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PROACTIVE MODELS IN THE AREAS OF PROJECT PORTFOLIO MANAGEMENT OF A GENERAL CONTRACTING ORGANIZATION IN A TURBULENT ENVIRONMENT

ПРОАКТИВНІ МОДЕЛІ В ГАЛУЗЯХ УПРАВЛІННЯ ПОРТФЕЛЯМИ ПРОЄКТІВ ГЕНПІДРЯДНОЇ ОРГАНІЗАЦІЇ В УМОВАХ ТУРБУЛЕНТНОГО СЕРЕДОВИЩА

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Abstract. *Purpose*. The purpose of the study is to develop the approach to proactive management of project portfolios of a general contracting organization in a turbulent environment in the context of portfolio management knowledge areas.
Method. The study used general scientific methods of analysis and synthesis, the method of analysis of literary sources, methods of project and project portfolio management, methods of set theory, and the method of SWOT analysis.
Results. The article analyzes literary sources on portfolio management and sources on proactive management, identifies previously unresolved part of the scientific problem, formulates the goal and objectives of the study. In the further development of existing proactivity classification models, new sign of the classification of proactivity models of portfolio management in construction organizations are proposed. A set of models for managing portfolios of projects of a general contracting organization in a turbulent environment is also proposed. Among the mentioned models are the following: a model of adherence to one's own proactive strategy, a model of a proactive anchor, a model of a proactive leader, a model of proactive synergism, a model of forecasting based on Big Data. The application of each of the models in the fields of portfolio management is described. A SWOT analysis of the proposed set of models is conducted.
Scientific novelty. Elements of scientific novelty include the further development of proactivity classification models, in the form of new sign of the classification of proactivity models of portfolio management in construction organizations, as well as the proposed set of models for managing project portfolios of a general contracting organization in a turbulent environment.
Practical importance. The implementation of the proposed models will allow general contracting construction organizations to increase the systematic nature of management, improve the organization's resilience to turbulent influences, better diversify portfolio risks among portfolio participants and subcontractors, and strengthen the reputation of the construction company thanks to an innovative portfolio management system.
Key words: project portfolio management; construction general contracting organization; proactivity.

Анотація. *Мета*. Метою дослідження є розробка підходу проактивного управління портфелями проєктів генпідрядної організації в умовах турбулентного середовища в контексті галузей знань з портфельного управління.
Методика. У дослідженні використано загальнонаукові методи аналізу і синтезу, метод аналізу літературних джерел, методи управління проєктами і портфелями проєктів, методи теорії множин, метод SWOT-аналізу.
Результати. У статті було проведено аналіз літературних джерел з портфельного управління та джерел з проактивного управління, виділена невирішена раніше частина наукової задачі, сформульовано мету і задачі дослідження. У подальший розвиток моделей класифікації проактивності, що існують, запропоновано нові ознаки класифікації моделей проактивності портфельного управління в будівельних організаціях. Також запропоновано набір моделей управління портфелями проєктів генпідрядної організації в умовах турбулентного середовища. Серед зазначених моделей такі: модель дотримання власної проактивної стратегії, модель проактивного якоря, модель проактивного лідера, модель проактивного синергетизму, модель прогнозування на основі Big Data. Застосування кожної з моделей у галузях управління портфелями описане. Проведено SWOT-аналіз запропонованої множини моделей.

Наукова новизна. До елементів наукової новизни можна віднести подальший розвиток моделей класифікації проактивності, у вигляді нових ознак класифікації моделей проактивності портфельного управління в будівельних організаціях, а також запропонований набір моделей управління портфелями проєктів генпідрядної організації в умовах турбулентного середовища.
Практична значимість. Впровадження запропонованих моделей дозволить генпідрядним будівельним організаціям збільшити системність управління, покращити стійкість організації до турбулентних впливів, краще здійснювати диверсифікацію ризиків портфеля серед учасників портфеля та субпідрядників, зміцнити репутацію будівельної компанії завдяки інноваційній системі портфельного управління.
Ключові слова: управління портфелями проєктів; будівельна генпідрядна організація; проактивність.

PROBLEM STATEMENT

The management of construction organizations and companies that are project-oriented is facing new challenges. The digitalization of management systems using elements of artificial intelligence, the war in Ukraine and other less influential factors are creating a new landscape in the management of construction projects and project portfolios. Such a landscape is characterized by a high degree of uncertainty and is prone to sudden and profound changes.

In this context, project portfolios of construction companies require new management methods in response to modern challenges. The use of traditional approaches to portfolio management, even with elements of the Agile flexible methodology, does not fully solve the problems of effective portfolio implementation in modern conditions; an urgent scientific task is to develop models and methods of portfolio management, the proactivity of which would be a response to modern challenges of the external environment of construction organizations and companies.

ANALYSIS OF LATEST RESEARCH

The issue of portfolio management in the world of project management was first developed in the PMBOK standard, the latest edition of which defines a portfolio as the highest structural level of project activity in an organization [1], to which other portfolios (sub-portfolios), programs, individual projects and even individual operations (business processes) of the company may be subordinate. In 2006, PMI released the first standard on portfolio management, the latest edition of which [2] identifies 7 areas of knowledge in portfolio management: *Portfolio Governance, Portfolio Strategic Management, Portfolio Risk Management, Portfolio Value Management, Portfolio Stakeholder Engagement, Portfolio Capacity and Capability Management, Portfolio Life Cycle*. The evolution of portfolio management within the framework of the development of the British PRINCE2 standard is also interesting – from a separate standard for portfolio management [3], to a standard for project, portfolio and program management offices [4], and further to the inclusion of the portfolio management concept in the current edition of the PRINCE2 standard itself, where the corresponding system consists of the following domains: *Strategic Alignment* (Ensures all change initiatives (projects/programs) support the organization's vision and goals); *Value Optimization* (Focuses on getting the best return on investment (ROI) from the portfolio); *Balanced Portfolio* (Considers the mix of changes, risks, and benefits across the entire portfolio); *Benefits Realization* (Tracks benefits from projects to ensure they contribute to strategic outcomes); *Resource Management* (Optimizes the allocation of resources across competing projects) [5].

Along with the development of the portfolio management industry, its structuring and formalization using best practices, the concept of proactive management is developing in parallel, which is appropriate to apply to portfolio management in the context of modern challenges of the portfolio environment. Proactivity began to be studied as a phenomenon of employee behavior in an organization that can ensure sustainable development for such an organization [6], developed into a strategy in interaction with stakeholders [7], a matrix technology for managing organizational development based on proactivity [8], a set of models and methods for implementing proactive behavior and proactive strategy [9], as well as its application in intelligent data analysis [10]. Scientists have studied proactivity from the point of view of developing models and methods that use it, in application to large regional infrastructure systems [11], to assessing the feasibility of developing organizational and technical systems [12], to developing a proactive risk-oriented methodology for managing programs for the creation and development of a technical regulation system in construction [13].

The authors' scientific works in the field of the studied topic develop the approach of using artificial intelligence models in portfolio management for use in the decision support system of the portfolio manager [14], as well as the joint use of such models with models of emotional intelligence of the construction project portfolio management team [15].

In general, it is worth noting that the scientific direction of searching for new and innovative models and methods of portfolio management in the conditions of modern tough challenges of the portfolio environment is actively developing, is relevant and practically significant.

SEPARATION OF PREVIOUSLY UNSOLVED PARTS OF THE PROBLEM

Based on the analysis of the development of models and methods for managing project portfolios, in particular in the construction industry, it is possible to identify a

previously unresolved part of the problem. In particular, the use of emotional intelligence in this field by itself remains insufficiently studied, as well as its use in combination with elements of artificial intelligence used in the decision-making support system of the portfolio team. Also insufficiently studied is the task of developing proactivity models for use in managing project portfolios of a general contracting construction organization, in the context of the fields of knowledge of project portfolio management.

PURPOSE OF THE RESEARCH

The purpose of this study is to develop an approach to proactive management of project portfolios of a general contracting organization in a turbulent environment in the context of the fields of knowledge of portfolio management.

To achieve the goal, the following tasks are set:

– in the further development of proactivity classification models, to propose new features of the classification of proactivity models of portfolio management in construction organizations;

– to propose a set of models for managing project portfolios of a general contracting organization in a turbulent environment;

– to conduct a SWOT analysis of the proposed approach, to formulate conclusions.

METHODS, OBJECT AND SUBJECT OF THE RESEARCH

The study used general scientific methods of analysis and synthesis, the method of analysis of literary sources, methods of project and project portfolio management, methods of set theory, and the method of SWOT analysis.

The subject of the study is the activities of managing portfolios of construction general contracting organizations.

The object of the study is the processes of proactive management of the portfolio of construction projects of general contracting organizations.

MAIN PART

In the activities of construction general contracting organizations, each contract for the implementation of a general contract can be considered both as a project and as a portfolio of projects, depending on the scope of work under the general contract and the number of participants in the work (subcontractors). In this context, in further development of existing proactivity classification models, we propose new features for the classification of proactivity models of portfolio management in construction organizations (Table 1).

Next, we will propose a set of models for managing project portfolios of a general contracting organization in

Table 1. Classification of portfolio management proactivity models in construction companies

№	Classification sign	Varieties of models within a sign
1.	According to the field of application in types of construction organizations	– proactive models of development companies; – proactive models of enterprises producing building materials – proactive models of construction companies – proactive models of customer service – proactive models of general contracting organizations
2.	According to the degree of artificial intelligence use in proactivity models	– proactive models without the use of artificial intelligence elements – proactive models with the use of artificial intelligence elements – proactive models fully implemented by artificial intelligence
3.	According to the use of team emotional intelligence in proactivity models	– proactive models without using team emotional intelligence – proactive models using team emotional intelligence – proactive models using a combination of team emotional intelligence and artificial intelligence management tools
4.	According to the organization of the proactivity implementation	– implementation of proactive models by a proactive leader – implementation of proactive models by a collegial body (e.g., a portfolio management committee) – implementation of proactive models by a self-managed construction project portfolio management team
5.	According to the synergy consideration degree between the proactive approach elements	– proactive models without taking into account the synergy between the elements of the proactive approach – proactive models taking into account the synergy between individual elements of the proactive approach – proactive models taking into account the synergy between all elements of the proactive approach
6.	According to the forecasting base as an element of proactive models	– proactive models that use forecasting based on expert assessments of specialists (external experts) – proactive models that use forecasting based on assessments of portfolio management team members – proactive models that use forecasting based on Big Data processing – proactive models that use combined approaches to forecasting

a turbulent environment (Fig. 1) and describe each of the proposed models.

The model of adhering to one's own proactive strategy.

The model is based on the general contracting organization's determination of individual elements of the organization's proactive development strategy (including turbulence response scenarios) and its integration into a single proactive strategy:

$$S = \langle B, M, H, T, O \rangle \quad (1)$$

where B – elements of a higher-level proactive strategy, and $B = \{b_1, b_2, b_3\}$, and b_1 – vision, b_2 – mission, b_3 – strategy; M – proactive management methodology of construction project portfolios, and $M = \{m_1, m_2, m_3\}$, where m_1 – standard that is the basis of the methodology, m_2 – portfolio management domains, m_3 – the set of models and methods for proactive management of construction project portfolios; H – the set of response scenarios, and $H = \{h_1, h_2, h_3\}$, where h_1 – the set of preventive scenarios that ensure increased resistance of the construction organization to turbulence, h_2 – the set of scenarios that are a response to symptoms of turbulence, h_3 – the set of scenarios for responding to the onset of turbulence, T – predicted types of turbulence in the external environment, O – organizational artifacts of the organization, including the list of roles in portfolio management, the corresponding hierarchy and assets of the construction organization processes.

The application of the model in portfolio management domains is described below.

Portfolio Governance: refinement of model elements occurs during high-level portfolio management meetings, in particular at the portfolio management board and the change committee.

Portfolio Strategic Management: within this domain, a proactive strategy is implemented and its implementation is monitored, refinements to the proactive strategy are developed, which are provided to the Portfolio Governance level.

Portfolio Risk Management: within this domain, a typification of turbulence in the external environment (T) is carried out and periodically updated, a set of turbulence response scenarios (H) are developed and refined.

Portfolio Value Management: within this domain, the model is profiled in terms of elements of the proactive higher-level strategy (B) and periodically reviewed in light of the value system of the construction general contracting organization.

Portfolio Stakeholder Engagement: within this domain, interaction is carried out with stakeholders of the construction organization's project portfolios, in particular with project customers (which are included in the portfolio), subcontractors of each project (in which the construction organization acts as a general contractor). In particular, elements H and T of the specified model are specified.

Portfolio Capacity and Capability Management: This domain may develop, review, and refine a methodology for proactively managing construction project portfolios (M).

Portfolio Life Cycle: This domain proactively manages the life cycle of a general contracting organization's construction project portfolio, which may change as a result of the onset of T element of model and the implementation of element H of model in response to or to prevent turbulence.

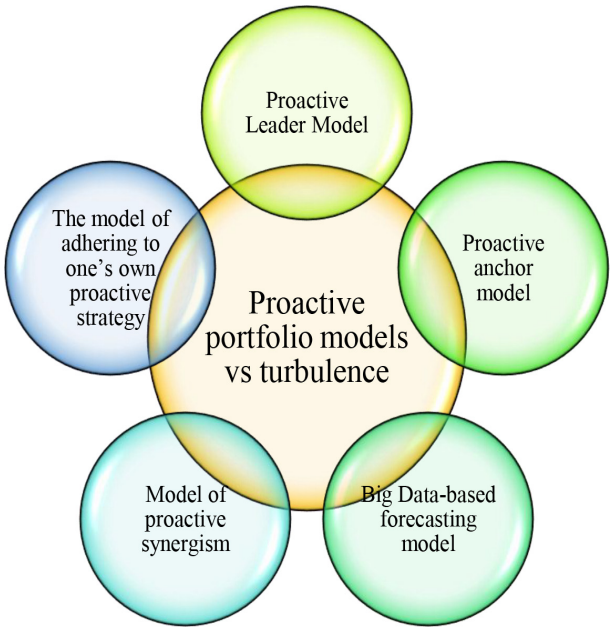

Fig. 1. Proactive models of construction project portfolio management in turbulent conditions

Proactive Anchor Model.

The implementation of this model involves the isolation of an element of proactive strategy that is the most developed in terms of implementing proactivity. Such an element may be an element (portfolio management domain, methodology element, construction organization unit, etc.) whose proactivity effectiveness has been statistically confirmed, or an element that will be selected at the Portfolio Governance level as a pilot for implementing proactive models and methods. Other elements (portfolio management domains, construction organization units, etc.) will inherit proactive models, methods, and artifacts from the pilot element.

$$\forall m^1 (m^1 \in M, M \in S) : f^e (m^1) \geq f^e(m_i), m_i \in M, \quad (2)$$

where m^1 – the element of the set M, the proactivity efficiency of which (f^e) can be greater than the proactivity efficiency of other elements m_i of the set M. In this case, efficiency can be measured in terms of reducing time, reducing cost, or reducing labor costs in implementing tasks (processes, functions) of managing a construction projects portfolio. Then m^1 will be called the proactivity anchor.

The application of the model in portfolio management domains is described below.

Portfolio Governance: within this domain, the anchor of proactivity can be, for example, the business process of making changes to project portfolio artifacts, the business process of organizing the execution of the project portfolio, etc.

Portfolio Strategic Management: within this domain, the anchor of proactivity can be, for example, the business process of making changes to strategic project portfolio artifacts, the business process of implementing the project portfolio strategy, etc.

Portfolio Risk Management: within this domain, the anchor of proactivity can be the business process of developing, implementing and monitoring the effectiveness of a set of preventive scenarios that ensure an increase in the resilience of the construction organization to turbulence (h_1) or the business process of developing, implementing and monitoring the effectiveness of a set of scenarios that are a reaction to the symptoms of the onset of turbulence (h_2), etc.

Portfolio Value Management: within this domain, the anchor of proactivity can be the business process of profiling the model (1) in terms of elements of the higher-level proactive strategy (B) or the business process of periodically reviewing such elements based on the value system of the construction general contracting organization, etc.

Portfolio Stakeholder Engagement: within this domain, the anchor of proactivity can be either the business process of delivering values to stakeholders of a construction project or the business process of balancing the values of the entire pool of stakeholders of a construction project portfolio, etc.

Portfolio Capacity and Capability Management: within this domain, the anchor for proactivity could be the business process of increasing the institutional capabilities of a construction project portfolio or the process of expanding a construction project portfolio, etc.

Portfolio Life Cycle: within this domain, the anchor for proactivity could be, for example, a new construction project portfolio life cycle model that combines elements of Waterfall and Agile.

Proactive Leader Model.

This model involves the identification (appointment, performance-based defines or self-identification) of a leader in the construction organization to implement proactive models and methods. The work of such a leader, in particular, should be based on the use of his own emotional intelligence (EI). If the performance-based leader model is chosen, this model may look like this:

$$L = \{l_1, l_2, l_3, l_4, l_5\}, \quad (3)$$

where l_1 – the person's competencies in the field of portfolio management (hard skills), l_2 – the person's psychological competencies (soft skills), l_3, – the person's competencies in the field of strategic management, l_4, – the person's competencies in the field of application of proactive management, l_5 – the person's creativity (competencies in the field of creating new models, techniques, methods, tools, principles).

The application of the model in the portfolio management domains is described below.

Portfolio Governance: within this domain, a proactive leader may be (can be identified as) a representative of the Portfolio Board at the highest level of portfolio management (top management of a construction company), who most successfully uses proactive models and methods.

Portfolio Strategic Management: within this domain, a proactive leader may be (can be identified as) a representative of the strategic level of portfolio management – a portfolio manager, a manager of one of the portfolio projects, or the head of one of the portfolio committees (change committee, etc.), who most successfully uses proactive models and methods.

Portfolio Risk Management: Within this domain, a proactive leader may be (can be identified as) a risk manager for one of the portfolio projects or one of the portfolio risk managers who most successfully uses proactive models and methods to prevent turbulence or to mitigate its impact on the portfolio of projects.

Portfolio Value Management: Within this domain, a proactive leader may be (can be identified as) a top-level manager who participates in the implementation of a portfolio of construction projects and most successfully uses proactive models and methods in the process of delivering portfolio values.

Portfolio Stakeholder Engagement: within this domain, a proactive leader may be (can be identified as) one of the portfolio project managers (or portfolio manager) who participates in the implementation of a portfolio of construction projects and most successfully uses proactive models and methods in the process of involving stakeholders in the implementation of the portfolio.

Portfolio Capacity and Capability Management: within this domain, a proactive leader may be (can be identified as) one of the portfolio implementation participants who most successfully uses proactive models and methods in the processes of Capacity and Capability Portfolio Management.

Portfolio Life Cycle: within this industry, a proactive leader may be (can be identified as) one of the participants in the portfolio implementation who most successfully uses proactive models and methods in the processes of managing the life cycle of the project portfolio.

Proactive Synergism Model.

The implementation of this model involves the isolation of several (two or more) elements of a proactive strategy, which in combination with each other will potentially provide the greatest development

of proactivity. Such elements may be the portfolio management industry, an element of the methodology, a division of the construction organization, a proactive leader, etc.

$$\forall m_i^1, m_i^2 \left(m_i^1, m_i^2 \in M, M \in S\right): f^e\left(m_i^1, m_i^2\right) \geq f^e\left(m_i, m_j\right); \quad m_i, m_j \in M, \tag{4}$$

where m_i^1, m_i^2 – elements of the set M, the efficiency of proactivity from the synergy of which (f_e) can be greater than the efficiency of proactivity from the synergy of other elements m_i and m_j of the set M. In this case, efficiency can be measured in reducing time, reducing cost or reducing labor costs in the implementation of tasks (processes, functions) of managing a portfolio of construction projects. Then m_i^1, m_i^2 will be called a pair of proactivity synergies.

Proactivity synergy pairs can be formed from different domains of construction project portfolio management: Portfolio Governance, Portfolio Strategic Management, Portfolio Risk Management, Portfolio Value Management, Portfolio Stakeholder Engagement, Portfolio Capacity and Capability Management, Portfolio Life Cycle.

Forecasting model based on Big Data.

The application of this model involves the use of forecasting trends in the development of the environment of a portfolio of construction projects. This is possible with the involvement of AI elements (neural network), which uses Big Data with information about the behavior of environmental elements in previous periods. The construction of trends is possible both separately for each element of the environment and collectively for the environment as a whole. The corresponding analysis should be drawn up in a standardized form and provided at the level of the following domains: Portfolio Governance, Portfolio Strategic Management, Portfolio Risk Management, Portfolio Value Management, Portfolio Stakeholder Engagement and Portfolio Capacity & Capability Management. Based on the results of studying the data of this model, relevant specialists can make more informed decisions in the portfolio. Therefore, the forecasting model based on Big Data can be used as an element of the decision support system for portfolio management, which is built on the basis of AI.

Let's conduct a SWOT analysis of the proposed approach, highlight its strengths, weaknesses, opportunities and threats (Table 2).

According to the results of the SWOT analysis, the proposed set of models should be considered as being of medium complexity, moderately risky and potentially effective. In case of successful implementation, the proposed approach can significantly increase the capabilities of a construction general contracting organization not only to implement individual general contracting projects, but also portfolios of such projects, and provide greater capabilities for survival and effective portfolio management in a turbulent external environment.

CONCLUSIONS

Construction organizations and companies that implement general contracting and manage the corresponding project portfolio are faced with many challenges of our time, with significant turbulence in the external environment. In response to such challenges, they need new models and methods of portfolio management, taking into account the implementation of portfolios in conditions of high uncertainty. In this context, we consider it appropriate to use the concept of proactive management and the corresponding models and methods.

This article analyzes the literary sources on portfolio management and literary sources on proactive management, identifies the previously unresolved part of the scientific problem, formulates the goal and objectives of the study. In the further development of existing proactivity classification models, new features of the classification of proactivity models of portfolio management in construction organizations are proposed. A set of models for managing project portfolios of a general contracting organization in a turbulent environment is also proposed. Among these models are the following: a model of adhering to one's own proactive strategy, a model of a proactive anchor, a model of a

Table 2. SWOT analysis of the proposed set of proactive models

Strengths	Weaknesses
– the systematic nature of this approach; – the presence of forecasting as an important element of a proactive strategy; – strategic focus on ensuring survival in a turbulent environment	– insufficient research of the proposed approach; – the presence of a human factor in the implementation of models; – the complexity of models, methods and forecasting algorithms based on Big Data
Opportunities	**Threats**
– the possibility of implementing actions to anticipate, dampen the impact of turbulence; – the possibility of improving interaction with stakeholders; – obtaining synergy from combining different models, increasing the number of new projects (orders)	– war and war risks reduce the relevance of new approaches, in particular proactive models in portfolio management; – deterioration of relations with stakeholders due to unsuccessful forecasting, narrowing of the portfolio; – unsuccessful implementation of the approach, loss of reputation, decrease in profitability

proactive leader, a model of proactive synergism, a model of forecasting based on Big Data. The application of each of the models in the fields of portfolio management is described (Portfolio Governance, Portfolio Strategic Management, Portfolio Risk Management, Portfolio Value Management, Portfolio Stakeholder Engagement, Portfolio Capacity and Capability Management, Portfolio Life Cycle). A SWOT analysis of the proposed set of models was conducted, which confirmed the potential of their effectiveness.

The implementation of the proposed models will allow general contracting construction organizations to increase the systematicity of management, improve the organization's resistance to turbulent influences, better diversify portfolio risks among portfolio participants and subcontractors, and strengthen the reputation of the construction company thanks to an innovative portfolio management system.

The prospects for research in the chosen direction can be considered as follows: testing the specified models in practice, making adjustments to the model based on the results of such testing, studying typical turbulent impacts on the portfolio of general contracting projects of a construction organization, and developing mathematical models for proactive response to such turbulent impacts.

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