

Conceptual Risk-oriented Model of Goal Setting in the Implementation of Concession Projects in Seaports

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Abstract

The subject of research is methods, models and mechanisms of risk-oriented management of concession projects in seaports. The aim of the article is to develop a risk-oriented mechanism based on information technology for managing a concession project implemented in a seaport by forming a conceptual model of goal-setting taking into account the interests of stakeholders. The objectives of the study are analysis of the conceptual apparatus of public-private partnership and identification of the concession project; development of a conceptual model for concession project implementation in the port based on information technology; establishing the functions and goals of the stakeholders of the concession project implemented in the seaport; distribution of opportunities and threats for stakeholders by stages of concession project implementation; development of a conceptual information system model for setting and achieving goals by stakeholders of the concession project in the seaport, taking into account the risk management system. Research results: it is established that the application of project management methods and mechanisms based on information technology will increase the efficiency of port activities; the conceptual model of concession project implementation in the seaport is proposed, which shows the main stages of project implementation; prerequisites for successful project implementation are set and criteria for project stakeholders are selected; opportunities and threats of concession project implementation in the port are evaluated; the conceptual information system model of goal setting based on risk-oriented approach is developed, which allows setting and achieving goals of each stakeholder involved in concession project implementation; it is proposed in further developments to use a stakeholder goal setting management information system, which will greatly simplify the procedure for project participants to achieve the set targets based on the use of the risk management system.

Keywords 1

Concession project, information system, seaport, risk management, maritime transport

1. Introduction

Plenty of countries around the world have long appreciated the benefits of public-private partnership projects as an effective mechanism for progressive economic development of the state, and created a flexible economic and legal basis for mutually beneficial cooperation.

International practice shows that the main areas of public-private partnership are the transport sector with its infrastructure (namely – ports, airports, road and rail infrastructure), telecommunications technology, innovation technology, construction, energy, housing and communal

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services (e.g., heat and water supply, street lighting, water purification), health care and other areas of social activity (for example, in relation to the reconstruction of cultural heritage sites, etc.) [1].

According to the National Transport Strategy of Ukraine for the period up to 2030, the unsatisfactory level of transport and logistics technologies and multimodal transportation reduces the competitiveness of the transport environment [2]. In order to make the most of Ukraine's geographical position as a transit country, urgent measures should be taken to ensure the organization of freight traffic between Europe, Asia and the East [3].

A strategic component of Ukraine's economic development is the port activity as one of the key links in the transport system. In current conditions, the state does not have enough budget funds to upgrade the loading and unloading equipment of ports, repair of offshore structures in the waters and warehousing.

International experience proves the feasibility of port development using effective mechanisms of public-private partnership, project management, namely the implementation of concession projects.

The peculiarity of these projects is that the state within the partnership, remaining the full owner of the property that is the subject of the concession agreement, authorizes the private partner to perform for some time the functions specified in the contract and gives it the appropriate powers to ensure proper functioning of the concession object. For the use of state property, the concessionaire pays a fee under the terms of the agreement [4, 5].

2. Analysis of Literature Data and Resolving the Problem

In international and domestic scientific journals the following definitions of the concept of public-private partnership can be found. Public-private partnership includes all types of interaction between the public and private sectors in setting standards, providing services and access to infrastructure [6, 7].

In [8], the implementation of public-private partnership projects is based on contractual relationships between government agencies and the private sector, aimed at increasing the participation of private business in the implementation of transport projects.

The author of [9] points out that this is an institutional and organizational alliance between the state and business, created to implement socially significant projects and programs in a wide range of industries – from industry, research and design to services.

Also, public-private partnership projects in [10] are considered as medium-term and long-term relations between the public and private sectors; the partnership includes the distribution of risks and revenues, as well as the use of qualifications and resources of the public and private sectors to achieve the planned strategic results in the interests of the state.

The study is based on the provisions of the Strategy for the Development of Seaports of Ukraine until 2038 [11], the Decree of the President of Ukraine "On measures to ensure the development of Ukraine as a maritime state" [12], Laws of Ukraine "On Concession" [13] and "On public-private partnership" [14]. The main reason that is a prerequisite for the implementation of concession projects in seaports is the rapid loss of the market share in freight turnover in favor of other terminals by state-owned enterprises in recent years [15-17]. The need for new investments to realize the opportunities associated with growing exports, significant reinvestment in existing assets necessitates the introduction of a project approach to the activities of seaports based on the implementation of concession projects [18-20]. It is necessary to increase the efficiency and competitiveness of the transport sector, improve the legal mechanism of public-private partnership, strengthen cooperation between the public and private sectors, public and local governments and carry out necessary reforms, including decentralization, especially through coordinated public policy initiatives [21-24]. These principles will provide a firm foundation for sustainable development of the transport industry and the creation of a free and competitive market for transport services.

It should be noted that concession project implementation in the seaport will allow to implement advanced management decisions of a private port operator in the public sector, increase the cost of port infrastructure and improve the quality of stevedoring services.

The relevance of this research is due to the importance of intensifying the implementation of concession projects in seaports at the state level, which will positively affect their competitiveness.

3. The Purpose and Objectives of the Research

The aim of the article is to develop a risk-oriented mechanism based on information technology for managing a concession project implemented in a seaport by forming a conceptual model of goal-setting taking into account the interests of stakeholders. The objectives of the study are analysis of the conceptual apparatus of public-private partnership and identification of the concession project; development of a conceptual model based on information technology for concession project implementation in the port; establishing functions and goals of stakeholders of the concession project implemented in the seaport; development of the conceptual information system model for setting and achieving goals by stakeholders of the concession project in the seaport, taking into account the risk management system.

4. Materials and Methods of the Research

Modern realities show that there are situations when the state is unable to fulfill the interests of society due to lack of certain resources. At the same time, the private sector has resources that the state does not have, and has the tools to use them more efficiently. And the need to combine resources and means of their use by the state and business is another fact that confirms the feasibility of concession projects. At the same time, the interests of already specific project stakeholders such as government agencies and business structures are beginning to play an important role.

The main reasons for slowing down the implementation of public-private partnership projects, including concession projects, refer to the following statements [25-27]: the complexity of the mechanism based on information technology of providing state support for long-term investment projects involving private partners; lack of effective measures in the field of public-private partnership to create conditions for its development, as well as a clear division of powers between public authorities and coordination of their activities; a low level of institutional capacity of public authorities and business structures to implement public-private partnership projects; inconsistency of the legal framework on public-private partnership; the presence of industry specifics of economic activity and the complexity of the conditions of long-term and mutually beneficial cooperation between the state and private partners; a low level of public confidence in public authorities and awareness of the benefits of investment projects based on public-private partnership, lack of public awareness of the benefits and risks of using such partnership mechanisms, inadequate staffing of executive authorities and local governments in implementation of public-private partnership projects, insufficient funding for the real economy sector; imperfection of the tariff regulation mechanism and economic unreasonableness of tariffs; unfavorable investment climate and the complexity of the conditions for doing business during the implementation of public-private partnership projects; lack of an effective mechanism for providing state support in public-private partnership (including the implementation of concession projects).

Partnership, as an interaction of all stakeholders involved in the implementation of infrastructure projects, provides for achieving common or at least agreed goals. The desire of private business for effective financial and economic activities, which determines its own well-being, is quite natural, so there must be rules that create the necessary reasonable conditions for this. Such rules, of course, imply certain restrictions on the development of strategies and tactics of behavior, both government and business [28, 29]. Participants in the implementation of public-private partnership projects are public and private sectors of the economy with the possible participation of third parties. In this case, the public sector acts as the customer, and the private one acts as the executor of the order.

Successful implementation of concession projects provides for certain prerequisites in the country, namely [30]: transparent and effective procedures in the process of implementing concession projects; developed investment environment; stable, clear and transparent legislative framework; political support for the implementation of concession projects; favorable economic environment; sufficient financial resources for state support of concession projects; public support for the implementation of concession projects; perfect development and analysis of the effectiveness of concession projects;

application of the project management methodology of the port activity; fair distribution of risks between stakeholders of concession projects.

The implementation of a public-private partnership project in the seaport, where the concession project was implemented by all stakeholders is considered.

The conceptual information system model of concession project implementation on the example of the port is presented in Figure 1.

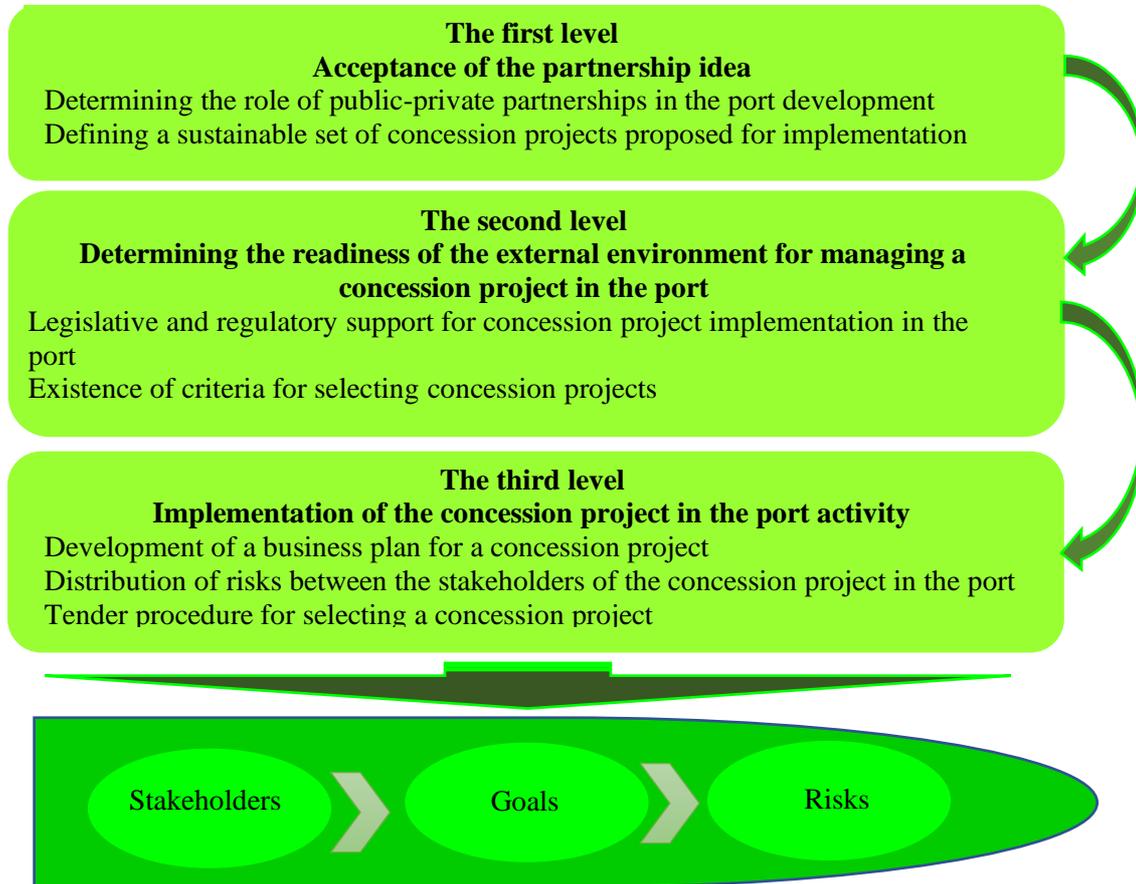


Figure 1: Conceptual information system model of concession project implementation in the port

We classify the information system criteria that play a significant role in determining the winner of the concession tender in the concession project implementation in the port. These include: the most profitable and reliable scheme of financing the concession project at the stages of construction or reconstruction of port infrastructure; the shortest payback period of port infrastructure; the reliability of the concessionaire, the seriousness of his intentions and the intentions of his partners; the largest share of own funds invested by the applicant in the financing of the port as an object of concession; the value of the port infrastructure operation cost, which provides optimal operation profitability; the maximum use of port employees in concession project implementation; the shortest terms of construction or reconstruction of port infrastructure.

An important aspect is to determine the functions of the main stakeholders such as the public sector and business structures in concession project implementation (Table 1).

The following participants such as the state, a private investor (concessionaire), local authorities, port staff, citizens, port business, financial institutions and regulatory authorities can act as the concession project stakeholders. Table 2 shows the opportunities and constraints experienced by the concession project at different stages of the life cycle [31].

Thus, the goals of the concession project stakeholders in the port can be grouped and presented in the form of the model shown in Figure 2.

Table 1

Distribution of functions of the stakeholders of the concession project

State	Local authorities	Private business
Legislative framework	Local legislative framework	Port management
State support, guarantees	Guarantees and support from local authorities	
Priorities and development strategy	Local development policy, strategies, master plans	Guarantees of reliability and quality of services
Quality control of services within the concession project	Quality control of services within the concession project	
Creating a favorable investment climate	Creating a favorable investment climate	
Issuance of relevant decisions, conclusions, permits, licenses	Issuance of relevant decisions, conclusions, permits, licenses	Implementation of the concession project

The effectiveness of the overall implementation of stakeholder goals is affected by the risks that arise at all stages of the concession project in the port. An essential feature of concession projects is their significant uncertainty. The probability of successful implementation of the concession project in the port should be taken into account during its initiation and implementation.

Table 2

Distribution of opportunities and threats according to the stages of the concession project

Stages of the concession project	Opportunities	Threats
Financing	<p>Additional budget revenues from payments from users of infrastructure facilities</p> <p>The use of long-term credit mechanisms</p> <p>Meeting the need for financing of infrastructure facilities in the absence of adequate budget funds</p> <p>Improving the efficiency of infrastructure facilities (freeing up additional resources)</p>	<p>Significant risks, low competence in their management</p> <p>Uncertainty of tax revenues in the long run may lead to excessive government spending on the concession project</p> <p>Given the low creditworthiness of the region (budget) for the long term it is impossible to attract a private partner</p>
Planning and selection	<p>Balanced assessment of infrastructure constraints and making appropriate project decisions</p> <p>Improving the quality of pre-project analysis</p> <p>Necessary competencies and motivation to select the most effective options for the concession project</p>	<p>Low quality of project analysis</p> <p>The choice of project can be influenced by political forces, which leads to wrong decisions</p> <p>Lack of relevant information, leading to wrong choices</p>
Management	<p>High management motivation to make a profit</p> <p>Relatively higher level of management</p> <p>The quality of operation is regulated by the requirements of the concession project agreement</p> <p>Stakeholder compensation of operating costs</p>	<p>Low quality of project and other works organized by the state partner reduces the quality of project management</p> <p>Insufficient elaboration of the requirements of the concession project agreement</p> <p>Insufficient financial interest of the infrastructure operator in its rational operation</p>

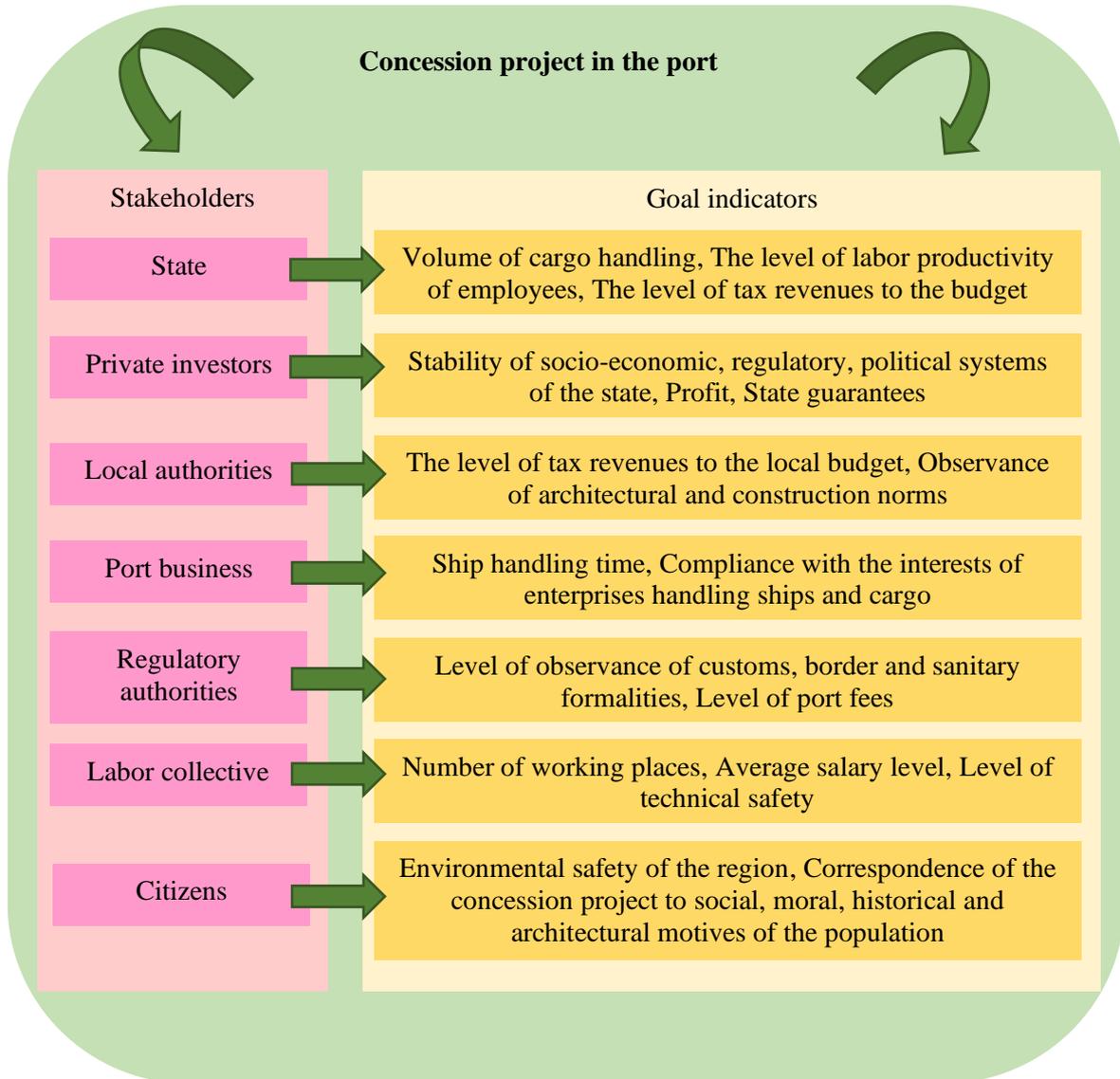


Figure 2: The conceptual information system model of setting goals for the concession project stakeholders in the port

To solve this problem, the proposed concept uses risk management models and methods in accordance with the ISO 31000 standard, which defines that risk is the effect of uncertainty on the goal. It is the presence of significant risks that forces businesses to be very careful about participating in public-private partnership projects. However, only through the introduction of investment it is possible to arrange the effective achievement of this goal.

The value of the complex risk indicator is calculated on the basis of the analysis of the set of criteria grouped by the corresponding directions:

$$R_p = f(R_z; R_l; R_d), \quad (1)$$

where R_z – the risk of the port financial and property state; R_l – logistical risk; R_d – the risk of prospects for the port development.

The risk of the port financial and property state includes the following components:

$$R_z = f(r_{z1}; r_{z2}; r_{z3}; r_{z4}), \quad (2)$$

where r_{z1} – the risk of the port property status; r_{z2} – the risk of the port financial state (liquidity risk); r_{z3} – the risk of using the port production capacity; r_{z4} – the risk of business of port activities, which affects the project profitability.

When implementing a concession project in the port, there is also a risk of the port logistical attractiveness, which can be described as follows:

$$R_l = f(r_{l1}; r_{l2}; r_{l3}), \quad (3)$$

where r_{l1} – the transport risk (availability, lack of access roads to the port); r_{l2} – the location risk (finding the port at the intersection of international transport corridors); r_{l3} – the risk of industrial areas (availability, lack of such areas near the port).

Regarding the risk of prospects for the port development, it should be noted that this indicator contains the following components:

$$R_d = f(r_{d1}; r_{d2}; r_{d3}), \quad (4)$$

where r_{d1} – the risk of port service of additional cargo flows; r_{d2} – the risk of maintenance of large vessels by the port; r_{d3} – the risk of construction of new infrastructure facilities in the port (new berths, terminals, warehouses).

The effectiveness of the concession project in the port is reflected in the achievement of strategic goals of its stakeholders, which form a set of indicators and the importance of each indicator.

In order to determine the specific weight of each criterion, it is necessary to compile a table in which the coefficients of relative importance of one criterion in comparison with another will be entered.

Based on the method of analytical hierarchies, experts fill in a pairwise comparisons matrix of criteria for each concession project stakeholder.

The coefficients of importance of criteria are established on Saaty's scale: 1 – equal importance of criteria; 3 – moderate importance of one over another; 5 – strong importance; 7 – very strong importance; 9 – extreme importance; 2, 4, 6, 8 – intermediate (compromise) values. The table is characterized by the property of inverse symmetry.

The weight of the coefficients of relative importance for the eleven criteria presented in Table 3 is determined using the ranking method.

Table 3

The relative importance of the criteria for the state in implementing the concession project in the port

	r_{z1}	r_{z2}	r_{z3}	r_{z4}	r_{l1}	r_{l2}	r_{l3}	r_{d1}	r_{d2}	r_{d3}
r_{z1}	1	3	5	6	7	2	3	4	5	8
r_{z2}	1/3	1	4	3	2	4	6	3	2	7
r_{z3}	1/5	1/4	1	4	4	3	3	4	7	2
r_{z4}	1/6	1/3	1/4	1	3	3	4	2	2	5
r_{l1}	1/7	1/2	1/4	1/3	1	3	7	7	4	2
r_{l2}	1/2	1/4	1/3	1/3	1/3	1	2	5	5	2
r_{l3}	1/3	1/6	1/3	1/4	1/7	1/2	1	7	3	4
r_{d1}	1/4	1/3	1/4	1/2	1/7	1/5	1/7	1	2	5
r_{d2}	1/5	1/2	1/7	1/2	1/4	1/5	1/3	1/2	1	4
r_{d3}	1/8	1/7	1/2	1/5	1/2	1/2	1/4	1/5	1/4	1

Based on the comparison, the weights of the criteria are calculated. To do this, the geometric mean of the numbers written in the lines is first determined:

$$w_i = \sqrt[n]{r_{i1} \cdot r_{i2} \cdot \dots \cdot r_{in}}, i = 1, \dots, n, \quad (5)$$

where r_{in} – the value of the i -th criterion; n – the number of criteria.

The specific weight of the i -th criterion is determined by the formula:

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i}, i = 1, \dots, n. \quad (6)$$

The coefficient of inconsistency of the expert's findings taking into account the number of inconsistencies H :

with odd n :

$$k = 1 - \frac{24 \cdot H}{n^3 - n}; \quad (7)$$

with even n :

$$k = 1 - \frac{24 \cdot H}{n^3 - 4n}. \quad (8)$$

The mathematical model for achieving the goals of the concession project in the port by the j -th stakeholder ($j = 1, \dots, m$) contains the objective function:

$$Z = \sum_{j=1}^m \bar{S}_j \rightarrow \max \quad (9)$$

where \bar{S}_j – the share of the distance to its "desired state", which is overcome by the j -th stakeholder in the case of successful concession project implementation in the port.

Let the indicators of the innovation program participants' goals be determined by set $G = \{G_1, G_2, \dots, G_i\}$, ($i = 1, \dots, n$). At the time of concession project initiation, the values of the relevant indicators are determined by matrix G_{ij}^i . The "desired" values of strategic indicators form matrix G_{ij}'' , and their values in the case of successful implementation of innovation program G_{ij}^P . In this case, if the i -th indicator is not among the strategic for the j -th stakeholder, it is not taken into account.

The indicators of the goals of the concession project stakeholders can be found when solving the optimization problem with the objective function:

$$Z = \sum_{j=1}^m \sum_{i=1}^n \sqrt{W_{ij} \cdot \left(\frac{G_{ij}^P - G_{ij}^i}{G_{ij}'' - G_{ij}^i} \right)^2} \rightarrow \max \quad (10)$$

The values of W_{ij} can be determined by the expert evaluation method or the method of ranking.

The constraints for this optimization task are the resources of stakeholders of the concession project in the port:

$$\sum_{k=1}^a v_{kj} \leq V_j, \quad \forall j = 1, m, \quad \forall k = 1, a, \quad (11)$$

where v_{kj} – the required amount of the k -th resource of the j -th stakeholder for successful concession project implementation; V_j – the available amount of the k -th resource of the j -th concession project stakeholder in the port.

5. Conclusions

The concept of public-private partnership is analyzed and it is established that an effective form of its implementation in seaports is the use of mechanisms, models and methods of project management in the implementation of concession projects to improve the efficiency of port development.

The reasons that slow down the implementation of concession projects in the seaports of Ukraine are indicated. It is indicated that the use of the project management methodology based on the application of the risk management system will increase the efficiency of concession projects in ports.

The research presents a conceptual information system model for concession project implementation in the seaport, which shows the main stages of project implementation, provides the prerequisites for successful project implementation and sets criteria for selecting project stakeholders.

The possibilities and threats that may arise during concession project implementation in the port are assessed, as well as the model of distribution of goals among stakeholders is proposed.

It is established that the effectiveness of the concession project in the port is reflected in the achievement of strategic goals of its stakeholders based on information technology, which form a set of indicators and the importance of each indicator. The developed conceptual model of goal-setting on the basis of risk-oriented approach and information technology will allow to set and achieve the goals of each stakeholder involved in the concession project.

The development and use of a stakeholder goal setting management information system will greatly simplify the procedure for project participants to meet the set goals. The use of an information system in the implementation of the proposed conceptual risk-oriented model of goal setting in the implementation of concession projects in seaports will allow to operate more targets and more accurately assess the risks that project stakeholders may face.

6. References

- [1] S. Bushuyev, D. Bushuiev, V. Bushuieva, Interaction Multilayer model of Emotional Infection with the Earn Value Method in the Project Management Process, in: 2020 IEEE 15th

- International Conference on Computer Sciences and Information Technologies (CSIT), 2020, pp. 146-150, doi: 10.1109/CSIT49958.2020.9321949.
- [2] A. Bomba, N. Kunanets, M. Nazaruk, V. Pasichnyk, N. Veretennikova, Model of the Data Analysis Process to Determine the Person's Professional Inclinations and Abilities, in: *Advances in Intelligent Systems and Computing*, 2020, pp. 482-492.
- [3] R. Holoshchuk, V. Pasichnyk, N. Kunanets, N. Veretennikova, Information modeling of dual education in the field of IT, in: *Advances in Intelligent Systems and Computing*, 2020, pp. 637-646.
- [4] S. Bushuyev, D. Bushuiev, V. Bushuieva, Modelling of emotional infection to the information system management project success, in: *Advances in Intelligent Systems and Computing*, 2021, 1265 AISC, pp. 341-352.
- [5] A. Bondar, S. Bushuyev, V. Bushuieva, S. Onyshchenko, Complementary strategic model for managing entropy of the organization, in: *CEUR Workshop Proceedings*, 2021, 2851, pp. 293-302.
- [6] O. Duda, N. Kunanets, O. Matsiuk, V. Pasichnyk, N. Veretennikova, A. Fedonuyk, V. Yunchyk, Selection of Effective Methods of Big Data Analytical Processing in Information Systems of Smart Cities, in: *Proceedings of the 2nd International Workshop on Modern Machine Learning Technologies and Data Science (MoMLet+DS 2020)*, Volume I: Main Conference, Vol. 2631, pp. 68-78.
- [7] S. Bushuyev, V. Bushuieva, S. Onyshchenko, N. Pavlova, Agile-Transformation Organizational Development based on Portfolio Management, in: *2021 11th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications (IDAACS)*, 2021, pp. 444-451, doi: 10.1109/IDAACS53288.2021.9660972.
- [8] S. Bushuyev, A. Puziichuk, Development organizational structure for value-oriented reengineering project of construction enterprises, in: *2021 IEEE 16th International Conference on Computer Sciences and Information Technologies (CSIT)*, 2021, pp. 367-370, doi: 10.1109/CSIT52700.2021.9648758.
- [9] N. Kunanets, A. Kazarian, R. Holoshchuk, V. Pasichnik, A. Rzheskyi, Information support of the virtual research community activities based on cloud computing, in: *International Scientific and Technical Conference on Computer Sciences and Information Technologies, CSIT 2018*, 2018, pp. 199-202.
- [10] O. Sagaydak, Concept of optimization of ship-port-cargo interface, taking into account existing risk assessment methods and use of electronic technologies, *Transport Development* 2(9) (2021) 64-77. <https://doi.org/10.33082/td.2021.2-9.05>.
- [11] V. Pasichnyk, N. Kunanets, IT education and IT business in Ukraine: Responses to the modern challenges, in: *2015 Xth International Scientific and Technical Conference "Computer Sciences and Information Technologies" (CSIT)*, 2015, pp. 48-51, doi: 10.1109/STC-CSIT.2015.7325428.
- [12] A. Sagaydak, V. Torskiy, Ship-Cargo Interface: Concept of Optimization, Using Risk Assessment Methods and Network Data Exchanging Technologies. *TransNav, the International Journal on Marine Navigation and Safety of Sea Transportation* 15(2) (2021) 359-364. doi:10.12716/1001.15.02.12.
- [13] V. Tomashevskiy, I. Pohrebniuk, N. Kunanets, V. Pasichnyk, N. Veretennikova, Construction of individual learning scenarios, in: *Advances in Intelligent Systems and Computing (AISC)*, 2020, Vol. 1247, pp. 609-620.
- [14] S. Bushuyev, N. Bushuyeva, D. Bushuiev, I. Babayev, J. Babayev, Modeling Leadership for developing information technologies based on Agile methodology, in: *2021 IEEE International Conference on Smart Information Systems and Technologies (SIST)*, 2021, pp. 1-5, doi: 10.1109/SIST50301.2021.9465910.
- [15] D. Kobylkin, O. Zachko, Structural Models of Safety-Oriented Management of Infrastructure Projects Decomposition, in: *2020 IEEE 15th International Conference on Computer Sciences and Information Technologies (CSIT)*, 2020, pp. 131-134, doi: 10.1109/CSIT49958.2020.9321877.
- [16] S. Bushuyev, I. Babayev, J. Babayev, B. Kozyr, Complementary Neural Networks for Managing Innovation Projects, in: *2019 IEEE International Conference on Advanced Trends in Information Theory (ATIT)*, 2019, pp. 393-396, doi: 10.1109/ATIT49449.2019.9030454.

- [17] A. Ivankevich, V. Piterska, A. Shakhov, V. Shakhov, V. Yarovenko, A Proactive Strategy of Ship Maintenance Operations, in: 2019 IEEE 14th International Conference on Computer Sciences and Information Technologies (CSIT 2019), Lviv, 2019, pp. 126–129. doi: 10.1109/STC-CSIT.2019.8929741.
- [18] E. Kirillova, Justification of stability ranges of commercially reasonable, allowable loss-making and crisis operation of the vessel, *Eastern-European Journal of Enterprise Technologies* 6 (2015) 4-10.
- [19] S. Bushuyev, D. Bushuiev, V. Bushuieva, Interaction Multilayer model of Emotional Infection with the Earn Value Method in the Project Management Process, in: 2020 IEEE 15th International Conference on Computer Sciences and Information Technologies (CSIT), 2020, pp. 146-150, doi: 10.1109/CSIT49958.2020.9321949.
- [20] V. Piterska, A. Shakhov, O. Lohinov, L. Lohinova, The Method of Transfer of Research Project Results of Institution of Higher Education, in: 2019 IEEE 14th International Conference on Computer Sciences and Information Technologies (CSIT), 2019, pp. 77-80, doi: 10.1109/STC-CSIT.2019.8929887.
- [21] S. Bushuyev, S. Onyshchenko, N. Bushuyeva, A. Bondar, Modelling projects portfolio structure dynamics of the organization development with a resistance of information entropy, in: 2021 IEEE 16th International Conference on Computer Sciences and Information Technologies (CSIT), 2021, pp. 293-298, doi: 10.1109/CSIT52700.2021.9648713.
- [22] C. Wolff, S. Bushuyev, S. Recker, O. Verenych, G. Tabunshchuk, A. Badasian, International Educational Project: ELearning Results Assessment (Case Study), in: 2021 IEEE 16th International Conference on Computer Sciences and Information Technologies (CSIT), 2021, pp. 445-448, doi: 10.1109/CSIT52700.2021.9648734.
- [23] O. Zachko, R. Golovaty, D. Kobylkin, Models of safety management in development projects, in: 2019 IEEE 14th International Conference on Computer Sciences and Information Technologies (CSIT), 2019, pp. 81-84, doi: 10.1109/STC-CSIT.2019.8929743.
- [24] A. Bomba, N. Kunanets, M. Nazaruk, V. Pasichnyk, N. Veretennikova, Model of the Data Analysis Process to Determine the Person's Professional Inclinations and Abilities, in: *Advances in Intelligent Systems and Computing*, 2019, Vol. 938, pp. 482–492.
- [25] O. Zachko and D. Kobylkin, Discrete-Event Modeling of the Critical Parameters of Functioning the Products of Infrastructure Projects at the Planning Stage, in: 2018 IEEE 13th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT), 2018, pp. 152-155, doi: 10.1109/STC-CSIT.2018.8526629.
- [26] N. Veretennikova and N. Kunanets, Automated System of Information Support of Virtual Research Team, in: 2017 12th International Scientific and Technical Conference on Computer Sciences and Information Technologies (CSIT), 2017, pp. 20-23, doi: 10.1109/STC-CSIT.2017.8098727.
- [27] O. Matsyuk, M. Nazaruk, Y. Turbal, N. Veretennikova, R. Nebesnyi, Information Analysis of Procedures for Choosing a Future Specialty, in: *Advances in Intelligent Systems and Computing*, 2019, Vol. 871, pp. 364–375.
- [28] O. Fedorovych, N. Kunanets, Y. Leshhenko, N. Veretennikova, Dual Education as a Bridge Between Theoretical and Practical Knowledge, in: *Proceedings of the 1st International Workshop IT Project Management (ITPM 2020)*, Vol. 2565, pp. 295-306
- [29] A. Rzhеuskyi, A. Shakhov, V. Piterska, O. Sherstiuk, O. Rossomakha, Management of the technical system operation based on forecasting its “aging”, in: *CEUR Workshop Proceedings* 2565, 2020, pp. 130–141.
- [30] A. Bomba, N. Kunanets, M. Nazaruk, V. Pasichnyk, N. Veretennikova, Information technologies of modeling processes for preparation of professionals in smart cities, in: *Advances in Intelligent Systems and Computing*, 2018, pp. 702–712.
- [31] A. Rzhеuskyi, H. Matsuiк, N. Veretennikova, R. Vaskiv, Selective Dissemination of Information – Technology of Information Support of Scientific Research, in: *Advances in Intelligent Systems and Computing III*, 2018, Vol. 871, pp. 235–245.