations between business and public sector.
European Commission [9]	"PPP is a cooperation between public and private partners with a relatively long period of project implementation at all stages of its realization; financing (co-financing) of the project by a private partner with the division of responsibilities and risks between the public and private partners fixed in the contract".	Unlike the UNECE definition European Commission emphasize on the importance of risks and responsibilities division.
PPP as an agreement/contract		
The World Bank [33]	"PPPs are agreements between the state and business regarding the production and provision of infrastructure services, which are concluded in order to attract additional investment and, more importantly, as a means of improving the efficiency of budget funding. A long-term contract between a private party and a governmental entity for the provision of a public asset or service, in which the private party bears significant risk and management responsibility and the reward is related to performance".	This definition refutes the notion of an agreement between public and private sides. This definition encompasses PPPs that provide new assets and services, and those for existing assets and services. It can include PPPs in which the private party is paid entirely by service users, and those in which a government agency makes some or all of the payments.
Eurostat [10]	"Public-Private Partnerships (PPPs) are long-term contractual arrangements between a government body and a non-government partner, usually for public service building projects".	This definition once again emphasizes on the long duration on project`s implementation.
Public-Private Partnership Commission [30]	"PPP is a legally enforceable contract in which a Contracting Authority partners with a Private Sector Partner to build, expand, improve, or develop infrastructure or service in which the Contracting Authority and Private Sector Partner contribute one or more of know-how, financial support, facilities, logistical support, operational management, investment or other input required for the successful deployment of a product or service, and for which the Contracting Authority and the Private Sector Partner is compensated in accordance with a pre-agreed plan, typically in relation to the risk assumed and the value of the result to be achieved".	The term`s explanation by PPP Commission has a formal characteristic of the peculiarities of PPP projects.
PPP as a delegation of authorities		
European Commission [9]	"PPP is a delegation to the private sector of part of the powers, responsibilities and risks for the implementation of investment projects that have traditionally been implemented or financed by the public sector".	This definition demonstrates one another vision of the PPP, which already aims to delegate authority between two sectors (public and private).
PPP as a form		
Ivanishkina Yu. [18]	"PPP - a set of forms of medium- and long-term interaction between the state and business to solve socially significant problems on mutually beneficial terms".	PPP can be defined as a form, but still with an aim to solve socially huge problems.
Fedulova L., Yanenkova I. [12]	"PPP is a form of compromise of interests between the participants, which is expressed in attracting investment in the real sector of the economy, economic development of the regions".	The form of PPP can`t exist without investments` attracting.

Source: compiled by the author on the materials [1; 9; 11; 12; 18; 27; 30; 33; 36; 37].

A review of the literature indicates that the concept of "public-private partnership" is an ambiguous term with a set of interpretations that differ and can be used in various contexts.

According to the results, which were demonstrated above, to our mind it`s important to summarize our own definition of PPP.

Therefore, to our mind the term "public-private partnership" can be described as an agreement between the public sector and business with predetermined risk-sharing and responsibilities between partners, or as a public institution with the possibility of transferring state powers to the private sector, including a set of formal and informal rules in order to implement national, international, local large-scale socially significant long-term projects, as well as to provide financing, planning, construction and operation of facilities, joint activities between public authorities and the private sector on the basis of a set of alternatives followed by attraction of additional investments and increase of efficiency of budgetary financing.

The fundamental meaning of this partnership is to combine the advantages of organizing transactions by the state and private business in order to minimize the economic and financial losses that are typical for each of them separately.

Commonly thought, a partnership is any association in economic or institutional form in which joint action takes place. PPP arises when one or more public organizations agree to cooperate with one or more private organizations. PPPs maintain public sector partnerships with business and civil society organizations, including community, voluntary and non-governmental organizations.

It is hard to consider PPP as a kind of simple contractual relationship. Although sometimes third parties can define PPP as a "partnership", but it isn`t a simple triadic relationship between public sector, a private-sector partner and members of the public interested in providing a service. A PPP is or should be a mutually beneficial agreement mainly aimed at social purposes.

On this base, we conclude that the term of PPP is enough new and still insufficiently studied, but according to our research this concept can be defined by different sizes and can be used mainly in such fundamentally various contexts: as public institution; as a form of cooperation; as a contract or agreement; as a form and as a delegation of authorities.

1.2 Classification of models of partnership between the state and business

Effective management of the process of coordination of interests and coordination of efforts of the state and business as the main institutions of market economy is one of the dominant areas of public administration, which ensures adequate consideration of new trends in

economic development, successful movement in accordance with target management vectors. economic systems of different hierarchical levels [23].

The state-business interaction can be structured in three main interdependent spheres: political, social, economic (Figure 1.1) [23].
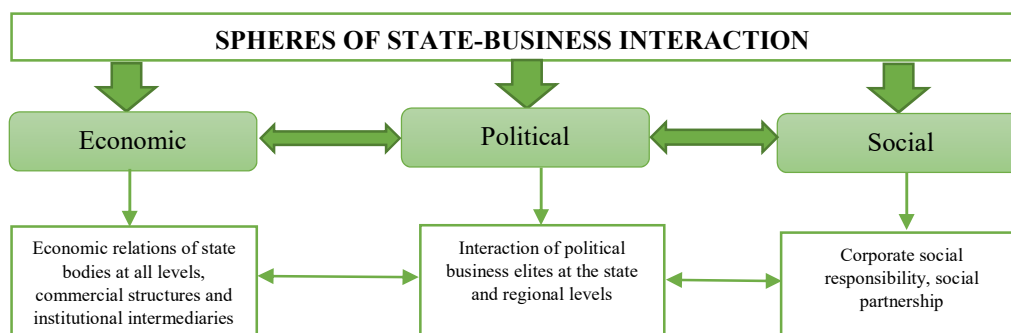
Figure 1.1 – Spheres of state-business interaction

The process of managing the interaction of state and business in modern conditions consists of creating favorable institutional conditions for public-private cooperation, taking into account their high differentiation in different socio-economic systems; selection, evaluation, organization of implementation and development of the most effective forms and technologies of interaction between entities from the public and commercial sectors; stimulation and regulation of development of subjects of interaction in the direction of coordination of their economic interests and strengthening of organizational, financial, information, personnel potential for change of qualitative and quantitative characteristics and results of interaction [6].

The world experience of involving such structures in the process of the state-business interaction can be explored within the boundaries of the most common conceptual models of partnership (Table 1.2).

Table 1.2 - Advantages and disadvantages of the main models of the state-business interaction

Name, essence and territory of distribution	Advantages	Disadvantages
Institutional model provides active participation of various associations and business associations in cooperation with government agencies (popular in Western Europe, Japan)	- provides the interests of big and small business in partnership with government authorities; - allows the state to establish cooperation with business sector on a civilized basis not on biz and commanding elite; - provides institutionalization and formalization of contacts between representatives of the public and commercial sectors	- rigidity and high bureaucratization of the representation system of interests through unions and associations; - impossibility of full representation of business interests through associations representing the diversified structures connected with several branches of economy; - forced business combinations pose a threat to volatile, mobile transition economies; - impossibility to implement a variety of forms and channels of communication with government agencies.

Table 1.2 (Continuation)

Intermediary (two-sector) model is characterized by the emergence of a competitive link of independent intermediaries, developing in the direction of professionalization, specialization, differentiation and expansion of services (popular in U.S.)	- using the advantages of free competition to select the most viable forms of cooperation; - more flexible than institutional model; - formation of markets for mediation and services to ensure the representation of interests	- the threat of a conflict of dispersed interests due to the growing number of subjects of interaction; - potential narrowing of the information space to gain competitive advantage

Source: compiled by the author on the materials [23].

In the scientific literature there are also other classifications of models of interaction between government and business. For example, A. Dehtyar and S. Narozhnyi [6] in their work define two additional models of state-business interaction: pluralistic ("state is traditionally seen as an external force, whose role is to develop regulatory rules with business, resolve conflicts that the business community itself can`t cope with, and to support national business in international markets") and neo-corporatist ("focus on partnership and cooperation of various professional and social groups ("capitalism of cooperation"), guarantees of achieving a certain standard of living, prevention of possible shocks and losses, the desire to avoid business failures").

The choice of PPP model depends on many project characteristics and government objectives, and often even with complete information, decision-making is a complex process.

Nowadays, besides the above-mentioned models of state-business interaction, in the world the following models of PPP are also in great popularity (Table 1.3):

Table 1.3 – Analysis of models of PPP

Definition	The essence of model	Location	Notes
Anglo-Saxon model	It envisages the widespread introduction of a competitive environment, the development of clear short-term contracts, and the creation of supervisory bodies that monitor their implementation. Objects are eventually transferred to private ownership	U.S., Great Britain, some Latin American countries, Southeast Asia, India	The aim of the model is to increase the number of effective owners by using the potential of private business in the infrastructural and social spheres
Latin model	Provides for the transfer of infrastructure or facilities management from state or local authorities to private companies while maintaining state-owned assets. The state retains the right to choose the main and investment development strategy, while meeting the needs of the population is carried out by firms themselves	France, Germany, Denmark, Holland, some countries Eastern of Europe	Ability to achieve balanced solutions in compliance interests of all stakeholders (government, commercial companies and consumers)

Source: compiled by the author on the materials [23].

It should be taken into account that today there are significant differences in the classification of PPP models used by different countries, international organizations. According to the I. Brailovskyi [5], the forms of PPP can be defined in following ways and such classification slightly different from the above-mentioned models:

• a service contract (< 5 years) is concluded between public and private partners for the provision of certain types of services. The purpose of this type of contract to use the specific benefits of business, that are too expensive for the state. This is a type of PPP contract for the construction of an infrastructure facility, as the implementation of the service package is more attractive to the private sector and allows to allocate capital costs and a longer period of time, as well as improve opportunities for profit over a long period of time;

• a management contract (3-5 years) is the contract that aimed at transfer of authority to manage public institutions and provide services to a private partner, including full responsibility and authority to manage all necessary functions and personnel to ensure more effective management;

• concession (from 10 to 60 years) agreement with a private partner, in which the latter may be responsible for the design, construction, financing, renovation, management and operation of the created or existing infrastructure, with ownership of the property. The project most often remains with the state or can be transferred to the private sector for some time until the end of construction or the concession period. Concessions apply to both existing infrastructure and existing facilities [5].

Speaking about world experience, we can mention that in addition to the classification of the most common models of PPP in the implementation of infrastructure projects characterizes the basic principles of risk sharing between the state and the private sector and can be classified in the following four groups according to the World Bank practice [33] (Figure 1.2):

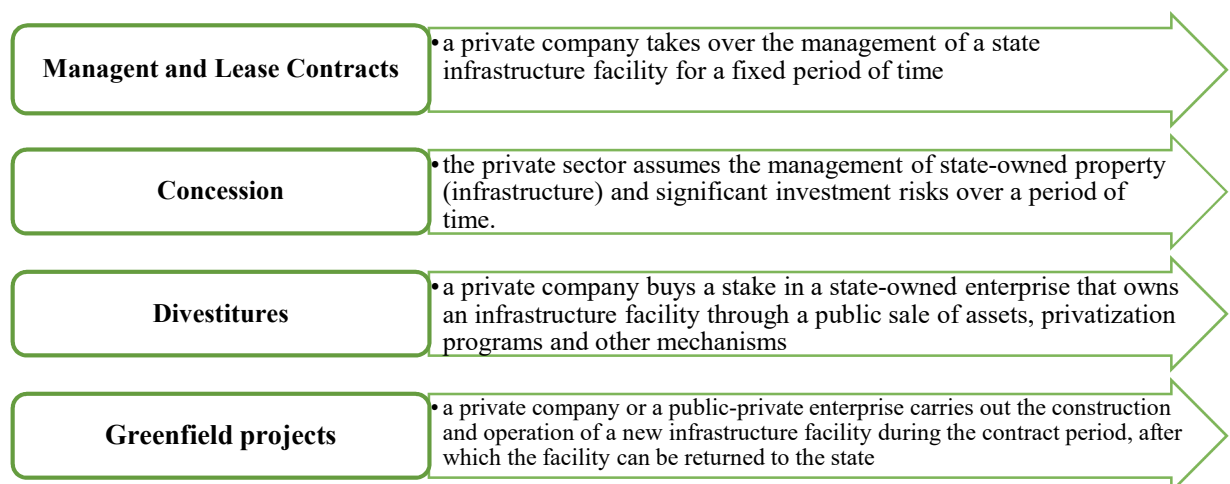| Managent and Lease Contracts | • a private company takes over the management of a state infrastructure facility for a fixed period of time |
Concession	• the private sector assumes the management of state-owned property (infrastructure) and significant investment risks over a period of time.
Divestitures	• a private company buys a stake in a state-owned enterprise that owns an infrastructure facility through a public sale of assets, privatization programs and other mechanisms
Greenfield projects	• a private company or a public-private enterprise carries out the construction and operation of a new infrastructure facility during the contract period, after which the facility can be returned to the state

Figure 1.2 – Models of PPP (the World Bank practice)

The main PPP models used in the implementation of infrastructure projects in the EU differ slightly from the above classification, mainly the degree of involvement and transfer of project risks from the state to the private sector [7]:

- Service contract - an agreement between a state body and a private company on the transfer of simple. These contracts are applied in operational activities and include tasks related to the implementation, operation and maintenance of new equipment (short-term).

- Operation and management contract (O&MC; O&M) - agreement between a public body and a private company, according to which the responsibility for the management and operation of the infrastructure is transferred to the private sector (short-term, but longer than service contract).

- Leasing (BLT (built-lease-transfer), BLTM (built-lease-transfer-maintain), LROT (lease-renovate-operate-transfer)) - an agreement in which a private company receives revenues generated by a state asset - an infrastructure facility, in exchange for fixed lease payments and the obligation to operate the facility while maintaining it in working order. Leasing allows a private enterprise to receive cash proceeds from a project for a certain period of time for a fixed government lease fee.

- Mixed types of contracts - the form of partnership is chosen depending on the risks distributed between the partners, which are fixed in the contract. The name of the mechanism reflects the functions performed by the private partner in accordance with the contract. Such mechanisms provide that the state party pays the business for the services provided. The term of contracts does not exceed 30 years. It can be implemented in the following mixed types: BOT (built-operate-transfer) (the business builds the facility, manages the project and hands it over to the state while the state pays the business for the services provided); DBOT (design-built-operate-transfer) (it involves the responsibility of the private sector to perform several functions at once: the design, construction and maintenance of the facility, such agreements are long-term, making the private sector a strategic partner of the government, but the funding function remains with the state); ROT (renovate-operate-transfer) (similar to the DBOT, the private party takes over the management of an existing facility and its responsibilities include restoring it); DBFO (design-built-finance-operate) (this form of partnership is the main mechanism for attracting additional financial resources from the private sector to infrastructure projects) [7; 25].

Thus, PPP is a set of models for building relations between the state and the private sector for the joint implementation of projects to create public sector infrastructure or provide services based on it, in which there is a division of responsibilities, rights, risks and financial involvement of the parties in project. Each model has its pros and cons, they can be suitable for achieving different goals of the public and private sectors.

An attempt to classify all PPP models is not able to cover the full range of possible ways to involve the private sector in cooperation with the public. The wide variety of PPP models and their subspecies provides the necessary flexibility in accordance with the expectations of the state, a wide coverage of the real conditions of investment projects in transport infrastructure, and above all a relatively fair distribution between partners of numerous risks. The correct

assessment of the capabilities and potential of each of the parties - PPP participants directly affect the choice of PPP model and the probability of successful project implementation.

1.3 The place and role of public-private partnership projects in the implementation of state policy of economic development

In contemporary world the importance of new approaches to the adequate institutionalization of a mutually beneficial partnership between the state and private business is increasing as the pace of economic development of almost all countries over the Globe slows down and national governments show the inability to reverse this trend. This is largely due to the fact that lately there have been both quantitative and qualitative changes in the economic functions of modern states that have not received a satisfactory theoretical explanation.

According to the participants of the World Economic Forum (WEF, 2020) one of the effective mechanisms for ensuring not only sustainable economic growth in the Globe but also the key to tackling climate change becomes the development of various forms of public-private partnership. This can only happen at scale and speed if the public and the private sectors come together on joint execution plans focused on ultimate efficacy and long-term impact [40]. It was mentioned that "At the World Economic Forum, our purpose is clear: we aim to shape the future of public-private cooperation. We want to do so globally, regionally and nationally. We want to help develop successful and responsible business models. We want to harness the technologies of the Fourth Industrial Revolution. We want to design cohesive, sustainable and resilient social and economic systems. And we want to enhance the stewardship of our global commons" [39].

To shape the future of public-private cooperation, 53 heads of state and government were joined by public figures from 117 countries who convened to accelerate progress on building a better future. Politicians, scientists and practitioners noticed the importance of public-private partnership implementation.

Such an instrument of interaction between the state and business as PPP creates new opportunities for social development in terms of better understanding of the activities and capabilities of each sector of the economy, as well as finding new ways of its applying to achieve the common good. Combining the financial resources of the public and private sectors allows for more efficient economic and social challenges. Moreover, both business and the state will benefit from such an association in the form of PPP. Ultimately, it serves to improve the quality of life and strengthen the competitiveness of the economy.

The economic effect for society from PPP is that there can be a great possibility to reduce amount of costs of projects at same time in a result receive public goods and services at so high quality. PPP also provides effective risk allocation, improve of management and public

administration, increases the profitability of projects in general, actively attracts investment for the implementation of socially significant projects, many of which could hardly be implemented without the combined efforts of the private and public sectors.

The need for modern and high-quality infrastructure is constantly growing. However, the state has the opportunity to provide favorable conditions for the private sector for the development of infrastructure projects, such as allocating land for construction of infrastructure, licensing, as well as assistance through the use of various financial instruments - government guarantees, subsidies, soft loans, etc. On the other hand, private business has significant financial resources that are more mobile than public ones; it is often ahead of the public sector in technical and technological innovations. However, it is often difficult for him to access those areas that are traditionally considered public, or the risks are very high.

The basis for the success of pooling financial resources in the PPP concept is that both the state and the private sector have their own specializations and advantages, which combine to form this cooperation and create a synergy effect. It is possible to work more efficiently and achieve better results, especially in the field of infrastructure.

The partnership of business and government can significantly increase the chances of success in major projects. The pooling of resources and the equitable sharing of risks between the parties to a partnership make it possible to actively attract investment for socially and socially significant projects, many of which could hardly have been implemented without the combined efforts of the private and public sectors.

From the point of view of the state, the combination of financial resources of the public and private sectors allows to solve a number of important tasks: improving the efficiency of infrastructure development and management; maximization of invested resources; spending public financial resources in modern conditions to save them in the future; concentration of investments in key projects for society; transfer of a significant part of risks to the private sector; stimulating innovation through competition mechanisms [25].

The joint work of business and government in the implementation of PPP projects promotes the development of innovative forms of project financing, stimulates entrepreneurial thinking and promotes the introduction of advanced management methods in government. All this contributes to the development of dialogue between business and government in various fields.

Speaking about macroeconomic role of cooperation between public and private sectors the following reasons can be defined:

- at the main stages of various forms of PPP unemployed can be provided by jobs;
- stimulating investment demand through the development of market infrastructure;

• during crisis situation it is possible not only to support aggregate demand in the short term, but also provide long-term economic growth through the advanced development of market infrastructure, around which business activities will be carried out in the future.

Prerequisites for initiating the process of partnership with the private sector by the authorities:

• services or projects cannot be provided (implemented) only with the use of financial resources of the authority;

• the participation of a private partner will improve the quality of services; and accelerate the implementation of the project or the start of services;

• the opportunity for competition between potential partners;

• possibility of simple measurement of the result and setting the cost of services;

• the cost of the implemented project or newly created services can be reimbursed through the mechanism of payment of users;

• the project or new services are innovative;

• there is experience of partnership between the authority and the private sector;

• a result of the partnership there is an opportunity to accelerate the economic development of the community (territory, region).

The following scheme of advantages and disadvantages of PPP for different participants of this partnership in a form of PPP can help analyze situation more deeply (Figure 1.3) [27].

For society:
• improving the quality of service due to the introduction of innovations;
• the possibility of transferring risks from taxpayers to the private sector.

For public sector:
• solving systemic development problems;
• the possibility of reducing budget expenditures for the development and introduction of new infrastructure;
• gaining access to the introduction of advanced technologies attracting various financial resources through business structures;
• improving the management of public resources;
• improving the quality and efficiency of works and services;
• increasing in revenues from taxes and other payments to the budget;
• increasing of investment and innovation activity;
• increasing the level of competition, reducing tariffs, strengthening social stability the ability to share risks between partners.

Advantages

PPP

Disadvantages

For private sector:
• expansion of own investment opportunities;
• direct state support and participation;
• use of foreign experience;
• possibility of long-term placement of investments under state guarantees;
• possibility to choose from a large number of projects.

• asymmetric distribution of preferences between certain groups of people and levels of society;
• non-transparency and accountability of government agencies (corruption in the selection of private partners);
• lack of special PPP legislation;
• the need to ensure an appropriate level of knowledge and skills of government and municipal officials who will participate in the creation and management of PPP;
• there is a risk that the private sector party will become insolvent or make large profits during the course of the project – this can cause political problems for the public entity;
• the long-term nature of a PPP project means that debt is incurred long before the benefits appear.
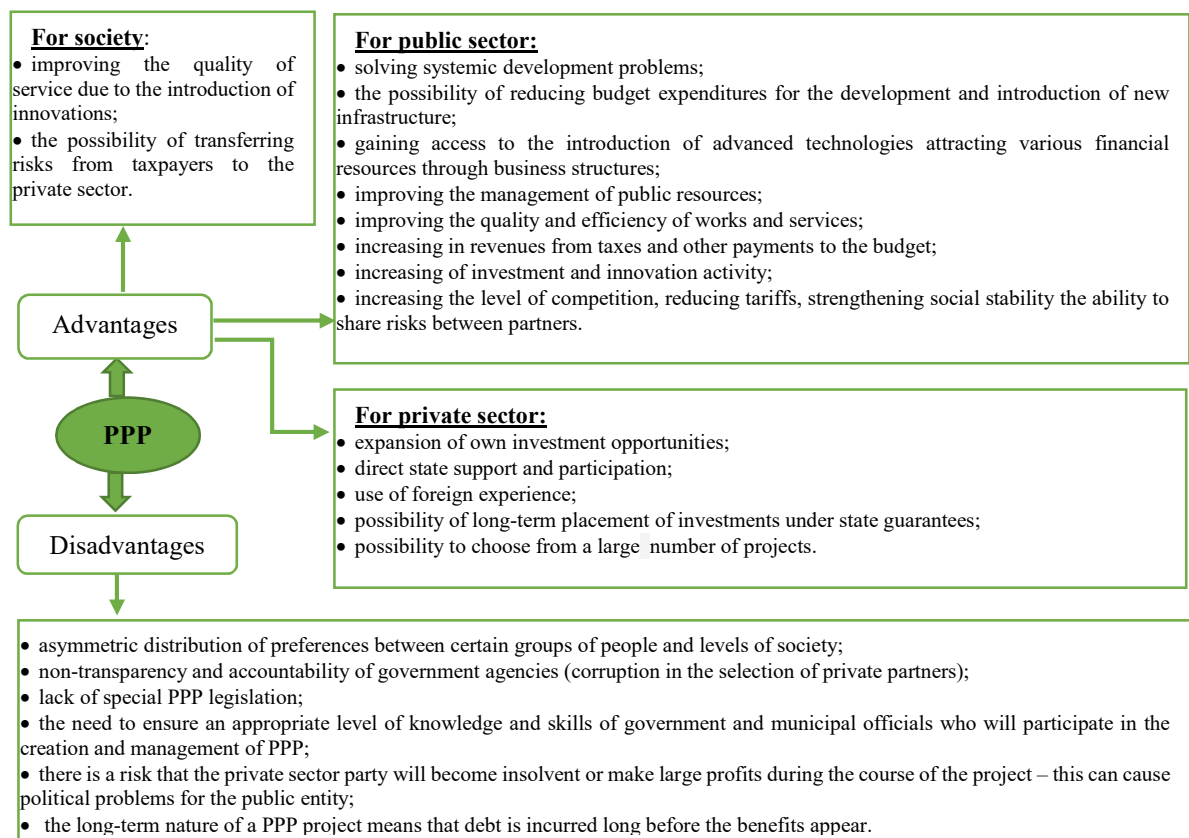
Figure 1.3 – Advantages and disadvantages of PPP

The experience of the establishment and operation of PPPs in many countries around the world allows us to compile a list of factors that positively affect the effectiveness of the partnership. The main factors that affect the success of public-private partnership:

- support by higher levels of government for the involvement of the private sector in the implementation of the project and in general the existence of PPP development policy; •

- clear division of responsibilities for project implementation among government agencies (financial, management);

- the application by the authorities of the principles of transparency and impartiality in identifying opportunities for cooperation that exist in the public and private sectors; analysis and evaluation of potential private partners;

- impartial, transparent competitive selection of a private partner for the project implementation;

- application of a single agreed set of procedures in the formation and management of PPP;

- use of reliable data on costs / revenues / risks in the process of government work

- ensuring the maximum level of competition between potential participants in the partnership;

- fair policy on employees; pooling assets / services within a structure of sufficient size to realize economies of scale while ensuring a sufficient level of competition;

- willingness of authorities to take risks that the private sector is unable to control, assess or guarantee (in particular, land acquisition, regulatory permits, environmental assessment and regeneration) [5].

Despite the great amount of advantages of PPP implementation, there are a number of uncertain barriers that continue to restrain PPP`s development and need urgent solution. They are imperfection of the legal basis for the establishment of a PPP, in particular for a transparent competition for the selection of a qualified and motivated private partner; instability of the regulatory environment in which PPP is implemented; lack of political will of the relevant authority to initiate and implement a partnership; dissatisfaction with the project by key stakeholders (local communities, the general population, local businesses); creating excessive risk to the environment; lack of financial incentives for a private partner to participate in the project; inefficient distribution of functions and risks in the partnership.

2 ANALYSIS OF PUBLIC-PRIVATE PARTNERSHIP PROJECTS IN INFRASTRUCTURE FIELD

2.1 Sectoral-level analysis world experience in PPP infrastructure projects implementation

Speaking about development of form of cooperation between the state and the private sector, which were analyzed in the previous issue, in world practice, it should be noticed that at present it is quite widely, especially in Europe, in the implementation of socio-economic tasks, such as ensuring effective governance in the field of PPP, reducing burden on the budget, strengthening the social responsibility of business, improving the quality of life of the country`s population, etc.

In view of that the World Bank recognized reforming and developing the infrastructure as one of the strategic directions to long-term economic growth, we can observe that the largest number of investment projects implemented within the system of PPP in European countries are projects in mention sphere. Besides all of this, such trend of infrastructure reforming can be treated as anti-crisis measures in the short term, as the implementation of large-scale infrastructure projects allows to create new jobs, improve the condition of metallurgy, construction, services, etc.

Formation and development of public-private partnership projects in world practice is based on the following principles [25]:

- priority of state interests, which means that the state acts as a customer of the project and determines the basic rules of interaction with business;
- effective distribution of risks between the parties, ie the risk should be transferred to the party that can manage it more effectively;
- political support of the state, which means the existence of a clear public policy, which is the basis for resolving all disputes that arise during the implementation of PPP projects;
- the principles of transparency, according to which the society to meet the needs of which the actions of partners are aimed, has access to information about their activities;
- partnership, equal nature of relations between the parties.

PPP projects are implemented in the transport sector, education and health care, housing and communal services, waste disposal, energy sector, etc. Regional features of public-private financing of infrastructure investment projects are also found in the context of individual sectors of the economy (Appendix G).

The results demonstrated in Appendix G represent that in the field of aviation the largest number of investment PPP projects is implemented by the countries of Latin America and the Caribbean, as well as East Asia and the Pacific region, which account for 15%. The countries of

Europe and Central Asia account for only 9.3% of PPP investment projects in this sector of the economy.

It is of importance that the dependence on these projects changes somewhat during their distribution in terms of countries` groups investment per 1 project. The most investment-intensive projects of this area are in the Middle East and North Africa, for which investments per 1 project amount to $2 204,19 million (average investments for this type of project in the world is $4 212,09 million). As well as there is a significant share of projects in South Asia – $700,74 million per 1 project. Almost twenty-four times the average investment in aviation projects in sub-Saharan Africa is lower than the world average, for which the average investment in one project is only $117,83 million. Such situation is caused by objective natural factors that complicate the process of development of the aviation industry in this region and increase investment needs.

PPP investment projects in the field of collection and transport have not become widespread. Most of the projects are in Latin America and the Caribbean, which account for half of the industry`s average investment. During the analyzed period (2000-2019), investment projects in this area in such regions as East Asia and the Pacific, the Middle East and North Africa were implemented in relatively small numbers, while in sub-Saharan Africa projects were not implemented at all. It should be noted that for investment projects in this area according to statistics are characterized by a high level of variation in the amount of investment per 1 PPP project by region of the world. On average, $498,27 million was invested in 1 PPP project for the development of transport infrastructure in the world. But in sphere of roads communications were realized 865 PPP projects with total amount of investments $334 304,74 million. Mentioned above fact demonstrates that the countries worldwide paid enough attention to the issue of development road connection.

In the field of railway communication, the largest number of PPP projects and the largest amount of investments were made by the countries of Latin America and the Caribbean. They accounted for 68.0% of the total number of projects of this type and 39.0% of the volume of relevant investments. The least intensive investments in the railway sector are made by partners from the Middle East and North Africa, as well as Europe and Central Asia (its number is 2 and 5 investment projects for the entire analyzed period). Nevertheless, among the countries of the world the largest was the volume of investments per 1 project in the countries of East Asia and the Pacific region – $1 493,87 million (35% of the total share of all investments per 1 project).

Public-private investment`s analysis in the development of water and sewerage demonstrates that the most active are the countries of South Asia, where during 2000-2019 were realized 499 projects with a total volume of $14 621,79 million, which corresponds to 59.0% of the total number of projects in the world and 33.8% of the global investment of PPP in water supply and sewerage. Significant quantitative parameters of public-private investment in this

area during analyzed period were also observed in Latin America and the Caribbean (225 projects and \$20 337,03 million of investments). At the same time, the largest amounts of public-private investment in 1 project were made in the Middle East and North Africa (\$4 469,23 million), and least at all in sub-Saharan Africa (\$3 418,85 million). It is connected first of all with excellent qualitative characteristics of the corresponding projects.

It should be noticed that Latin America and the Caribbean account for the largest share of total public investment in electricity: 32.6% or \$254 411,69 million. However, in the regions of the Middle East and North Africa there are the largest amounts of investment per 1 project in this area of the economy. The amount of which is \$306,08 million.

Significant volumes are also invested in sphere of electricity by PPP projects of the countries of South Asia (\$194 525,08 million or 25% of the total volume of investments in the corresponding direction). Investments in Europe and Central Asia per 1 project are quite poor, lower than the world average and amount to only \$145,05 million.

This analysis indicates that in general in the field of PPP the most active investors are South Asia countries, as well as Latin America and the Caribbean, which are leaders in the implementation of investment projects in all economic projects. The total number of PPP projects implemented in the countries of these regions is \$478 286,93 million and \$362 995,37 million respectively, with an average investment of 1 project \$1 936,35 million and \$2 125,01 million.

During 2000–2019 the countries of Europe and Central Asia implemented a total of 529 PPP projects, but their funding per 1 project was higher than the world average and amounted to \$2 595,42 million. The lowest number of projects was implemented in sub-Saharan Africa and the Middle East and North Africa, with a share of projects in the total number of projects worldwide of 5% and 4.7%, respectively.

Among the analyzed sectors of the economy, the most involved in the field of investment in PPP is electricity. In this sphere was realized 261 projects with a total investment of \$779 522,29 million. Likewise, a significant number of projects have been implemented in the sphere of road communication, as well as water supply and sewerage. Aviation and railway projects account for only 2.2% and 3.4%, respectively. The least invested sector was collection and transport, where PPP implemented only 43 projects in the period from 2000 to 2019.

It is worthy of note that that the quantitative PPP indicators published by the World Bank and European organizations have some differences in indexes. According to European organizations, in general, a larger number of projects were implemented with correspondingly slightly inflated amounts of investment. This situation can be explained by the difference in the methodology of formation of generalizing indicators. When grouping projects by regions, the World Bank accepts the criteria of territorial affiliation of the project implementation site on a basis, as a same time as EU statistical organizations accept the factor of participation in the circle

of public-private partners of non-resident residents of the place. In other words, EU statistics also consider a wide range of investment projects carried out within the framework of a public-private partnership with the participation of representatives of EU countries and had a cross-border character.

The main indicators that characterize the development of PPP with the participation of partners from EU countries, according to the European PPP Expertise Center are given in Table 2.1.

Table 2.1 - The main indicators characterizing the development of PPP in Europe in 2000–2019

Year	Number of projects	Investments, million EUR	Average investment per project, million EUR	Investment growth rate
2000	91	1445,9	15,88901099	x
2001	76	1326,9	17,45921053	0,917698319
2002	77	1697	22,03896104	1,278920793
2003	87	1729,3	19,87701149	1,019033589
2004	119	1592	13,37815126	0,920603712
2005	102	2159,5	21,17156863	1,356469849
2006	136	2626,9	19,31544118	1,216438991
2007	129	2679,5	20,77131783	1,020023602
2008	107	2365,2	22,1046729	0,882701997
2009	98	1499,3	15,29897959	0,633899882
2010	106	1830	17,26415094	1,220569599
2011	81	1747,4	21,57283951	0,954863388
2012	62	1208,6	19,49354839	0,691656175
2013	81	2082,6	25,71111111	1,723150753
2014	76	1586,1	20,86973684	0,761596082
2015	49	1553,1	31,69591837	0,97919425
2016	64	1067	16,671875	0,687013071
2017	33	1305,3	39,55454545	1,223336457
2018	32	1157,7	36,178125	0,886922547
2019	30	1057,2	35,24	0,913189946
Total	1636	33716,5	451,556176	x

Source: calculated by the author on the materials [34].

According to the date, which is demonstrated above, we can see that the annual number and volume of investment of infrastructure projects in the system of PPP with the participation of partners from EU countries tended to increase during 2000-2010. In 2010-2019 the number of projects begins to decline significantly. According to the European PPP Expert Center (EPEC), the average annual growth rate of public-private investment in EU countries for the corresponding period was only 0,43%. In total, 1,636 PPP projects were implemented in the EU countries during this period, and public-private investments in the amount of 33 716,5 million EUR were made. At the same time, the average investment in 1 project will be 452 million EUR.

It should be noted that the greatest activity of EU countries in terms of public-private partnerships was observed during 2004-2010, with about 800 PPP projects worth a total of about 14,595 million EUR. This is primarily caused by the accession of 10 new members to the European Union, whose economy requires significant investment in the development of production and infrastructure. Its reduction since 2008 is a consequence of the global financial

crisis, which has appreciably reduced the investment opportunities of PPP both in the EU and in the world. In the last decade, the dynamics have changed somewhat, the number of PPP projects has decreased, although their total cost was 14,595 million EUR.

A comparison of the dynamics of the total volume of investments in PPP projects implemented by the EU during 2000-2019 and the volume of investments per 1 project (Fig. 2.1) [34] allows us to conclude that in Europe there was a gradual transition from the implementation of projects with huge amount of investments to projects with smaller investment needs.

Therefore, the territorial distribution of investments in public-private infrastructure projects with European countries is quite uneven. It reflects the different level of implementation of PPP mechanisms in national investment different state`s policies.
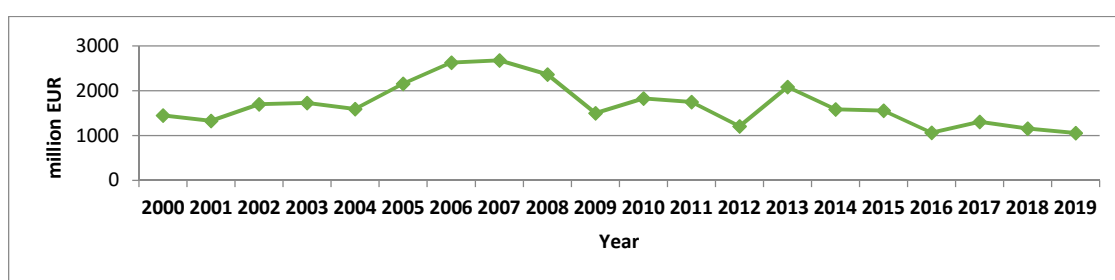
a) dynamics of total investment
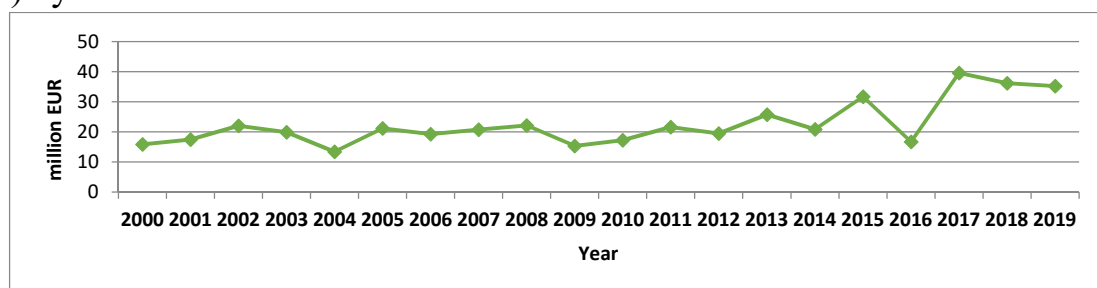
b) dynamics of the investments` volume per project

Figure 2.1 - Dynamics of investment in PPP projects in Europe in 2000-2019

Among European countries, the most active investment within the public-private partnership is carried out by the United Kingdom, which accounts for 40 % of total investment, France – 13 %, Spain – 10 % and Turkey – 9 % (Fig. 2.2) [10].
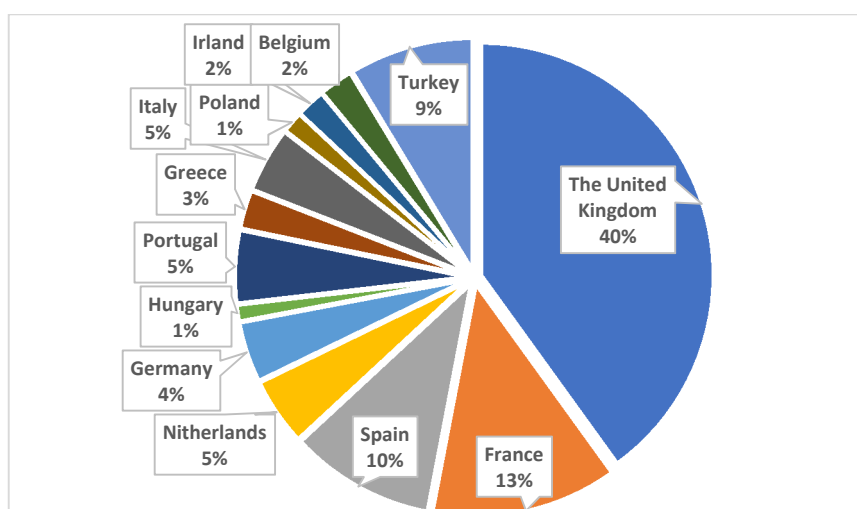
Figure 2.2 – Structure of investments in public-private partnership projects by European countries in 2000–2019

Visually, the differences in investment activity in the implementation of PPP projects in different countries of Europe are shown in Figure 2.3 [10].
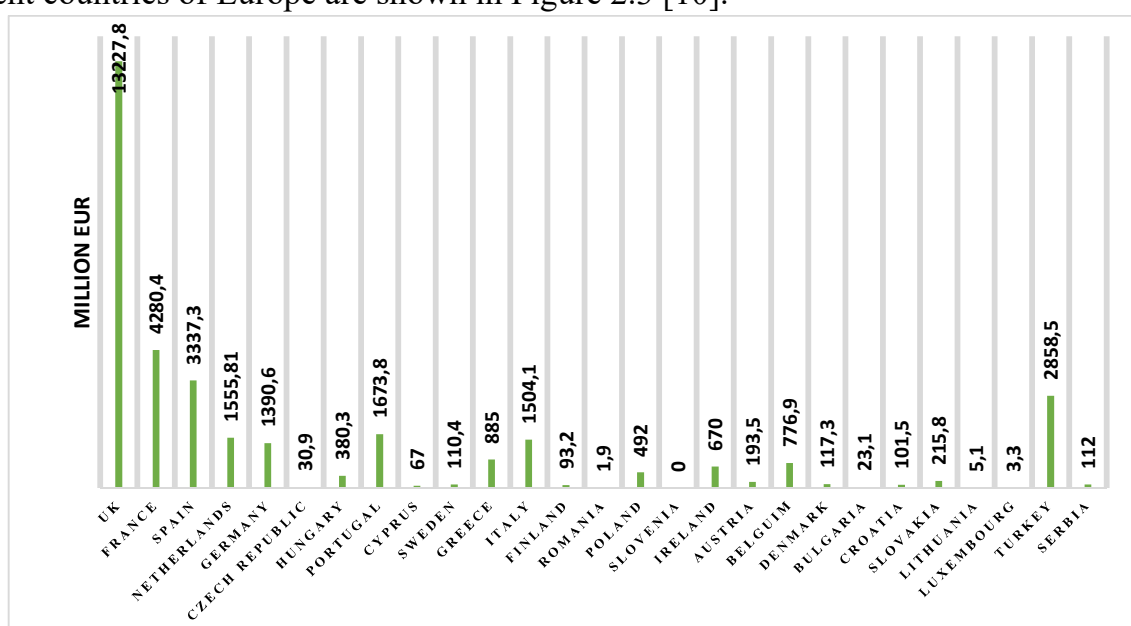
Figure 2.3 – Comparison of the volume of investment of PPP projects in European countries during 2000–2019

As it can be seen from Figure 3, in addition to the above-mentioned countries, Italy and Portugal also have volumes higher than the average level of public-private investment, and all other countries lag far behind in the implementation of public investment and business policy. At the same time, the volumes of public-private investments during 2000–2019 were rather low in Lithuania, Slovenia, Luxembourg, Romania and Bulgaria.

The main array of investment projects implemented by European countries is represented by transport projects (Figure 2.4) [10]. Proceeding from study, transport accounts for 20% of the

total number of projects implemented in the system of PPP during 2000-2019. Its number takes 53% of the total volume of relevant investments. This is evidence of the high capital intensity of this sector of the economy compared to others. Significant amounts of public-private investment are in projects in the field of health care (13%), education (11%) and the environment (6%). At the same time, projects demonstrated in other areas have a lower capital intensity, as evidenced by the combination of low share of projects of this group in the total amount of capital invested by public and private partners (2-4% of the total) in the total number of projects (up to 5%) [10].
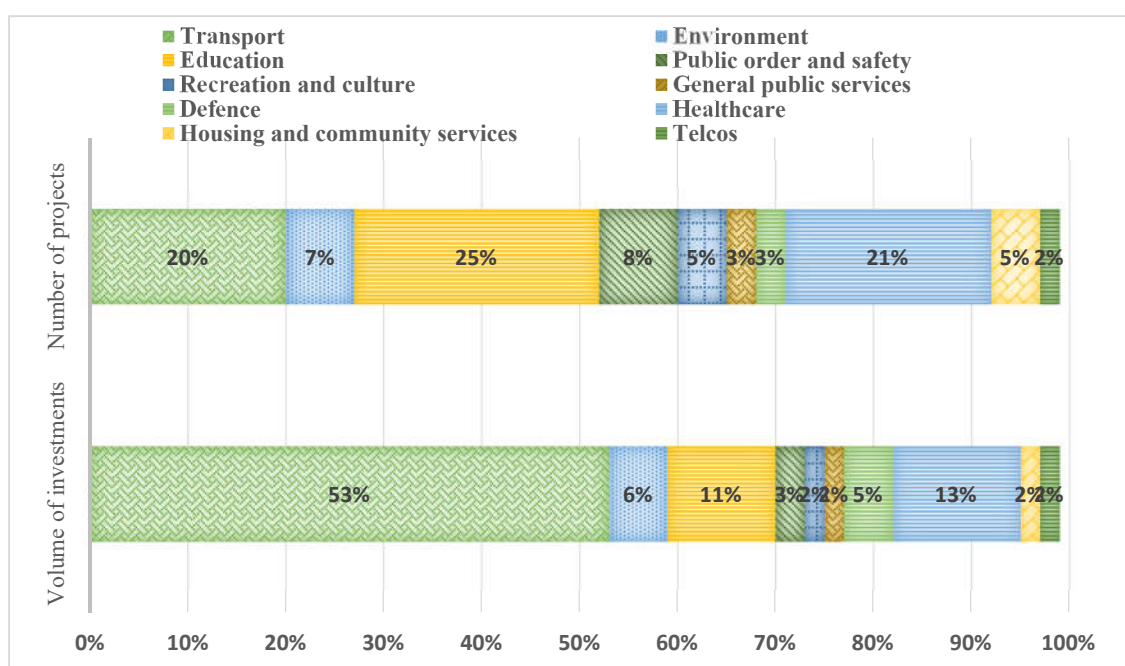
Figure 2.4 – Structural distribution of the main indicators of PPP in European countries by economic sectors in 2000–2019,%

The results of the analysis of countries with well developed economies and developing countries` economies indicate the presence of a dominant trend aimed at intensifying the processes of partnership between the state and business, which ensures the development and renewal of the national economy. This requires the state to implement a systematic and consistent public policy that considers various aspects of the nature of the partnership form of management.

The high level of PPP use presupposes coordinated action by governments, state and local authorities and private partners. The priorities for ensuring the mechanism of public-private partnership in local governments: the use of financial resources of private partners in the implementation of local programs and projects; reduction of budget expenditures for the development of necessary facilities and reconstruction of infrastructure; introduction of advanced technologies and well developed risks management, which, to our mind, can be a key factor in successful PPP projects implementation.

2.2 Analysis of PPP infrastructure projects from the risk management perspectives

Nowadays evaluation of PPP projects is no easy task due to the fact that evaluation means many things to many people. Evaluation can vary in strength, from personal impressions and "back-of-the-envelope`s assessments at one extreme, to more systematic and comprehensive studies using statistical principals and control methods at the other". They can also be taken for quite different reasons, such as narrow perspective of improving PPP delivery processes and organizational learning, through to the broader perspective of assessing public policies themselves.

Paying attention to the evaluation of specific PPP projects, regardless of the objectives of the evaluation and its object, there are three approaches to evaluating the success of projects: cost, comparative, income. The most objective and informative when evaluating business projects is the income approach. It is equally well suited for estimates of both market and investment value and allows the most accurate assessment of synergies and integration costs. This approach is based on the principle of expectation: any asset acquired for the purpose of obtaining income will cost exactly as much as it will bring in the future, taking into account the time factor. However, PPP projects are aimed primarily at achieving socially important goals. Therefore, according to the research of S. Naumenkova and J. Ovsiannikova [24], today there are the following main alternative methods of evaluating the effectiveness of public-private partnership projects:

- Cost-Benefit Analysis (CBA) - full cost-benefit analysis. Method focuses on revenue using net present value (NPV) and a certain rate of return. In our opinion, the ideas of a comparative approach must be used in PPP projects.

- Public Sector Comparator (PSC) - comparative analysis of public sector costs. Method is based on comparing the effectiveness of the project on the basis of PPP with traditional public procurement. Productivity, which focuses all the work on the consumer, of course, is the leading category of success in managing the development of the territory.

- Tenders – competitive tender. Method is an example of a comparative approach, but it is more suitable for contracting (outsourcing), when the state or local government outsources certain functions to third parties. That is, the state or local government simply purchases certain goods or services on a competitive basis.

Both methods - PSC and CBA - are similar in many ways, as they involve the use of net present value (NPV) and must be taking into account the costs incurred throughout the project life cycle. At the same time, the PSC method focuses on the results obtained in comparison with alternatives.

These main methods of evaluating the effectiveness of public-private partnership projects in accordance with foreign practice can be summarized in following way (Table 2.2).

Table 2.2 - The main methods of evaluating the effectiveness of public-private partnership projects in accordance with foreign practice

Method	The level of method`s complexity	Project types	Countries of implementation
Cost-Benefit Analysis	The highest	Traditional project	Germany, new EU member states
Public Sector Comparator	Medium	Traditional project	Japan, South Africa, Hong Kong, Ireland, Netherlands, Australia, U.S.
Tenders	Lowest	Other PPP projects	France, Latin America, Eastern Europe.

Source: compiled by the author on the materials [24].

Currently, the market environment, which is the place of PPP projects` realization, can be connected with presence of uncertainty and various risks. In general, PPP provides for a fair distribution of risks between project participants. But guided by one of the principles of the PPP on the existence of an effective distribution of risks between the parties, we can emphasize that the risk should be transferred to the partner that can manage it more effectively. The degree of responsibility of the parties and the extent of tolerable risks vary significantly depending on the type of PPP project from almost zero to almost full responsibility.

An important issue in PPP project planning is to understand the nature of PPP risk by the project partners. No less important is the awareness of the partners that the risk management process in a PPP project is much more complex than in a conventional investment project. This is due to the difficulties that arise in agreeing on the goals of the state and the private partner, as well as in the distribution of responsibilities and risks between PPP partners.

The system of risks` controlling of PPP projects can help to avoid in situations of uncertainty. It consists of several stages: risk identification, assessment and accounting of risks of PPP projects, control and audit of risks and the final creation of information and analytical base for management decisions to minimize the risks of PPP projects. To our mind, the stage of risks` analysis, which includes risks identification and evaluation, is the most important one

During risks` identifying, all risks affecting the PPP project are defined. There are many approaches to the classification and systematization of the risks of PPP projects.

PPP can be divided into following types: financial; operating; political; underfunding risk; risk of non-compliance in time; risk of operational inefficiency; the risk of termination of the agreement; risk of loss of profits; risk of incomplete construction; risk of unpreparedness of objects for operation; the risk of lack or fall in demand.

Risks of the private partner arising during realization of PPP projects can be classified as follows: the risks connected with work of public authorities; risks associated with the

participation of the state as a partner; business risks; risks associated with protests of the population, public and international organizations.

Classification in accordance with the resolution of the Cabinet of Ministers of Ukraine based on approval of the "Methodology for identifying risks associated with public-private partnership, their assessment and determination of the form of their management" [2] identify the following type of risks: risks associated with the influence of external circumstances that do not depend on the will of the partners; political; related to non-fulfillment by the partners of the terms of the agreement; commercial; financial; ecological.

To our mind above mentioned classification doesn`t reveals the variety of risks to the full extend. Consider some of the more detailed and available classifications of such risks in the Table 2.3.

Table 2.3 – Classification of PPP project`s risks

Feature	Types of risks
According to the source of origin	external, political and economic, social, natural, managerial, organizational, technical, resource, financial
According to the consequences (directions of influence):	project implementation costs; risks of income shortfall due to inflation, lower prices, demand for products / services, deterioration of the quality characteristics of the final product; risks of negative impact on the environment during project implementation; risks with other consequences
According to the probability of occurrence	risks with a low probability of occurrence (up to 19%); risks with a low probability of occurrence (from 20 to 39%); risks with an average probability of occurrence (from 40 to 59%); risks with a significant probability of occurrence (from 60 to 79%); risks with a high probability of occurrence (over 80%).
According to the degree of possible damage	insignificant risk, admissible risk, significant risk, critical risk, catastrophic risk

Source: compiled by the author on the materials [3].

The orientation of the modern management system on the strategic development and creation of the potential of long-term socio-economic growth of the country necessitates the development and application of modern management tools and ensuring their effectiveness. Today, controlling risks becomes an independent management tool, with its own goals, objects, functions, methods, and it is a logical development of controlling, both in conceptual and practical aspects [13].

Identifying the maximum number of potential risks and their subsequent quantitative analysis using statistical methods makes it possible to identify the most significant risks by the amount of losses and probabilities, which become the object of risk control.

In our opinion, risk control of PPP projects should be defined as a comprehensive system of methodological, analytical, information support for effective management decisions in the implementation of the partnership agreement in conditions of increased risks and economic instability, which aims to timely identify and neutralize external and internal risks and threats. which hinder the effective implementation of state-business partnership projects [3].

Risk management is very dynamic, the effectiveness of its operation largely depends on the rapid response to changes in market conditions, economic situation, financial conditions and other external as well as internal factors. Therefore, risk management should be based on knowledge of risk management standard methods, on the ability to assess a specific economic situation quickly and correctly, on the ability to quickly find a decent, if not the only way out of the situation.

We propose to consider the process of risk management within the framework designed by American Project Management Institute (PMI) called "A Guide to the Project Management Body of Knowledge" (PMBOK) [26]. PMBOK is a general guide in which formats of project activities are formalized, standardized and structured, approaches to the organization and concept of project management are described, terminology and concepts are fixed, called "inputs" and "outputs", as well as recommended methods that can be applied in this or that phase. PMBOK can be used as the framework of the algorithm for building a risk management system of the projects, especially for PPP infrastructure project (Appendix F).

Project risk management processes means "risk management planning, risk identification and analysis, development of risk response methods, control, monitoring and risk management during project implementation. Through project risk management processes, project managers seek to increase the probability of occurrence and impact of favorable risks (events) on the project and reduce the probability of occurrence and impact of adverse risks (events) on the project at the time of this project". According to the PMBOK`s project risk management consists of 7 processes, which is closely connected with each other: planning of risk management; identifying of risks; performing of qualitative risk analysis; performing of quantitative risk analysis; planning of risk responses; implementing of risk responses; risk`s controlling [26].

Risk management planning is the process of defining approaches and planning project risk management operations. As a management system, risk management includes the process of developing the purpose of risk and risk capital investment, determining the probability of occurrence of the event, identifying the degree and magnitude of risk, environmental analysis, selection of risk management strategy, selection of risk management techniques and methods reduction (ie risk management techniques), the implementation of targeted impact on risk. These processes together constitute the stages of risk management.

At the first stage it is possible to determine the level and types of risk management operations, ensure compliance with risk management activities and allocate sufficient time and resources to carry out risk management operations and to establish a common basis for risk assessment, define the risk probability and impact. During these processes, the tools and techniques, which can be used are meetings, data analysis and expert judgment. As a result, a risk management plan is considered to be one output.

The next step is connecting with risks identifying. To characterize specific risks and analyze the causes and factors of their occurrence, a classification is needed, which means the systematization of many risks on the basis of certain features and criteria that allow to combine many risks into more general concepts. There are many approaches to the classification and systematization of PPP projects risks. A good list of potential risks to a project`s cost, schedule, or any other critical success factor is the key to great risk management.

The third step in accordance with the project risk management in PMBOK framework is to conduct a qualitative risk analysis. It allows to conduct a logical analysis of possible events and their consequences This stage includes prioritizing risks. Given the fact that risks consist of two components: probability of occurrence and impact, each of them should be given priority in scale. The main advantage of qualitative methods is the possibility of application in the early stages of project development, starting from the moment of concept creation, and the main disadvantage is the impossibility to rank risks on the basis of some methodology.

After the qualitative analysis it should be used quantitative risk analysis. The analysis gives not point, but interval and probabilistic estimates of project parameters, in particular, its effectiveness. To our mind quantitative risk assessment methods make it possible to quantify the impact of risk on the main financial and economic performance indicators of the project, and this is their undoubted advantage. However, if they are not based on qualitative analysis, their application can be reduced to formal manipulation of numbers, which can mislead users of information. Therefore, at different stages of project analysis it is necessary to combine all groups of methods.

The fifth stage of project risk management is connected with plan of risk responses. At this stage, the most important risks are taking into account and the action plan is created aimed at risks responding and monitoring. As a result, when a risk event is triggered, the response plan springs into action. Then the next stage of risk implementation is fulfilled.

After all above-mentioned stages, when the risks have been identified, assessed, and risk response plans generated, the one of the important stages while risk management begins. It is risk monitoring and controlling. Monitoring of project risks can be organized on the principle of expert assessment of the status of each indicator according to five possible characteristics: positive (deviation from the indicator for the better); normal (corresponds to the indicator); unfavorable (deviation for the worse); anxious (significant deviation for the worse); threatening (critical deviation for the worse) [26]. Deviation of these indicators from the calculated values for the worse indicates about the threat of inefficient project implementation. The state of indicators captures a set of signal indicators that allow to identify potential threats in the early stages and assess changes in risks compared to the established calculated values – markers.

Project management needs a standard that is applicable to any project scale, industry and culture. PMBOK is an excellent concept, which is process oriented. It describes the

knowledge required to manage the life cycle of any project, program, and portfolio through processes. It identifies inputs, tools, techniques, and outputs required for each process. It defines the body of knowledge from which best practices in any industry can be created and infrastructure sphere isn`t an exemption.

In practice, a wide range of methods and techniques are used to assess and take into account the risks of public-private partnership in the process of substantiation and adoption of investment decisions that affect the effectiveness of public investment policy. It should be noted that, as a rule, to take into account the risk and uncertainty, methods based on probability theory and expert assessment of individual parameters are used, the applied aspects of which are quite detailed and thoroughly covered in modern sources.

PPP can be considered as a new financing model and it is not a strange fact that all processes in PPP are characterized by great uncertainty as well as a total theory of PPP is now enough imperfect. PPP projects can be affected by many uncertain factors. Although this problem of risks in relationship between two sectors involved in PPP projects is studied by various scholars, but the issue of sustainability risk of PPP projects is still urgent and, unfortunately, little attention is paid to it.

2.3 A Fuzzy Comprehensive Evaluation Model for sustainability risk evaluation of PPP projects

Sustainability risk can be defined as "a type of risk that is a set of probabilities and consequences of events that affect company`s sustainable growth". These types of risks can be also connected with the concept of stable development and the term of a triple approach, which aims to measure the financial, social and environmental performance of the company over a period of time [4].

The risk of stability can appear in different areas and industries. In the sphere of PPP project management, the risk assessment is connected with four main aspects: environment, economy, resources and society. Its aim is to monitor changes in PPP projects, correct strategies with a future attainment of balance between economy, environment, resources and society. Furthermore, complex relationships during the PPP process the amount of risk is increased.

Simultaneously, the precision of sustainability risk assessment, we should admit, that it is clearly distinct from traditional project types, plays a significant role for PPP project. In PPP project despite other project types, investors pay a great attention to the project`s stability, as the general fact that the amount of investment in this situation may be increased if such PPP projects don`t satisfy this issue of sustainability standards. The fact of stability risk means that such kind

of PPP project risk can be evaluated, precluded and controlled during the implementation process.

To our point of view, it is important to analyze the main influence of such type of risk in PPP projects using the Fuzzy comprehensive evaluation model (FCEM) and Failure mode, effects and criticality analysis (FMECA). The main idea of mentioned model is to provide a total view focused on reflecting the sustainability risk level factors of PPP projects by evaluating the sustainability risk level of each category [4].

According to the FMECA all risks are divided into five groups of 1st level risks: risks in culture and society, cost and economy, ecology and environment, project and organization and politics and policy. All these categories can help in stability risk evaluation. Additionally, all 1st level risks are subdivided into more detailed categories of 2nd level risks. In this case it is important to build a complex factor system of stability risks, as it is demonstrated in Appendix A before the risks evaluation.

Many factors that a closely connected with the level of stability risk during the process of risk assessment can be with a strong fuzzy uncertainty and it is so hard to evaluate such types of risks, using general methods (especial quantitative one), moreover it is troublesome to estimate according to the results only of one key criterion. Zage [41] in 1965 year proposed to solve this issue with the help of fuzzy sets concept, nowadays it is known as FCEM.

FCEM is based on "the membership degree theory in fuzzy mathematics, which transform the qualitative evaluation into quantitative evaluation". Nowadays it can be considered as an effective multifactorial mechanism for comprehensive assessment. In common interaction with the expert estimate method, demonstrated model can completely represent on the evaluation criteria and the factors influencing the equivocality, and then ensure the evaluation results closer to the current situation [4]. Since 1990s, FCEM has been used to decide general practical problems and research on the fulfillment of that model has been promptly expanding to different spheres. According to these studies, the stability of model is quite higher than other methods due to predestined weights and decline of blur by establishing participant functions [4]. We`ve decided to propose to take FCEM as a tool to stability risk assessment. Steps of evaluation are demonstrated in the Table 2.4 and Table 2.5.

Table 2.4 – Methodology of FCEM (Step 1-3)

Step	Essence	Formulas	Clarification
1	Establish a risk assessment factor set.	$Q = \{Q_1, Q \dots, Q_i, Q \dots, Q_n\}$ (2.1) $Q_i = \{Q_{i1}, \dots, Q_{ij}, \dots, Q_{im}\}$ $(i = 1,2, \dots, n; j = 1,2, \dots, m)$ (2.2) *where* Q is the risk assessment factor set and n is the number of 1st-level sustainability risk factors in set Q; Q_i $(i = 1,2, \dots, n)$ is the i th 1st-level sustainability risk factors; Q_{ij} is the j th 2nd-level sustainability risk factor of Q_i; m is the number of 2nd-level sustainability risk factor.	Elements in set Q are the factors that affect the risk evaluation. An integrated level of risk is reflected by these elements at a given time, the risk assessment factor set Q and the elements in this set shown as Formulas

Table 2.4 (Continuation)

2	Establish a risk assessment comment set P	$P = \{p_1, p_2, p_3, p_4, p_5\}$ (2.3) *where P* is the risk assessment comment set; p_1, p_2, p_3, p_4, p_5 - are the comments representing the sustainability risk level are "Devastating", "Unacceptable", "General", "Acceptable" and "Desirable", which is represented as the score of comment: 1, 2, 3, 4 and 5, respectively.	Comment set P is a collection consisted of 5 comments that evaluators make evaluation to the sustainability risk level according to the criterion of FCEM, shown as Formula
	Define the fuzzy comprehensive evaluation matrix R and $R_i (i = 1, 2, ..., n)$	$$R_i = \begin{matrix} r_{i11}\ r_{i12}\ r_{i13}\ r_{i14}\ r_{i15} \\ r_{i21}\ r_{i22}\ r_{i23}\ r_{i24}\ r_{i25} \\ r_{i31}\ r_{i32}\ r_{i33}\ r_{i34}\ r_{i35} \\ ...\ ...\ ...\ ...\ ...\ ... \\ r_{im1}\ r_{im2}\ r_{im3}\ r_{im4}\ r_{im5} \end{matrix}$$ (2.4) *where* $R = \{R_1, R ..., R_i, R ..., R_n\}$ and $R_i (i = 1, 2, ..., n)$ are the fuzzy comprehensive evaluation matrix of Q and Q_i; $r_{imk} (k = 1,2,3,4,5)$ is the comment of 2nd-level sustainability risk factor Q_{im}.	Then, the fuzzy comprehensive evaluation matrix of 1st-level sustainability risk factors can be constructed based on the scores of 2nd-level sustainability risk factors.
3	Build a weights vector W; and $W_i^{\grave{}}$.	$W = \{W_1, W_2, ..., W_i, ..., W_n\}$ (2.5) $W_i^{\grave{}} = \{W_{i1}^{\grave{}}, W_{i2}^{\grave{}}, ..., W_{ij}^{\grave{}}, ..., W_{im}^{\grave{}}\}$ $(i = 1,2 ..., n; 1 \leq j \leq m)$ (2.6) $\sum_{i=1}^{n} W_n = 1$ (2.7) $\sum_{j=1}^{m} W_{im}^{\grave{}} = 1$ (2.8) *where* W and $W_i^{\grave{}}$ are the weights vector of 1st-level and the 2nd-level sustainability risk factors, W_i and $W_{im}^{\grave{}}$ is the weight of Q_i and Q_{im}, respectively.	Each element in set Q and Q_i makes different contribution to the realization of risk assessment, so the weight of these factors are different. The assessment index weights vector can be determined, shown as Formulas.

Source: compiled by the author on the materials [8].

Then the valuations of W_i and $W_{im}^{\grave{}}$ can be figure out by the method of Failure Mode, Effects and Criticality Analysis (FMECA).

FMECA is "an inductive analytical tool provides a systematic, comprehensive evaluation and analyzes the effects of potential failures in the system design" [19].

The analysis process includes overlook and estimate failure, the influence of these faults on system functioning and determining the implications, if any, for system safeness. It provides appropriate evaluations, determining on the cause of the issue, to avert recurrence after identifying feasible system mistakes and the possibility of failure, austerity, and danger of each element. According to proposed analysis, the weight of stability risk factors can be measured by Formulas 2.9 and 2.10:

$$W_i^{``} = \frac{H_i \times S_i \times D_i}{C_i} \qquad (2.9)$$

$$W_{im}^{``} = \frac{H_{im} \times S_{im} \times D_{im}}{C_{im}} \qquad (2.10)$$

where $W_i^{``}$ is the cross-sectional area of 1st-level sustainability risk factor $Q_i$, $W_{im}^{``}$ is the cross-sectional area of the 2nd-level sustainability risk factor Q_{im}, H_i is the occurrence probability of Q_i, S_i is the loss and impact after Q_i occurs, D_i is the perceived degree of Q_i, C_i is the ability to control and compensate the loss after Q_i, occurs [19].

The value of H_i, S_i, D_i and C_i can be determined by using experts grading method (EGM) where $H_i = [1, 5]$, $S_i = [1, 5]$, $D_i = [1, 5]$, $C_i = [1, 5]$. The principles of expert evaluation are shown as Formulas 2.11-2.14 [19].

$$H_i = \begin{cases} 1 & Lowest\ probability\ of\ risk \\ 5 & Highest\ probability\ of\ risk \\ h_i & Otherwise \end{cases} \quad (2.11)$$

$$S_i = \begin{cases} 1 & Slightest \\ 5 & Worst\ of\ fected \\ s_i & Otherwise \end{cases} \quad (2.12)$$

$$D_i = \begin{cases} 1 & Most\ easily\ to\ be\ perceived \\ 5 & Most\ easily\ to\ be\ perceived \\ d_i & Otherwise \end{cases} \quad (2.13)$$

$$C_i = \begin{cases} 1 & Most\ difficult\ to\ control\ (compensate\ the\ loss) \\ 5 & Most\ easily\ to\ control\ (compensate\ the\ loss) \\ c_i & Otherwise \end{cases} \quad (2.14)$$

Then, the weight of various levels of stability risk factors W_i and W_{im} would be achieved after normalized the worth of $W_i``$ i and $W_{im}`$.

Table 2.5 – Methodology of FCEM (Step 4-5)

Step	Essence	Formulas	Clarification
4	Establish a fuzzy comprehensive assessment matrix G to reflect the sustainability risk level of the PPP project	$G = W \times B^T$ (2.15) $B = (B_1, \dots, B_i, \dots, B_n)$ (2.16) $B_1 = W_i` \times R_i$ (2.17) *where G is the fuzzy comprehensive assessment matrix which could reflect the sustainability risk level of PPP project,* B_i is the fuzzy comprehensive assessment matrix of the 1st-level sustainability risk factor Q_i $(i = 1,2, \dots, n)$, B is the fuzzy comprehensive assessment matrix set.	According to Formulas 2.15-2.17, the fuzzy comprehensive assessment matrix of different levels assessment factors can be calculated.
5	Calculate the value of sustainability risk level of PPP project	$Z = P \times G$ (2.18) $Z` = (Z_1, \dots, Z_i, \dots, Z_n)$ (2.19) $Z_i = P \times B_i$ (2.20) *where Z is the sustainability risk level of the project,* $Z_i$ is the sustainability risk level of the 1st-level risk factor $Q_i$ $Z`$ is the set of the 1st-level risk factors` sustainability risk level.	Through Formulas 2.18-2.20, the value of sustainability risk level of the PPP project and the sustainability risk level of 1st-level risk factors can be obtained, which would provide a basis for the sustainability risk management decisions

Source: compiled by the author on the materials [8].

Such type of factor system of stability risk of PPP project is broadly used while risk evaluation in projects of infrastructure field. To our mind it is important to represent the supplement and efficiency of the stability risk assessment model, how that model of evaluation can be implement to the projects (in our analysis, we consider Project X as an instance of future infrastructure PPP project).

According to Appendix A, we assess stability risk applying the models, which were represented above. Q, which was determined as a factor set for future evaluation. Its division is demonstrated in the Appendix B. In accordance with FCEM all risks were divided into two levels. The amount of 1st level sustainable risk factor is five ($n = 5$); the set of first level factor - Q. Speaking about 2nd level of factors, its amount in every 1st level factor is different, in same time the set of 2nd level factors is defined as Q_{ij}. As shown in Appendix B, the number of Project X`s risk factors are $m = 24$ $i =1$; $m = 10$ $i =2$; $m = 16$ $i =3$; $m = 12$ $i =4$; $m = 10$ $i =5$.

Hence to the criterion of FCEM, and Formula 2.3, the risk assessment comment set of Project X, P, can be established, where $P = \{p_1, p_2, p_3, p_4, p_5\} = \{1,2,3,4,5\}$. We determined the P and $R_i (i = 1,2, ..., n)$ using the experts` results. The simple example of questions is demonstrated in Appendix C. With the aim to collect the results, we prepared a Google Form for our experts, which were chosen from the base SumDU Stakeholders [32]. The objectives of this question form were experts of different levels: project managers, staff in finance and banking spheres as well as technical staff. The total amount of forms was 130, but for us it was possible to collect only 100. Based on information mentioned above only 100 answers were taking into future research. The rate of the valid questionnaire can be identified at the level of 76,92%. Therefore, the results of this survey are considered real and effective and can be used for further analyses.

Reasoning from the results of the evaluation comments of 2nd-level stability risk factors, the proposed type of matrix of 1st-level stability risk factors, was constructed. Then we analyzed the answers to the questions proposed for participates and we defined their comments of stability risks (Appendix D).

In the Appendix D, the level of 2nd-level risk factor Q_{im} we measured by $r_{imk} = \frac{Frequency\ (Q_{impa})}{\sum_{a=1}^{5} Frequency\ (Q_{impa})}$; $here$ Frequency (Q_{impa}) is the time that the object of this questionnaire survey evaluated the sustainability risk level of Q_{im} is p_a (α = 1, 2, 3, 4 or 5). Then, proposed in the methodology matrix of factors can be demonstrated:

$$R_1 = \begin{bmatrix} 0,660 & 0,160 & 0,080 & 0,050 & 0,050 \\ 0,800 & 0,100 & 0,070 & 0,010 & 0,020 \\ 0,500 & 0,250 & 0,100 & 0,100 & 0,050 \\ 0,600 & 0,150 & 0,100 & 0,050 & 0,100 \\ 0,700 & 0,150 & 0,100 & 0,020 & 0,030 \\ 0,360 & 0,190 & 0,080 & 0,100 & 0,270 \\ 0,470 & 0,340 & 0,090 & 0,070 & 0,030 \\ 0,360 & 0,450 & 0,120 & 0,060 & 0,010 \\ 0,080 & 0,240 & 0,120 & 0,200 & 0,360 \\ 0,120 & 0,340 & 0,150 & 0,140 & 0,250 \\ 0,020 & 0,080 & 0,140 & 0,300 & 0,460 \\ 0,060 & 0,130 & 0,450 & 0,340 & 0,020 \\ 0,230 & 0,140 & 0,280 & 0,300 & 0,050 \\ 0,460 & 0,350 & 0,080 & 0,060 & 0,050 \\ 0,450 & 0,320 & 0,030 & 0,100 & 0,100 \\ 0,010 & 0,190 & 0,020 & 0,320 & 0,460 \\ 0,370 & 0,240 & 0,080 & 0,170 & 0,140 \\ 0,040 & 0,060 & 0,280 & 0,140 & 0,480 \\ 0,020 & 0,020 & 0,080 & 0,350 & 0,530 \\ 0,030 & 0,050 & 0,150 & 0,470 & 0,300 \\ 0,030 & 0,070 & 0,310 & 0,460 & 0,130 \\ 0,050 & 0,040 & 0,080 & 0,200 & 0,630 \\ 0,070 & 0,040 & 0,080 & 0,360 & 0,450 \\ 0,020 & 0,080 & 0,050 & 0,150 & 0,700 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} 0,050 & 0,060 & 0,160 & 0,530 & 0,200 \\ 0,020 & 0,080 & 0,110 & 0,340 & 0,450 \\ 0,020 & 0,050 & 0,150 & 0,570 & 0,210 \\ 0,010 & 0,010 & 0,330 & 0,570 & 0,080 \\ 0,020 & 0,020 & 0,070 & 0,650 & 0,240 \\ 0,100 & 0,110 & 0,180 & 0,270 & 0,340 \\ 0,010 & 0,080 & 0,090 & 0,340 & 0,480 \\ 0,040 & 0,120 & 0,070 & 0,540 & 0,230 \\ 0,030 & 0,070 & 0,560 & 0,230 & 0,110 \\ 0,010 & 0,080 & 0,470 & 0,320 & 0,120 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} 0,110 & 0,200 & 0,540 & 0,060 & 0,090 \\ 0,100 & 0,470 & 0,320 & 0,070 & 0,030 \\ 0,340 & 0,260 & 0,320 & 0,030 & 0,050 \\ 0,240 & 0,480 & 0,230 & 0,040 & 0,010 \\ 0,110 & 0,470 & 0,330 & 0,070 & 0,020 \\ 0,110 & 0,010 & 0,420 & 0,450 & 0,110 \\ 0,090 & 0,130 & 0,560 & 0,100 & 0,120 \\ 0,350 & 0,520 & 0,090 & 0,030 & 0,010 \\ 0,210 & 0,650 & 0,100 & 0,020 & 0,020 \\ 0,380 & 0,540 & 0,060 & 0,010 & 0,010 \\ 0,110 & 0,470 & 0,330 & 0,070 & 0,020 \\ 0,540 & 0,240 & 0,120 & 0,050 & 0,050 \\ 0,340 & 0,260 & 0,320 & 0,030 & 0,050 \\ 0,380 & 0,540 & 0,060 & 0,010 & 0,010 \\ 0,130 & 0,330 & 0,520 & 0,010 & 0,010 \\ 0,240 & 0,480 & 0,230 & 0,040 & 0,010 \end{bmatrix}$$

$$R_4 = \begin{bmatrix} 0,040 & 0,090 & 0,320 & 0,450 & 0,100 \\ 0,010 & 0,010 & 0,100 & 0,320 & 0,560 \\ 0,020 & 0,030 & 0,120 & 0,430 & 0,400 \\ 0,010 & 0,020 & 0,040 & 0,360 & 0,570 \\ 0,020 & 0,140 & 0,430 & 0,230 & 0,180 \\ 0,030 & 0,070 & 0,160 & 0,630 & 0,110 \\ 0,100 & 0,110 & 0,580 & 0,120 & 0,090 \\ 0,010 & 0,050 & 0,100 & 0,110 & 0,730 \\ 0,020 & 0,130 & 0,430 & 0,230 & 0,190 \\ 0,030 & 0,080 & 0,160 & 0,600 & 0,130 \\ 0,020 & 0,070 & 0,170 & 0,630 & 0,110 \\ 0,010 & 0,020 & 0,040 & 0,360 & 0,570 \end{bmatrix}$$

$$R_5 = \begin{bmatrix} 0,090 & 0,110 & 0,450 & 0,200 & 0,150 \\ 0,030 & 0,030 & 0,130 & 0,560 & 0,250 \\ 0,020 & 0,020 & 0,280 & 0,470 & 0,210 \\ 0,050 & 0,080 & 0,210 & 0,520 & 0,140 \\ 0,010 & 0,040 & 0,150 & 0,680 & 0,120 \\ 0,060 & 0,140 & 0,340 & 0,370 & 0,090 \\ 0,010 & 0,060 & 0,150 & 0,570 & 0,210 \\ 0,020 & 0,040 & 0,110 & 0,510 & 0,320 \\ 0,010 & 0,010 & 0,090 & 0,780 & 0,110 \\ 0,080 & 0,330 & 0,430 & 0,060 & 0,100 \end{bmatrix}$$

After that we used FMECA to evaluate weight vectors W and $W_i^{`}$, output of which play a significant role in determining the level of stability risk. With this aim we proposed 5 experts in the sphere of PPP risk management to take part in research and score the values of H_i, S_i, D_i and C_i based on Formulas 2.9-2.14 (the scoring table is shown in Appendix E), and the counting results of the 1st-level stability risk factors are demonstrated in Table 2.6.

Table 2.6 - Values of H_i, S_i, D_i and C_i scored by five experts.

Q		Evaluation of 1st expert					Evaluation of 2nd expert					Evaluation of 3rd expert					Evaluation of 4th expert					Evaluation of 5th expert					Average
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Q_1	H			x						x					x				x					x			8,16
	S			x							x	x							x			x					
	D	x					x									x	x								x		
	C			x					x						x					x				x			
	W_1		3					13,3					10					4,5					10					
Q_2	H			x						x				x					x						x		15,94
	S			x					x						x					x						x	
	D		x							x				x					x					x			
	C			x							x			x					x					x			
	W_2		16					12					5					26,7					20					
Q_3	H				x					x					x		x									x	15,26
	S				x				x					x					x					x			
	D		x				x							x						x		x					
	C			x					x			x							x			x					
	W_3		24					13,3					18					6					15					
Q_4	H				x			x							x				x						x		22
	S			x					x					x					x						x		
	D			x					x						x					x						x	
	C		x				x								x				x						x		
	W_4		10					48					12					20					20					
Q_5	H			x					x						x				x							x	12
	S		x					x							x				x						x		
	D	x					x							x					x					x			
	C		x				x								x				x					x			
	W_5		4					12					12					12					20					

Source: calculated by the author.

$$W = \{W_1, W_2, W_3, W_4, W_5\} = \{0,111; 0,217; 0,208; 0,300; 0,164\}$$

In exactly the same way, the weight of 2ⁿᵈ level stability risk factors $W_i^`$ can be gained:

$$W_1^` =$$

$$\begin{Bmatrix} 0,027; 0,031; 0,059; 0,025; 0,026; 0,013; 0,063; 0,053; 0; 041; 0,043; 0,032; 0,043; \\ 0,043; 0,015; 0,042; 0,017; 0,043; 0,039; 0,034; 0,053; 0,103; 0,024; 0,078; 0,053 \end{Bmatrix}$$

$$W_2^` = \{0,095; 0,150; 0,098; 0,096; 0,066; 0,140; 0,047; 0,103; 0,084; 0,121\}$$

$$W_3^` = \begin{Bmatrix} 0,023; 0,035; 0,036; 0,060; 0,110; 0,086; 0,042; 0,042; 0,049; 0,100; \\ 0,046; 0,064; 0,038; 0,086; 0,096; 0,049 \end{Bmatrix}$$

$$W_4^` = \begin{Bmatrix} 0,077; 0,056; 0,039; 0,139; 0,094; 0,102; 0,089; 0,068; 0,136; 0,044; \\ 0,100; 0,056 \end{Bmatrix}$$

$$W_5^` = \{0,083; 0,123; 0,097; 0,134; 0,068; 0,123; 0,054; 0,103; 0,094; 0,121\}$$

According to Formula 2.17 the proposed in the methodology matrix of 1ˢᵗ-level risk factors can be evaluated:

$$B_1 = |0,237; 0,170; 0,146; 0,218; 0,230|$$
$$B_2 = |0,034; 0,072; 0,223; 0,422; 0,248|$$
$$B_3 = |0,237; 0,394; 0,263; 0,073; 0,033|$$
$$B_4 = |0,027; 0,074; 0,240; 0,364; 0,294|$$
$$B_5 = |0,041; 0,094; 0,241; 0,456; 0,168|$$

In accordance with Formulas 2.15 and 2.16, proposed in the methodology matrix G, which reflects the stability risk level of Project X, can be evaluated:

$$G = W \times B^T = W \times \begin{vmatrix} B_1 \\ B_2 \\ B_3 \\ B_4 \\ B_5 \end{vmatrix} =$$

$$= |0,111; 0,217; 0,208; 0,300; 0,164| \times \begin{vmatrix} 0,237; & 0,170; & 0,146; & 0,218; & 0,230 \\ 0,034; & 0,072; & 0,223; & 0,422; & 0,248 \\ 0,237; & 0,394; & 0,263; & 0,073; & 0,033 \\ 0,027; & 0,074; & 0,240; & 0,364; & 0,294 \\ 0,041; & 0,094; & 0,241; & 0,456; & 0,168 \end{vmatrix}$$

$$= |0,064; 0,174; 0,232; 0,460; 0,160|$$

Hence to Formulas 2.18-2.20, the worth of Project`s X stability risk evaluation, Z, and the stability risk level of 1st-level risk factors, Z_i, can be calculated:

$$Z = P \times G = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,064 \\ 0,174 \\ 0,232 \\ 0,460 \\ 0,160 \end{vmatrix} = 3,748$$

$$Z_1 = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,237 \\ 0,170 \\ 0,146 \\ 0,218 \\ 0,230 \end{vmatrix} = 3,034 \qquad Z_2 = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,034 \\ 0,072 \\ 0,223 \\ 0,422 \\ 0,240 \end{vmatrix} = 3,778$$

$$Z_3 = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,237 \\ 0,394 \\ 0,263 \\ 0,073 \\ 0,033 \end{vmatrix} = 2,272 \qquad Z_4 = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,027 \\ 0,074 \\ 0,240 \\ 0,364 \\ 0,294 \end{vmatrix} = 3,824$$

$$Z_5 = |1\ 2\ 3\ 4\ 5| \times \begin{vmatrix} 0,041 \\ 0,094 \\ 0,241 \\ 0,456 \\ 0,168 \end{vmatrix} = 3,617$$

In addition, Figure 2.2 shows the sustainability risk level of 1st-level risk factors.
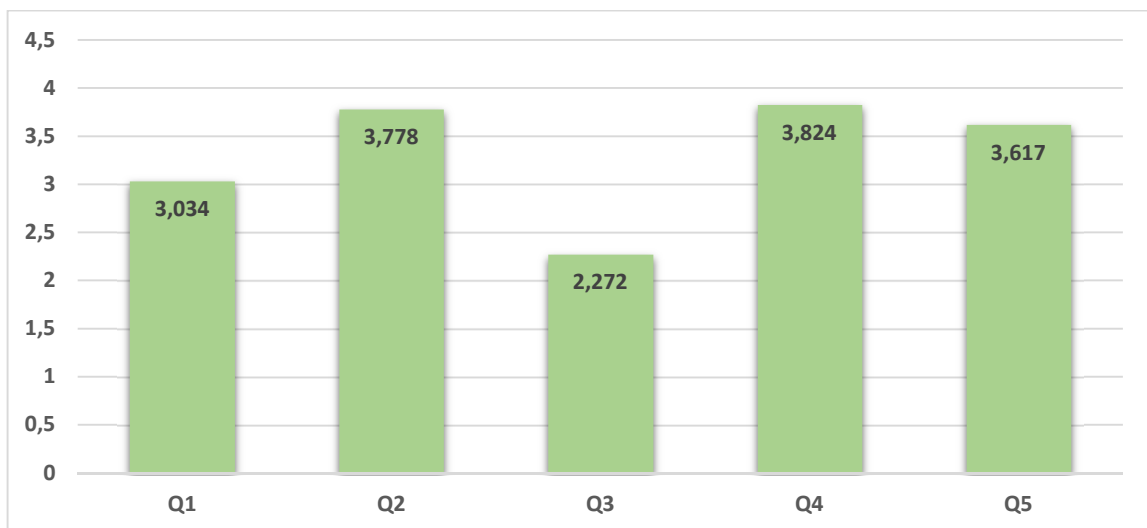
Figure 2.2 - Sustainability risk level of 1st-level risk factors

$Z = 3,748$ means that the worth of Project`s X stability risk level is 3,748, which is much higher than the average value of risk elements, 2,5, which defines that the Project`s X stability risk level is relatively higher and needed for science-based management in operation of project implementation.

In Figure 2.2, the worth of Project`s X stability risk evaluation is in accordance with the exponent, from highest to lowest:

1) Q_4 – Project and organization;

2) Q_2 – Ecology and environmental;

3) Q_5 – Politics and laws;

4) Q_1 – Culture and society;

5) Q_3 – Cost and economy.

Project and organization and ecology and environmental are the highest sustainability risk level factors. Therefore, if managers want to control the sustainability risk of Project X effectively, Q_3 and Q_1 are the key factors to be addressed first.

In comparison of various PPP projects, it is not troublesome to find that the stability risk level of the same elements, such as ecology and environment, society, and culture, in various projects are different due to the particularity of each project; it reflects that the stability risk level of various factor is comparative, which demands managers to take the practical situation into account when making decision on stability risk management for various PPP projects.

3 PROBLEMS AND PERSPECTIVE DIRECTIONS OF IMPLEMENTATION OF PPP PROJECTS IN UKRAINE

3.1 Dissemination of public-private partnership in Ukraine

In recent years, Ukraine has experienced growing macroeconomic imbalances and economic stagnation. This was due to unsatisfactory levels of macro-financial management, especially low level of risk management, declining investment and external demand. Inefficient governance and corruption have led to irrational public spending, destroyed the government`s ability to formulate public policy and manage public programs, and undermined public confidence in public institutions. At the same time, corruption and deteriorating protection of property rights, as well as imperfect legal regulation of investment activities and taxation, have significantly weakened the investment climate and hampered domestic and foreign private investment.

Ukraine`s extensive infrastructure needs combined with limited fiscal space require a concerted effort to strengthen public investment management. Investment in infrastructure is important for stimulating economic development. The transformation of public investment into assets largely depends on how effectively all types of public investment are managed. Today, the PPP management structure does not meet the requirements of the global PPP market. As the PPP system must be based on a functioning public investment management system, Ukraine`s prospects for attracting international investment from the global PPP market may now be unattainable.

Ukraine needs immediate reconstruction and long-term infrastructure development. Social and industrial infrastructure is the most vulnerable part of the Ukrainian economy. The most important reasons for this situation are the lack of budget funds to ensure expanded reproduction and high risks of investing in capital-intensive facilities in the absence of state guarantees. It is the responsibility of the state for the development of infrastructure sectors with limited financial resources determines the need to combine resources and actions of the state and the private sector in various forms of PPP.

Nowadays in Ukraine there is no official systematized information on PPP, which does not allow for an in-depth analysis of the situation. It is possible to draw conclusions about the state of PPP only on the basis of information from the websites of individual ministries and local authorities, but these data are fragmentary and not always accurate.

But it should be noted that the World Bank annually monitors the development of PPP projects in the field of infrastructure in the world and in some regions. According to this monitoring, in Ukraine during 1990-2020, only 85 projects were implemented, in which 6 888million dollars were invested, of which about 4 882million dollars - in the field of electricity (Table 3.1).

Table 3.1 – PPP projects in Ukraine in 1990–2020, according to the World Bank

Sector of infrastructure	Number of projects	Investments, million dollars
Electricity	60	4 822
ICT	5	1 461
Natural gas	11	38
Ports	3	295
Treatment/ Disposal	1	70
Water and sewerage	2	202

Source: compiled by the author on the materials [35].

The largest PPP projects during last years were implemented in electricity. The most famous were "Ukrtelekom" ($1,320 million), "DTEK Botievo Wind Farm" ($458 million), "Syvash Wind Power Project" ($428,45 million), "Active Perovo Solar Plant" ($411,80 million), "Zaporizhia Onshore Wind Farm Phase I" ($376 million), "Nikopolska Solar Power Plant" ($282 million), "Dniproenergo" ($248,70 million), "Zakhidenergo" ($237,20 million), "Active Ohotnikovo Solar Plant" ($200 million) and "Active Dunayska Solar Plant" ($168 million) [28].

Furthermore, the main sponsor of PPP projects in Ukraine are System Capital Management (SCM Group) (Ukraine) and Active Solar Holding (Austria) (Table 3.2).

Table 3.2 – Top sponsors of PPP projects in Ukraine

Sponsor	Country of origin	Investment, million dollars	Number of projects
System Capital Management (SCM Group)	Ukraine	2,572	22
Activ Solar Holding	Austria	1,095	9
Total Eren SA	France	428	1
Al Gihaz Holding	Saudi Arabi	428	1
Scatec	Norway	420	6
LongWing Energy SCA	Luxembourg	376	1
VLC Renewables Fund	United Kingdom	376	1
General Electric	United States	376	1
China Machinery Engineering Corporation	China	282	1
DTEK	Afghanistan	272	2

Source: compiled by the author on the materials [35].

According to the central and local executive bodies as of 01.01.2020 in Ukraine 187 agreements were concluded on the basis of PPP, of which 52 agreements are implemented (34 - concession agreements, 16 - joint venture agreements, 2 - other agreements), 135 agreements are not implemented (4 agreements - expired, 18 agreements - terminated, 113 agreements - not fulfilled) [21].

As for the structure of contracts concluded on the basis of PPP, as a rule, they are in a form of concession agreements, the number of which is growing every year.

Areas of public-private partnership use are shown in Table 3.3.

Table 3.3 – The state of PPP implementation in Ukraine

Project areas of application	Donetsk	Zhytomyr	Zakarpattia	Ivano-frankivsk	Kyiv	Khirovohrad	Luhansk	Lviv	Mykolaiv	Odesa	Poltava	Kharkiv	Kherson	Khmelnytskyi	Chernihiv
Prospecting, mineral exploration	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Infrastructure	-	-	-	1	-	-	-	-	-	5	-	-	1	-	-
Waste heap	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Real estate management	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Natural gas production/transportation	2	1	3	-	-	-	-	1	-	-	-	-	-	-	1
Water collection, purification and distribution	-	-	1	3	4	-	1	1	10	-	1	-	-	-	-
Tourism	-	-	-	-	1	1	-	2	-	-	-	-	-	-	-
Electricity production	-	-	-	-	-	-	-	-	1	-	-	1	1	-	-
Other	1	-	-	1	1	-	-	-	-	1	-	-	-	2	-

Source: compiled by the author on the materials [21].

According to the data of Ministry of economic development, trade and agriculture of Ukraine the majority of PPP project implement of the sphere of water collection, purification and distribution and also in infrastructure field. Basically, a significant part of projects is implemented on the territory of Mykolaiv (11 or 21,15% of all projects), Kyiv (6 or 11,5%) and Odessa (6 or 11,5%) regions.

The mechanism for implementing the concept of public-private partnership is just beginning to take shape in Ukraine. It is important to admit that even that unsignificant experience in PPP implementation (particularly in the field of infrastructure) cannot be considered successful. In general, Ukraine has a high potential for project implementation public-private partnership. But there are a great number of restraining factors which prevent PPP development.

3.2 Problems of implementation of public-private partnership projects in Ukraine

Elaboration of PPP principals in Ukraine can become an key factor for infrastructure modernization, introduction of new methods and management models owned by the private sector, which are aimed to implement large programs and realize PPP projects, development the regulatory framework that the interaction of state partners with private partners and the main one - joint participation of the state, local self-government authorities and a private partner in scientific research.

It should be noted that the successful experience of PPP projects in Ukraine is virtually absent. The reasons to our mind can be defined the following:

- complex and contradictory legislation in the field of PPP;

- lack of effective state support mechanisms of PPP projects;

- lack of a consistent state policy in the field of PPP and a proper system for managing the development of PPP;

- low level of institutional capacity of public bodies and the private sector to implement PPP (lack of available financial resources; authorities in Ukraine believe that domestic businesses don`t want to work transparently and pay taxes, in its turn, business, like the population in Ukraine in general, has little trust in the country`s authorities; lack of a clear definition of the partnership`s ideology; underestimation of project potential; insufficient professionalism of the public partner for the preparation of PPP projects);

- the absence in the Budget Code of Ukraine the possibility to guarantee compensation for losses of a private partner related to the mismatch of demand for goods and services to the planned indicators, non-fulfillment by the state of obligations under PPP agreements, compensation for differences in tariffs, etc.;

- lack of guarantees of financial obligations` fulfillment of PPP projects for the entire period of their implementation by the state, which is associated with the annual approval of the budget and adjustment of budget programs;

- lack of tax and customs benefits for the implementation of PPP projects, which reduces their attractiveness to private partners in the presence of such benefits for other forms of state incentives for investment;

- lack of confidence of the private partner in the possibility of equal protection with the state of their interests in the justice system, in particular the ability to demand from the state to fulfill its obligations and compensation for damages due to non-fulfillment of its obligations;

- the presence of a high level of corruption in government, which leads to more expensive PPP projects for a private partner; at the same time, it can be argued that this problem is not fundamentally insurmountable.

Additional we can agree with A. Mitskan, that in Ukraine there are significant problems in obtaining funding for PPP projects: insufficient state funding to improve public infrastructure; misunderstanding of the risks of utilities by commercial banks; the difficulty of obtaining guarantees and return on investment; the difficulty of borrowing funds by local governments; caution of private and portfolio investors; high interest rates on the loan; the consequences of the financial crisis and limited foreign capital; problems of guaranteeing permanent income for servicing loans [22].

The study of the impact of economic, political, legal, social, technological factors on the development of PPP in Ukraine, based on the method of extracting expert knowledge, PEST-analysis, analysis of indicators in global rankings allowed to determine the degree and nature of influence of factors on PPP development (Table 3.4).

Table 3.4 - Matrix of PEST-analysis of factors of macroenvironment of PPP development in Ukraine

Political and legal factors (P)	Economic factors (E)
Change of legislation (+); the probability of military action in the country (-); bureaucratization and level of corruption (-); institutional environment (-); stability of tax policy (-); stability of political power and the existing government (-); availability of national and regional PPP development strategies (+/-); the level of business confidence in public authorities (+/-); system of state aid and provision of state guarantees (-); availability of highly qualified specialists in various sectors of the national economy and PPP among state and local authorities (+/-).	Inflation (-); dynamics of the hryvnia exchange rate (-); monetary policy (-); fiscal policy (-); GDP dynamics (-); effective demand (-); the level of development of the banking sector (the development of the market of long-term liabilities and the level of lending to the real sector of the economy) (-); tariffs for services of natural monopolies (-); major currency rates; employment dynamics (-); degree of openness of the economy (+/-).
Social factors (S)	Technical factors (T)
Society`s need for quality infrastructure (+); population growth rates (-); increase in the number of temporarily displaced persons in the country (+/-); media influence (+/-); society`s attitude to PPP policy (+/-); the level of public awareness of the effectiveness of PPP projects (+/-).	Availability of technological support of public authorities for the implementation of PPP projects (-); feasibility study experience for PPP projects (-); access to the latest technologies (+/-); level of innovation (-); degree of use, implementation and transfer of technologies (-).

Note: (+) - positive impact, a factor that accelerates the development of PPP; (-) - negative impact, a factor that inhibits the development of PPP; (+/-) - average value, depending on the situation.

Source: compiled by the author on the materials [31].

The factors presented in the blocks are presented in descending order of their significance. This allowed us to identify the most significant factors that need to be focused on in shaping public policy on PPP development. The results of the expert assessment indicate that political, legal and economic factors have the greatest influence in Ukraine. The study of the nature of influence has shown that the social and political-legal spheres have the greatest number of positive factors, which means that society needs to develop partnership between government and business, and the state understands the importance of private partner involvement in socially important projects. A significant obstacle is the difficult economic situation in the country, which in turn significantly weakens the technological sphere, which is also a barrier to the development of PPP in Ukraine [31].

The functioning of the PPP requires a strong public sector that is able to adapt to the new role and learn new competencies. In particular, PPP systems require professionals who are not only experts in building partnerships and managing network partnerships, but also have the skills to negotiate, manage contracts and risk analysis. In fact, the transfer of the right to the public sector to provide public services involves an increase, not a reduction, as it may seem, of the responsibilities of public authorities and local governments. In addition, PPPs require the

creation of a new type of state and public expertise that will facilitate the implementation of projects and monitor their effectiveness.

Successful development of PPP as a mechanism for intensifying investment activities and attracting private investment in strategically important areas for the state is possible only if the balance of interests of the state and the private investor is ensured. The legal form of PPP implementation should provide the investor with attractiveness, security of investment in state property and realize the main goal of the project, ie to develop the area that is strategically important for the state. To do this, the latter must perceive the private investor as an equal partner. By requiring him to fulfill the obligations under the agreement, the state must, for its part, guarantee the fulfillment of its own obligations in full.

In the area of public investment management, Ukraine lacks several key elements that would classify it as a country with best practices in the international context. There is a lack of a strategic view of public investment priorities; clarity in determining which project proposals of a private company can be considered as public investment; a stable regulatory framework for PPPs and clear selection criteria and opportunities for effective management of traditional public investment and PPPs. In addition, when developing a general public investment management system, it is very important to recognize that PPPs often involve fiscal risks, and the government needs to be able to manage them to ensure that this system is in line with the global PPP market. Thus, Ukraine must continue to develop and carry out deep reforms in this area.

First of all, for more efficient and short-term problem solving, it is necessary to clearly understand not only the problems, but also possible solutions. In solving these problems, great attention should be paid to European and world practice, including taking into account current crisis trends.

3.3 Trends in the development of state policy to support PPP projects

For the practical introduction of the main forms of PPP in order to attract private investment resources into the Ukrainian economy, it is necessary to implement a purposeful and consistent state policy of PPP development.

It should be aimed at creating a favorable economic and managerial environment for the development and implementation of PPP projects, namely: improving the regulatory framework and institutional support for the development of PPP; increasing guarantees for the protection of the interests of public and private PPP partners in the process of developing, approving and implementing projects. A necessary prerequisite for the effective development of PPP is the formation of a general favorable environment for business, which provides for the improvement of the investment climate, tax and regulatory environments.

To eliminate the shortcomings and contradictions of the institutional and legal support for the development of PPP and intensify the practical implementation of projects it is necessary to: to introduce annual monitoring of the effectiveness of PPP projects and, if necessary, to make proposals based on its results to address the identified problems; to form at the state, regional and local levels a base of investment projects that can be implemented on the basis of PPP, to develop a feasibility study of projects; it can be assumed that the costs of such justification will be reimbursed by the private investor after the decision to implement the project; accelerate the preparation and implementation of PPP pilot projects in the field of road construction and housing modernization; clearly define the powers of the authorities involved in all stages of preparation and implementation of PPP projects at the state, regional and local levels, in order to eliminate duplication of functions; identify the bodies that can enter into a PPP contract as a party to it.

To increase the level of guaranteeing the protection of the interests of private investors and the state in the implementation of PPP projects it is necessary: to develop a mechanism of fair compensation in case of early termination of the PPP agreement at the initiative of the state partner in order to compensate for justified losses of the private partner; to develop a mechanism for compensation by the state partner to the private partner of the difference between the approved and economically justified tariffs (prices) for services (goods), to make appropriate changes to the Budget Code of Ukraine; provide for the possibility for the state partner to provide benefits to the private partner, if the increase in tariffs is problematic due to political or economic factors, to make appropriate changes to the Budget Code of Ukraine; to develop a mechanism to guarantee the financing of the PPP project by the state partner during the entire period of project implementation, to make appropriate amendments to the Budget Code of Ukraine; identify the types of support for PPP projects that can be provided by public authorities or local governments, make appropriate changes to the Budget Code of Ukraine; - provide for an accelerated procedure for registration of land use rights and buildings transferred to a private partner in the implementation of PPP, regardless of the form of their ownership (state or municipal).

The government of Ukraine should define a national strategy with clear priorities for economic and social infrastructure and motivating goals for improving services. This program should take into account the feasibility of achieving the objectives, taking into account both macroeconomic forecasts and the objectives of attracting capital from the national and foreign private sectors.

Coordination of activities in the field of analysis and approval of public investment projects and PPP / concessions in relation to state-owned objects should be provided by one central authority, regardless of the subject of initiating the relevant proposals, which should propose a method of their implementation and financing.

As the capacity to analyze, evaluate, negotiate and manage PPP projects in Ukraine is very weak, it will be necessary to implement a substantial institutional capacity building program, in particular for central government institutions with certain powers in this area. This, in turn, should be supported by government commitments to carry out the necessary reforms and increase employment stability in such central institutions.

All project proposals must be subject to a preliminary evaluation within the standard structure. This will allow focusing limited financial and human resources on those projects that are of greatest interest to the state and on those that demonstrate the most realistic prospects for implementation. This will mean that project ideas that fail to demonstrate their value will be rejected at an early stage and will not clutter the system.

There is a need for clear guidelines and transparent selection criteria for different project implementation methods. The lack of selection criteria, among other things, opens the way for projects proposed by policymakers to secure their funding without proper analysis, prior economic justification or evaluation according to the basic form of justification. The approval of criteria for the selection of traditional public investment projects is a step in the right direction.

There is an urgent need to develop the capacity to assess, manage and monitor the fiscal risks that arise from most PPP contracts. Today it is not possible to do this, and awareness of the essence of the case is very low. The Government of Ukraine should consider this task as an integral part of the future PPP development program, as without it there will be no chance to consider the sustainability of such risks.

Taking into account the world experience, the following priority areas of PPP development can be identified for Ukraine, which in turn require modernization and attraction of financial resources of the private sector:

- production infrastructure and high-tech production;
- construction and housing and communal services;
- social infrastructure and humanitarian development.

Further implementation and dissemination of PPPs in Ukraine should cover scientific, technical, innovative and informational spheres. The next step in solving the problems is to improve the investment climate and business environment in the context of PPP development. In order to improve business and attract private investment for the implementation of PPP, investment and innovation policy requires:

- establishment of the State Development Bank, whose activities will be aimed at stimulating and supporting the development of priority areas of the economy, investment and innovation projects;
- changes in PPP priorities: creation by the state of projects in priority areas and their further transfer to a strategic investor;

- creation of special, defined by law, organizational forms of management that stimulate investment and innovation activities (science parks, technology parks, free customs zones of industrial type);

- concentration of state resources on the implementation of priority areas of innovation for their priority in the development of production of the fifth and sixth technological modes.

To positively influence the development of PPP in Ukraine, first of all, the government`s investment policy should influence the focus on the world practice of PPP implementation. Based on this, it is necessary to implement a new investment and innovation policy at the state level.

CONCLUSIONS

During the scientific research as a part of master thesis we solved the scientific task, which was to study the theoretical and methodological foundations of public-private partnership projects as a form of partnership between the state and business for the further successful development of Ukraine`s economy. The results of the study allow us to draw the following conclusions.

Despite the fact that the term of "public-private partnership" can be considered as a new one, the term is still studied not at the propriate level. A review of various literature demonstrates that PPP defined by different scholars in various ways. We proposed our own definition of PPP as an agreement between public and private sector.

We generally believe that PPP is set of great verity of models, which can be used in the process of cooperation between the state and the private sector. Each model has its pros and cons, they can be suitable for achieving different goals of the public and private sectors. A wide range of PPP models and their subspecies provides the necessary flexibility in accordance with the expectations of the state, a wide coverage of the real conditions of investment projects in transport infrastructure, and above all a relatively fair distribution between partners of numerous risks. The correct assessment of the capabilities and potential of each of the parties - PPP participants directly affect the choice of PPP model and the probability of successful project implementation.

The cooperation between public and private sectors in the different models in the form of PPP can have a great number of advantages as well as disadvantages for both partners, which can be appeared in the process of partnership. All barriers that continue to restrain PPP`s development and need urgent solution.

The results of sectoral-level analysis gave us a total conception of successful implementation of PPP in the projects in various spheres, but infrastructure projects are in the top. Well developed countries as well as developing countries indicate the presence of a dominant trend aimed at intensifying the processes of partnership between the state and business, which ensures the development and renewal of the national economy. This requires the state to implement a systematic and consistent public policy that considers various aspects of the nature of the partnership form of management.

We proposed to analyze the problems of PPP infrastructure project from the risk management perspectives. To our mind, innovation and developing the system of risk management can be a key factor in successful PPP projects implementation.

PPP can be considered as a new financing model and it is not a strange fact that all processes in PPP are characterized by great uncertainty as well as a total theory of PPP is now enough imperfect. PPP projects can be affected by many uncertain factors. That`s why it is

important to identify a well-organized a system of risk management of project especially in infrastructure sphere.

Although this problem of risks in relationship between two sectors involved in PPP projects is studied by various scholars, but the issue of sustainability risk of PPP projects is still urgent and, unfortunately, little attention is paid to it. Sustainability risk can be defined as a type of risk that is a set of probabilities and consequences of events that affect company`s sustainable growth.

In the master thesis we proposed to use Fuzzy comprehensive evaluation model and Failure mode, effects and criticality analysis as basic models in reflecting the sustainability risk level factors of PPP projects by evaluating the sustainability risk level of each category. In result we define that project and organization and ecology and environmental are the highest sustainability risk level factors. They are the key factors to be addressed first.

Compared to different PPP projects, it is not difficult to find that the sustainability risk level of the same factors, such as ecology and environment, society, and culture, in different projects are different due to the particularity of each project; it reflects that the sustainability risk level of different factor is relative, which requires managers to take the actual situation into account when making decision on sustainability risk management for different PPP projects.

Continue research in detail in Ukraine we can conclude that the mechanism for implementing the concept of public-private partnership is just beginning to take shape in Ukraine. The amount of projects is extremely small. One of the reasons may be unsatisfactory levels of macro-financial management, especially low level of risk management, declining investment and external demand. Inefficient governance and corruption have led to irrational public spending, destroyed the government`s ability to formulate public policy and manage public programs, and undermined public confidence in public institutions. At the same time, corruption and deteriorating protection of property rights, as well as imperfect legal regulation of investment activities and taxation, have significantly weakened the investment climate and hampered domestic and foreign private investment.

It is important to admit that even that unsignificant experience in PPP implementation (particularly in the field of infrastructure) cannot be considered successful. In general, Ukraine has a high potential for project implementation public-private partnership. But there are a great number of restraining factors which prevent PPP development. Further implementation and dissemination of PPPs in Ukraine should cover scientific, technical, innovative and informational spheres. The next step in solving the problems is to improve risk management system, investment climate and business environment in the context of PPP development.

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Appendix A
FACTOR SYSTEM OF SUSTAINABILITY RISK OF PPP PROJECT

Table A.1 – Factor system of sustainability risk of PPP project

1st Level factors	2nd Level factors and contents	
1.Culture and Society	**1.1 Culture**	Local cultural inheritance
		Cultural heritage protection
		Respect for local cultural customs
		Cultural diversity protection
		Spread of advanced culture
	1.2 Public	Public participation
		Public awareness
		Public satisfaction
		Public credit
		Public happiness
		Related organization participation
		Degree of project on behalf of the public
	1.3 Safety	Safety of employees
		Safety of users
		Safety of local community
		Safety of construction
		Safety technology training
		Impact on the safety of other projects
	1.4 Social	Absorb local employment
		Social service
		Harmony between project and society
		Local employment skills
		Sustainable construction consciousness
		Local social environment
2. Cost and Economy	**2.1 Cost**	Cost of resettlement
		Cost of ecological compensation
		Cost of labor
		Cost of the user
		Cost of land
	2.2 Economic	Interest rate
		Foreign currency exchange
		Market demand
		Project uniqueness
		Inflation
3.Ecology and Environmental	**3.1 Ecosystem**	Natural landscape protection
		Fauna and flora protection
		Rate of change of green coverage in built-up area
		Project barrier effect
		Rate of green coverage in built-up area
		Harmony between project and ecosystem
		Land governance
	3.2 Environmental pollution and governance	Industrial sulfur dioxide emission
		Industrial waste water discharge
		Industrial soot emissions
		Municipal wastewater treatment rate
		Domestic garbage harmless treatment rate
		Industrial dust removal
		Industrial sulfur dioxide removal
		Pollution control capital investment
		Industrial solid waste comprehensive utilization
4. Project and Organization	**4.1 Project**	Project design
		Project financing
		Project technology
		Project construction
		Daily maintenance
		Synergy with other projects
		Renovation
	4.2 Organization	Project management maturity
		Shared resource allocation capabilities
		Stakeholder coordination capabilities
		Project portfolio capabilities
		Multi-objective optimization capabilities
5. Politics and Laws	**5.1 Politics**	Government decision-making mistakes
		Policy updates
		Political opposition
		Political instability
		Government dishonesty
		Project publicization
		Government decision-making process length
	5.2 Laws	Laws and regulations
		Project contract
		Third party default

Source: compiled by the author on the materials [4].

Appendix B

RISK ASSESSMENT FACTOR SET OF PROJECT X, Q.

Table B.1 – Risk assessment factor set of Project X, Q

1st Level factors, Qi	2nd Level factors and contents, Qij
1.Culture and Society, Q_1	Local cultural inheritance Q_{11}
	Cultural heritage protection Q_{12}
	Respect for local cultural customs Q_{13}
	Cultural diversity protection Q_{14}
	Spread of advanced culture Q_{15}
	Public participation Q_{16}
	Public awareness Q_{17}
	Public satisfaction Q_{18}
	Public credit Q_{19}
	Public happiness Q_{110}
	Related organization participation Q_{111}
	Degree of project on behalf of the public Q_{112}
	Safety of employees Q_{113}
	Safety of users Q_{114}
	Safety of local community Q_{115}
	Safety of construction Q_{116}
	Safety technology training Q_{117}
	Impact on the safety of other projects Q_{118}
	Absorb local employment Q_{119}
	Social service Q_{120}
	Harmony between project and society Q_{121}
	Local employment skills Q_{122}
	Sustainable construction consciousness Q_{123}
	Local social environment Q_{124}
2. Cost and Economy, Q_2	Cost of resettlement Q_{21}
	Cost of ecological compensation Q_{22}
	Cost of labor Q_{23}
	Cost of the user Q_{24}
	Cost of land Q_{25}
	Interest rate Q_{26}
	Foreign currency exchange Q_{27}
	Market demand Q_{28}
	Project uniquenessQ_{29}
	Inflation Q_{210}
3.Ecology and Environmental, Q_3	Natural landscape protection Q_{31}
	Fauna and flora protection Q_{32}
	Rate of change of green coverage in built-up area Q_{33}
	Project barrier effect Q_{34}
	Rate of green coverage in built-up area Q_{35}
	Harmony between project and ecosystem Q_{36}
	Land governance Q_{37}
	Industrial sulfur dioxide emission Q_{38}
	Industrial waste water discharge Q_{39}
	Industrial soot emissions Q_{310}
	Municipal wastewater treatment rate Q_{311}
	Domestic garbage harmless treatment rate Q_{312}
	Industrial dust removal Q_{313}
	Industrial sulfur dioxide removal Q_{314}
	Pollution control capital investment Q_{315}
	Industrial solid waste comprehensive utilization Q_{316}
4. Project and Organization, Q_4	Project design Q_{41}
	Project financing Q_{42}
	Project technology Q_{43}
	Project construction Q_{44}
	Daily maintenance Q_{45}
	Synergy with other projects Q_{46}
	Renovation Q_{47}
	Project management maturity Q_{48}
	Shared resource allocation capabilities Q_{49}
	Stakeholder coordination capabilities Q_{410}
	Project portfolio capabilities Q_{411}
	Multi-objective optimization capabilities Q_{412}
5. Politics and Laws, Q_5	Government decision-making mistakes Q_{51}
	Policy updates Q_{52}
	Political opposition Q_{53}
	Political instability Q_{54}
	Government dishonesty Q_{55}
	Project publicization Q_{56}
	Government decision-making process length Q_{57}
	Laws and regulations Q_{58}
	Project contract Q_{59}
	Third party default Q_{510}

Source: compiled by the author on the materials [4].

APPENDIX C
QUESTION FROM

Basic Information

Part 1

* Обязательно

Gender *

○ Male
○ Female

Age *

○ 20-29
○ 30-39
○ 40-49
○ 50 or more

Length of service *

○ Within 1 year
○ 1-5 years
○ 6-10 years
○ 11-20 years
○ 20 years and more

Your duties *

Мой ответ

Department *

Мой ответ

Nature of your department *

○ Management
○ Implementation
○ Accounting
○ Technology
○ other

Figure C.1 – Question form. Part 1. Basic information

Link: https://docs.google.com/forms/d/e/1FAIpQLSdDZgtvw-h25O2vCADWJPllBTVc38-C6-JAENXw0BmAOq2aEA/viewform?vc=0&c=0&w=1&flr=0&fbzx=5240837798791058244

Table C.1 - Part 2. Assessment comments of Project X sustainability risk factors.

Factors		Level of Sustainability Risk Factor				
		1 Devastating	2 Unacceptable	3 General	4 Acceptable	5 Desirable
1.Culture and Society, Q_1	Local cultural inheritance Q_{11}					
	Cultural heritage protection Q_{12}					
	Respect for local cultural customs Q_{13}					
	Cultural diversity protection Q_{14}					
	Spread of advanced culture Q_{15}					
	Public participation Q_{16}					
	Public awareness Q_{17}					
	Public satisfaction Q_{18}					
	Public credit Q_{19}					
	Public happiness Q_{110}					
	Related organization participation Q_{111}					
	Degree of project on behalf of the public Q_{112}					
	Safety of employees Q_{113}					
	Safety of users Q_{114}					
	Safety of local community Q_{115}					
	Safety of construction Q_{116}					
	Safety technology training Q_{117}					
	Impact on the safety of other projects Q_{118}					
	Absorb local employment Q_{119}					
	Social service Q_{120}					
	Harmony between project and society Q_{121}					
	Local employment skills Q_{122}					
	Sustainable construction consciousness Q_{123}					
	Local social environment Q_{124}					
2. Cost and Economy, Q_2	Cost of resettlement Q_{21}					
	Cost of ecological compensation Q_{22}					
	Cost of labor Q_{23}					
	Cost of the user Q_{24}					
	Cost of land Q_{25}					
	Interest rate Q_{26}					
	Foreign currency exchange Q_{27}					
	Market demand Q_{28}					
	Project uniquenessQ_{29}					
	Inflation Q_{210}					
3.Ecology and Environmental, Q_3	Natural landscape protection Q_{31}					
	Fauna and flora protection Q_{32}					
	Rate of change of green coverage in built-up area Q_{33}					
	Project barrier effect Q_{34}					
	Rate of green coverage in built-up area Q_{35}					
	Harmony between project and ecosystem Q_{36}					
	Land governance Q_{37}					
	Industrial sulfur dioxide emission Q_{38}					
	Industrial waste water discharge Q_{39}					
	Industrial soot emissions Q_{310}					
	Municipal wastewater treatment rate Q_{311}					
	Domestic garbage harmless treatment rate Q_{312}					
	Industrial dust removal Q_{313}					
	Industrial sulfur dioxide removal Q_{314}					
	Pollution control capital investment Q_{315}					
	Industrial solid waste comprehensive utilization Q_{316}					
4. Project and Organization, Q_4	Project design Q_{41}					
	Project financing Q_{42}					
	Project technology Q_{43}					
	Project construction Q_{44}					
	Daily maintenance Q_{45}					
	Synergy with other projects Q_{46}					
	Renovation Q_{47}					
	Project management maturity Q_{48}					
	Shared resource allocation capabilities Q_{49}					
	Stakeholder coordination capabilities Q_{410}					
	Project portfolio capabilities Q_{411}					
	Multi-objective optimization capabilities Q_{412}					
5. Politics and Laws, Q_5	Government decision-making mistakes Q_{51}					
	Policy updates Q_{52}					
	Political opposition Q_{53}					
	Political instability Q_{54}					
	Government dishonesty Q_{55}					
	Project publicization Q_{56}					
	Government decision-making process length Q_{57}					
	Laws and regulations Q_{58}					
	Project contract Q_{59}					
	Third party default Q_{510}					

Source: compiled by the author on the materials [4].

APPENDIX D

ASSESSTMENT COMMENT OF SUSTAINABILITY RISK FACTORS

Table D.1 – Assessment comment of sustainability risk factors

Factors		P_1	P_2	P_3	P_4	P_5
		Level of Sustainability Risk Factor				
1.Culture and Society, Q_1	Local cultural inheritance Q_{11}	66	16	8	5	5
	Cultural heritage protection Q_{12}	80	10	7	1	2
	Respect for local cultural customs Q_{13}	50	25	10	10	5
	Cultural diversity protection Q_{14}	60	15	10	5	10
	Spread of advanced culture Q_{15}	70	15	10	2	3
	Public participation Q_{16}	36	19	8	10	27
	Public awareness Q_{17}	47	34	9	7	3
	Public satisfaction Q_{18}	36	45	12	6	1
	Public credit Q_{19}	8	24	12	20	36
	Public happiness Q_{110}	12	34	15	14	25
	Related organization participation Q_{111}	2	8	14	30	46
	Degree of project on behalf of the public Q_{112}	6	13	45	34	2
	Safety of employees Q_{113}	23	14	28	30	5
	Safety of users Q_{114}	46	35	8	6	5
	Safety of local community Q_{115}	45	32	3	10	10
	Safety of construction Q_{116}	1	19	2	32	46
	Safety technology training Q_{117}	37	24	8	17	14
	Impact on the safety of other projects Q_{118}	4	6	28	14	48
	Absorb local employment Q_{119}	2	2	8	35	53
	Social service Q_{120}	3	5	15	47	30
	Harmony between project and society Q_{121}	3	7	31	46	13
	Local employment skills Q_{122}	5	4	8	20	63
	Sustainable construction consciousness Q_{123}	7	4	8	36	45
	Local social environment Q_{124}	2	8	5	15	70
2. Cost and Economy, Q_2	Cost of resettlement Q_{21}	5	6	16	53	20
	Cost of ecological compensation Q_{22}	2	8	11	34	45
	Cost of labor Q_{23}	2	5	15	57	21
	Cost of the user Q_{24}	1	1	33	57	8
	Cost of land Q_{25}	2	2	7	65	24
	Interest rate Q_{26}	10	11	18	27	34
	Foreign currency exchange Q_{27}	1	8	9	34	48
	Market demand Q_{28}	4	12	7	54	23
	Project uniqueness Q_{29}	3	7	56	23	11
	Inflation Q_{210}	1	8	47	32	12
3.Ecology and Environmental, Q_3	Natural landscape protection Q_{31}	11	20	54	6	9
	Fauna and flora protection Q_{32}	11	47	32	7	3
	Rate of change of green coverage in built-up area Q_{33}	34	26	32	3	5
	Project barrier effect Q_{34}	24	48	23	4	1
	Rate of green coverage in built-up area Q_{35}	11	47	33	7	2
	Harmony between project and ecosystem Q_{36}	1	1	42	45	11
	Land governance Q_{37}	9	13	56	10	12
	Industrial sulfur dioxide emission Q_{38}	35	52	9	3	1
	Industrial waste water discharge Q_{39}	21	65	10	2	2
	Industrial soot emissions Q_{310}	38	54	6	1	1
	Municipal wastewater treatment rate Q_{311}	11	47	33	7	2
	Domestic garbage harmless treatment rate Q_{312}	54	24	12	5	5
	Industrial dust removal Q_{313}	34	26	32	3	5
	Industrial sulfur dioxide removal Q_{314}	38	54	6	1	1
	Pollution control capital investment Q_{315}	13	33	52	1	1
	Industrial solid waste comprehensive utilization Q_{316}	24	48	23	4	1
4. Project and Organization, Q_4	Project design Q_{41}	4	9	32	45	10
	Project financing Q_{42}	1	1	10	32	56
	Project technology Q_{43}	2	3	12	43	40
	Project construction Q_{44}	1	2	4	36	57
	Daily maintenance Q_{45}	2	14	43	23	18
	Synergy with other projects Q_{46}	3	7	16	63	11
	Renovation Q_{47}	10	11	58	12	9
	Project management maturity Q_{48}	1	5	10	11	73
	Shared resource allocation capabilities Q_{49}	2	13	43	23	19
	Stakeholder coordination capabilities Q_{410}	3	8	16	60	13
	Project portfolio capabilities Q_{411}	2	7	17	63	11
	Multi-objective optimization capabilities Q_{412}	1	2	4	36	57
5. Politics and Laws, Q_5	Government decision-making mistakes Q_{51}	9	11	45	20	15
	Policy updates Q_{52}	3	3	13	56	25
	Political opposition Q_{53}	2	2	28	47	21
	Political instability Q_{54}	5	8	21	52	14
	Government dishonesty Q_{55}	1	4	15	68	12
	Project publicization Q_{56}	6	14	34	37	9
	Government decision-making process length Q_{57}	1	6	15	57	21
	Laws and regulations Q_{58}	2	4	11	51	32
	Project contract Q_{59}	1	1	9	78	11
	Third party default Q_{510}	8	33	43	6	10

Source: compiled by the author.

APPENDIX E
EXPERT SCORING TABLE

Table E1 – Expert scoring table

Factors	Scoring																			
	Occurrence Probability (H)					Loss and Impact (S)					Perceived Degree (D)					Ability to Control and Compensate (C)				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Local cultural inheritance Q_{11}																				
Cultural heritage protection Q_{12}																				
Respect for local cultural customs Q_{13}																				
Cultural diversity protection Q_{14}																				
Spread of advanced culture Q_{15}																				
Public participation Q_{16}																				
Public awareness Q_{17}																				
Public satisfaction Q_{18}																				
Public credit Q_{19}																				
Public happiness Q_{110}																				
Related organization participation Q_{111}																				
Degree of project on behalf of the public Q_{112}																				
Safety of employees Q_{113}																				
Safety of users Q_{114}																				
Safety of local community Q_{115}																				
Safety of construction Q_{116}																				
Safety technology training Q_{117}																				
Impact on the safety of other projects Q_{118}																				
Absorb local employment Q_{119}																				
Social service Q_{120}																				
Harmony between project and society Q_{121}																				
Local employment skills Q_{122}																				
Sustainable construction consciousness Q_{123}																				
Local social environment Q_{124}																				
Cost of resettlement Q_{21}																				
Cost of ecological compensation Q_{22}																				
Cost of labor Q_{23}																				
Cost of the user Q_{24}																				
Cost of land Q_{25}																				
Interest rate Q_{26}																				
Foreign currency exchange Q_{27}																				
Market demand Q_{28}																				
Project uniqueness Q_{29}																				
Inflation Q_{210}																				
Natural landscape protection Q_{31}																				
Fauna and flora protection Q_{32}																				
Rate of change of green coverage in built-up area Q_{33}																				
Project barrier effect Q_{34}																				
Rate of green coverage in built-up area Q_{35}																				
Harmony between project and ecosystem Q_{36}																				
Land governance Q_{37}																				
Industrial sulfur dioxide emission Q_{38}																				
Industrial waste water discharge Q_{39}																				
Industrial soot emissions Q_{310}																				
Municipal wastewater treatment rate Q_{311}																				
Domestic garbage harmless treatment rate Q_{312}																				
Industrial dust removal Q_{313}																				
Industrial sulfur dioxide removal Q_{314}																				
Pollution control capital investment Q_{315}																				
Industrial solid waste comprehensive utilization Q_{316}																				
Project design Q_{41}																				
Project financing Q_{42}																				
Project technology Q_{43}																				
Project construction Q_{44}																				
Daily maintenance Q_{45}																				
Synergy with other projects Q_{46}																				
Renovation Q_{47}																				
Project management maturity Q_{48}																				
Shared resource allocation capabilities Q_{49}																				
Stakeholder coordination capabilities Q_{410}																				
Project portfolio capabilities Q_{411}																				
Multi-objective optimization capabilities Q_{412}																				
Government decision-making mistakes Q_{51}																				
Policy updates Q_{52}																				
Political opposition Q_{53}																				
Political instability Q_{54}																				
Government dishonesty Q_{55}																				
Project publicization Q_{56}																				
Government decision-making process length Q_{57}																				
Laws and regulations Q_{58}																				
Project contract Q_{59}																				
Third party default Q_{510}																				

Source: compiled by the author on the materials [4].

APPENDIX F
PROJECT RISK MANGEMENT OVERVIEW FOR PPP INFRASTRUCTURE PROJECTS

PROJECT RISK MANAGEMENT OVERVIEW

1.Plan Risk Management

1.Inputs
.1 Project management plan;
.2 Project charter;
.3 Stakeholder register;
.4 Enterprise environmental factors;
.5 Organizational process assets.
2. Tools & Techniques
.1 Analytical techniques;
.2 Expert judgement;
.3 Meetings.
3. Outputs
.1 Risk management plan.

4.Perform Quantitative Risk Management

1.Inputs
.1 Risk management plan;
.2 Cost management plan;
.3 Schedule management plan;
.4 Risk register;
.5 Enterprise environmental factors;
.6 Organizational process assets.
2. Tools & Techniques
.1 Data gathering and representation techniques;
.2 Quantitative risk analysis and modeling techniques;
.3 Expert judgment.
3. Outputs
.1 Project documents updates.

2. Identify Risks

1.Inputs
.1 Risk management plan;
.2 Cost management plan;
.3 Schedule management plan;
.4 Quality management plan;
.5 Human resources management plan;
.6 Scope baseline;
.7 Activity cost estimates;
.8 Activity duration estimates;
.9 Stakeholder register;
.10 Project documents;
.11 Procurement documents;
.12 Enterprise environmental factors;
.13 Organizational process assets.
2. Tools & Techniques
.1 Documentation reviews;
.2 Information gathering techniques;
.3 Checklist analysis;
.4 Assumption analysis;
.5 Diagramming techniques;
.6 SWOT analysis;
.7 Expert judgment.
3. Outputs
.1 Risk register.

5.Plan Risk Response

1.Inputs
.1 Risk management plan;
.2 Risk register.
2. Tools & Techniques
.1 Strategies for negative risks or threats;
.2 Strategies for positive risks or opportunities;
.3 Contingent response strategies;
.4 Expert judgment.
3. Outputs
.1 Project management plan updates;
.2 Project documents update.

3. Perform Qualitative Risk Analysis

1.Inputs
.1 Risk management plan;
.2 Scope baseline;
.3 Risk register;
.4 Enterprise environmental factors;
.5 Organizational process assets.
2. Tools & Techniques
.1 Risk probability and impact assessment;
.2 Probability and impact matrix;
.3 Risk data quality assessment;
.4 Risk categorization;
.5 Risk urgency assessment;
.6 Expert judgment.
3. Outputs
.1 Project documents updates.

6. Control Risks

1.Inputs
.1 Project management plan;
.2 Risk register;
.3 Work performance data;
.4 Work performance reports;
2. Tools & Techniques
.1 Risk reassessment;
.2 Risk audits;
.3 Variance and tree analysis;
.4 Technical performance measurement;
.5 Reserve analysis;
.6 Meetings.
3. Outputs
.1 Work performance information;
.2 Change requests;
.3 Project management plan updates;
.4 Project documents updates;
.5 Organizational process assets updates.

APPENDIX G

AMOUNT AND VOLUME OF INVESTMENTS IN PPP PROJECTS BY REGIONS OF THE WORLD AND SECTORS OF THE ECONOMY IN 2000-2019

Table G.1 – Amount and volume of investments in PPP Projects by regions of the world and sectors of the economy in 2000-2019

Region	Number of projects	Investment volume, million dollars	The amount of investment per 1 project,million dollars
Airports			
East Asia and the Pacific	25	6723,82	268,95
Europe and Central Asia	13	3777,07	290,54
Latin America and the Caribbean	63	35899,39	569,83
Middle East and North Africa	21	46288,05	2204,19
South Asia	11	7708,10	700,74
Sub-Saharan Africa	7	1244,80	177,83
Total	**140**	**101641,23**	**4212,09**
Collection and transport			
East Asia and the Pacific	3	19,68	6,56
Europe and Central Asia	11	2385,12	216,83
Latin America and the Caribbean	22	5950,52	270,48
Middle East and North Africa	1	1,43	1,43
South Asia	6	17,84	2,97
Sub-Saharan Africa	0	0,00	0,00
Total	**43**	**8374,59**	**498,27**
Railways			
East Asia and the Pacific	14	20914,12	1493,87
Europe and Central Asia	5	4778,96	955,79
Latin America and the Caribbean	148	41320,73	279,19
Middle East and North Africa	2	247	123,50
South Asia	34	33417,86	982,88
Sub-Saharan Africa	15	6054,95	403,66
Total	**218**	**106733,62**	**4238,89**
Water and sewerage			
East Asia and the Pacific	73	14253,09	195,25
Europe and Central Asia	27	3489,71	129,25
Latin America and the Caribbean	225	20337,03	90,39
Middle East and North Africa	21	4469,23	212,82
South Asia	499	14621,79	29,3
Sub-Saharan Africa	16	3418,85	213,68
Total	**861**	**60589,7**	**870,68**
Roads			
East Asia and the Pacific	109	62260,06	571,19
Europe and Central Asia	16	13727,37	857,96
Latin America and the Caribbean	209	120367,57	575,92
Middle East and North Africa	10	23196,23	2319,623
South Asia	510	112704,7	220,99
Sub-Saharan Africa	11	2048,81	186,26
Total	**865**	**334304,74**	**4731,94**
Electricity			
East Asia and the Pacific	556	138287,31	248,72
Europe and Central Asia	457	66287,29	145,05
Latin America and the Caribbean	1690	254411,69	150,54
Middle East and North Africa	272	83254,56	306,08
South Asia	1034	194525,08	188,13
Sub-Saharan Africa	252	42756,36	169,67
Total	**4261**	**779522,29**	**1208,19**
General projects` amount in all sectors of the economy			
East Asia and the Pacific	780	242458,08	2784,54
Europe and Central Asia	529	94445,52	2595,42
Latin America and the Caribbean	2357	478286,93	1936,35
Middle East and North Africa	327	157456,5	5167,65
South Asia	2094	362995,37	2125,01
Sub-Saharan Africa	301	55523,77	1151,10
Total	**6388**	**1391166,17**	**15760,07**

Source: compiled by the author on the materials [29].