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DOI: 10.26410/SF_1/25/4

A SYSTEMIC APPROACH TO MANAGING PROJECT PORTFOLIOS FOR THE DEVELOPMENT OF TERRITORIAL SECURITY SYSTEMS

Abstract

The management of project portfolios for the development of territorial security systems (PPTSS) operates in a highly complex environment due to the dynamic nature of project settings, limited resources, and the absence of unified value assessment approaches for project outcomes. Traditional methods of feasibility assessment fail to account for the multidimensionality of hybrid projects implemented within the civil protection framework.

The systemic-value approach to managing PPTSS improves the rationale behind managerial decisions, reduces uncertainty risks at the planning stage, and ensures effective project execution. Future research should focus on enhancing modeling tools, identifying the characteristics of project environments, and establishing a dedicated scientific field in project management for security systems.

Keywords

project portfolio, territorial security systems, systems approach, simulation modeling, product value, hybrid projects, resource management.

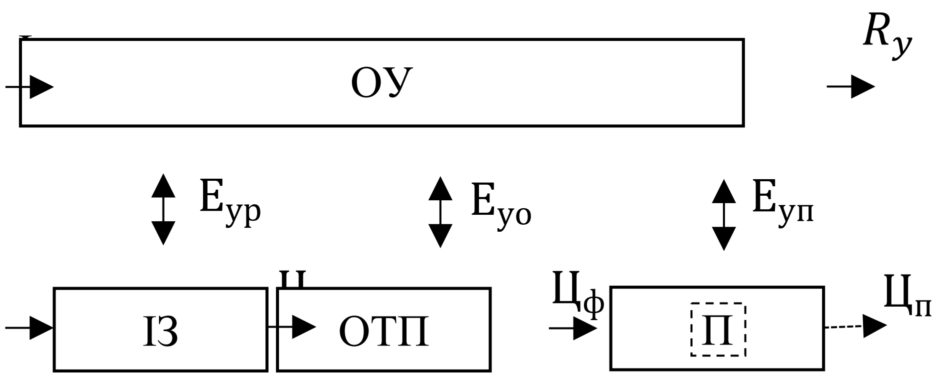
Introduction

Modern challenges in the field of national security of Ukraine, including war, hybrid threats, urbanization, environmental risks and social instability, require fundamentally new approaches to the organization and management of territorial security systems (TSS). The creation of adaptive, flexible and value-based management mechanisms is possible only with the use of modern concepts of project management, digital technologies and complex systems modeling.

The conceptual model for the development of the RTSS is the basis for further design of the project portfolio, which combines technical, organizational, regulatory and information components into a single managed system. Such a model allows to identify weaknesses in advance, define areas of strategic influence, and form a value-oriented development trajectory. Of particular importance is the inclusion in the model of mechanisms for assessing the effectiveness and value of projects, taking into account limited resources and environmental changes.

It is known that the portfolios of territorial security system development projects (TSSDPs) implemented in different regions of the state are production systems with a complex internal structure [1, 2]. Their life cycle is characterized by temporality, which always has a beginning and an end. The main components of these systems are the organizational and technical subsystem (ОТП), resource infrastructure (ІЗ), and management (ОУ) [3, 4]. In addition, the components of these systems include the product (П) itself, which is created (formed) as a result of the implementation of the PTSS (Fig. 1).

Figure. 1 – Block diagram of the "PPTSS" system



ОТП – organizational and technical subsystem; *ІЗ* – resource infrastructure; *ОУ* – management office; *П* – product; *I* – information; $R_у$, $R_П$ – resources for the management and implementation of the project portfolio; $Ц_з$ – the value of providing resources; $Ц_ф$ – value of product formation; $Ц_п$ – product value; $Е_{уо}$, $Е_{уп}$, $Е_{ур}$ — respectively, the efficiency of resource management, project portfolio and product development

Methodology

The research aims to develop a systemic approach to managing PPTSS through virtual product system modeling, quantitative evaluation of value indicators, and assessment of project feasibility using simulation modeling.

The study applies methods of systems analysis, simulation modeling, statistical evaluation, expert judgment, and configuration modeling of organizational and technical systems. a conceptual framework for hybrid projects has been developed, including a multi-level model of dependencies between management efficiency and the final product's value.

A structural model of PPTSS is proposed, incorporating the organizational-technical subsystem, resource infrastructure, management office, and the final product. Functional dependencies are established. The feasibility of using statistical simulation modeling is substantiated for forecasting outcomes of hybrid projects in dynamic environments. Value indicators are classified as systemic, functional, and cost-related. The use of virtual system modeling at the design stage is justified to assess the potential value of territorial security system products.

The main part

Each of these components of the "PPTSS" system performs certain system functions [4, 5]: 1) ОТП – product formation; 2) ІЗ – resource supply; 3) ОУ – management; 4) П – application (use) of territorial security systems (TSS) for their intended purpose. These functions are performed with a certain value for stakeholders, who determine the value of product formation 〚($Ц_ф$) and the value of resource supply ($Ц_з$), the efficiency of managing resources ($Е_{уо}$), the project portfolio ($Е_{уп}$) and its product ($Е_{ур}$), and finally the value of using the product ($Ц_п$) of the PRTSB [6].

There are interconnections between these indicators. In particular, the value of using the product ($Ц_п$) of the project portfolio depends on the configuration of the product (К) of the СТРР. At the same time, $К_п$ depends on the value of the formation of the product ($Ц_ф$) o of the PRTSB and the efficiency ($Е_{уп}$) of managing its formation [7, 8]:

$$Ц_п = f(К_п), f\left(Ц_ф, Ц_{ур}\right)$$

The value of forming a product ($Ц_ф$) of the project portfolio depends on the configuration of the organizational and technical subsystem ($К_{отп}$) of the RTSB. At the same time, $К_{отп}$ depends on the value of resourcing ($Ц_з$) in the RTSB and the efficiency ($Е_{уо}$) of managing this portfolio:

$$Ц_ф = f \quad (К_{отп}), К_{отп} = f \quad \left(Ц_з, Е_{уо}\right)$$

The value of resource provision ($Ц_з$) of a project portfolio depends on the configuration of the RTSB resource infrastructure (К). At the same time, $К_{із}$ depends on the available resources ($R_п$) for the implementation of the CTPP and the efficiency ($E_{ур}$) of their management [9]:

$$Ц_з = f\ (К_{із}),\ К_{із} = f\ \left(R_п, E_{ур}\right)$$

The effectiveness of managing resources ($E_{уо}$), project portfolio ($E_{уп}$) and its product ($E_{ур}$) depends on the configuration of the management office ($К_{оу}$) of the PRTSB. At the same time, $К_{оу}$ depends on the available management resources ($R_у$) and information (I) for making management decisions [10]:

$$E_{уо}(E_{уп}, E_{ур}) = f\ \left(К_{оу}\right),\ К_{оу} = f\ \left(R_у, I\right)$$

These indicators are a generalized reflection of the set of actions that are purposefully carried out by the components of the PRTSB system [11]. They are evaluated at all stages of the life cycle of the PRTSB system, from the creation of the PRTSB system to its completion and use. During the life cycle of a PRTSB, these indicators change (are refined). Like the PRTSB itself, they gradually (sequentially) move from predicted (virtual) to real ones. In fact, the assessment of the real value indicators of the PRTSB may end at the moment of its completion, or it may continue until the product with the refined value indicators satisfying the stakeholders is obtained. So, the value indicators of the PRTSB are the milestones that reflect the stages of its implementation.

Let's consider the peculiarities of forming value indicators in the PRTSB system. At the stage of creating the PRTSS, first of all, the value indicators of the PRTSS product are predicted. The so-called feasibility study of the feasibility of creating a PRTSB product is nothing more than a forecast of the value ($Ц_п$) of the future PRTSS product. Without paying much attention to the details of this process, we note that the current methods of such forecasting (justification) of the value of the future PRTSS product are characterized not only by many shortcomings, but also by the objective uncertainty of many components of the virtual product. However, without such a justification, the implementation of the next stages of the life cycle of the PRTSS cannot begin.

The peculiarity of our proposed methodology of system-value management of the PRTSS is that it involves the use of a systematic approach to the creation and formation of project portfolios and modeling the use of their future product for its intended purpose to assess its value ($Ц_п$) [12, 13]. In other words, at the stage of creating a PRTSS, its future product should be modeled and the value of the virtual system – the PRTSS product – should be assessed. Although system modeling methods are sufficiently developed, they are still being developed today [14]. Their application is determined by the peculiarities of the future product of the PRTSS. In particular, in the sphere of civil protection of the state's population, the product of the PRTSS can be either an independent regional system or a component of the state system.

In this case, the configuration ($K_п$) of the PRTSS product is justified on the basis of design, which, as a type of intellectual activity, is based on knowledge about the physical and functional regularities inherent in individual objects of TSS, as well as elementary systems where these objects are used [15]. Without going into an in-depth analysis of this knowledge, which is the subject of research being developed by certain scientific fields in the field of civil protection, we note that knowledge about systems in different spheres of human activity is not currently combined into a corresponding independent scientific specialty, and therefore is being developed by the science of project and program management. In this case, virtual TSBs (production systems) with new elements (configuration objects) that are the product of the respective PRTSBs are mostly studied [16].

This ensures the prediction of value indicators for hybrid projects implemented by TSBs. To study such value indicators, in our opinion, it is advisable to use simulation modeling [17]. Given the likely nature of the behavior of many components of the project environment of these hybrid projects, statistical simulation modeling should be used, which is carried out in several stages:

1. a conceptual model of the project is being developed;
2. research and quantify the characteristics of the changing project environment;
3. the analysis reveals the cause-and-effect relationships between the components of hybrid projects;
4. a flowchart of the algorithm and a computer program for statistical simulation modeling of hybrid projects are being developed;
5. the model of hybrid projects is being validated;
6. preliminary modeling of hybrid projects is performed and the model is checked for adequacy;
7. experiments with the model of hybrid projects are planned;
8. final modeling of hybrid projects is performed;
9. statistically processed and analyzed data on the value indicators of hybrid projects with the product of the future PRTSS.

The obtained value indicators are compared with the corresponding indicators of real TSBs and a decision is made on the feasibility of including a particular project in the PRTSB.

At the same time, the creation of hybrid project models is accompanied by some difficulties in identifying the cause-and-effect relationships between their components, researching and quantifying the characteristics of the changing project environment, as well as the physical and functional indicators of configuration objects that characterize the virtual (future) PRTSB product. To get rid of these difficulties, it is necessary to justify idealizations, as well as to develop methods and techniques for studying and quantifying the characteristics of the changing design environment both directly and indirectly. With regard to the identification of physical and functional indicators of the configuration objects of the components of the virtual product of the PRTSB, they are substantiated by the methods of analogy, design, or expert evaluation [18].

The value indicators of the PRTSB product are divided into systemic, functional, and cost indicators. Systemic indicators of the PRTSB product are those that reflect the results of the intended use of the TSB in the given conditions of the project environment during the duration of their life cycle. Functional indicators of the PRTSB product are reflected by indicators of the intended use of the components of the virtual product. The indicators of the value of the components of the improved (developing) PRTSB product are mostly known. In addition, the characteristics of the changing project environment are known, which in turn reflect the conditions in which the PRTSB product will be used for its intended purpose. In particular, the components of these conditions include subject, climatic, territorial, production, and technological.

Subject conditions are divided into subject-quality and subject-scale components. The subject-quality conditions of the PRTSB product characterize the objects of disaster protection in terms of its quality – initial and final (desired). The subject and scale conditions of the PRTSB product characterize disaster protection objects in terms of the scope of work in hybrid projects. The subject conditions, together with the product of the PRTSB (a separate TSB), which is in a transitional state of its development, resources and technological conditions, are the basis for the implementation of the relevant hybrid projects implemented by the virtual system. At the same time, technological conditions reflect knowledge about the qualitative transformation of the existing technological system into the desired one. They define the nomenclature, sequence, and modes of work in hybrid projects that implement individual TSBs. The product of hybrid projects is formed on the basis of work performed in a virtual organizational and technical system.

Conclusion

So, a systematic approach to the management of the PRTSS involves the study of the properties and configuration of their dynamic product systems and project systems, which requires the development of specific methodological principles. The study of the properties of virtual product systems and project systems that are part of the PTSS is possible only on the basis of their simulation modeling. The development of models of virtual product systems and project systems of systems belonging to the PRTSB is one of the important stages of their research.

So, the conceptual modeling of a hybrid project within the portfolio of territorial security systems development is a strategically important task that ensures a high level of coherence between the needs of the state, the expectations of citizens, and the limitations of the resource environment. The proposed approach combines system analysis, value-based management methodology, and digital modeling capabilities, in particular, using BPMN, UML, and ER diagrams, which contributes to building a transparent decision-making architecture.

The developed model is the basis for the further development of an information technology for managing the CBRN portfolio, which will allow for real-time monitoring, analysis and adaptation of projects. In the future, such a model can be scaled up to meet the needs of other security sectors, including civil protection, critical infrastructure, and risk management. Implementing the conceptual model in practice will help build a more resilient, adaptive, and technologically advanced national security system.

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