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## MODELS OF INFRASTRUCTURE PROJECT MANAGEMENT BY MEANS OF HYBRID TECHNOLOGIES

In the scientific article the actual scientific and applied task of development of models of management the infrastructure projects by means of hybrid technologies is solved. A thorough analysis of research in the field of infrastructure project management and identified its unresolved part. Was conducted the analysis of the subject area of the state of implementation of infrastructure projects at the regional level; terminological base of scientific research; a system of normative legal acts in the field of financial regulation of infrastructure projects and programs at the regional level and standards for project management; international experience in implementing programs at the regional level; modern approaches to the management of infrastructure projects and programs at the regional level. A scientific and applied concept of hybrid management of infrastructure projects and programs at the regional level by means of convergence of knowledge systems for project management has been developed. Described the project environment of infrastructure projects and programs at the regional level, which includes the core implementation and operation of infrastructure projects and programs using hybrid technologies at the regional level, and four blocks underlying the set of parameters and values of such projects and programs. It is determined that the complexity of infrastructure projects and programs of the territorial system determines the problem of project management, and accordingly the complexity of projects. Thus, complex projects are projects with a high level of uncertainty of input data, high probability or magnitude of potential risks and the need to use different approaches in project implementation, including the involvement of a relatively large number of experts in different fields of specialization. Scientifically based methods and mechanisms of hybrid management of infrastructure projects and programs at the regional level allow to identify and implement possible measures to improve the situation in the region and improve the organizational and functional structure of resource management.

**Keywords:** infrastructure project; project management; project environment; hybrid technologies.

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## МОДЕЛІ УПРАВЛІННЯ ІНФРАСТРУКТУРНИМИ ПРОЄКТАМИ ЗАСОБАМИ ГІБРИДНИХ ТЕХНОЛОГІЙ

У науковій статті вирішено актуальне науково-прикладне завдання розробки моделей управління інфраструктурними проєктами засобами гібридних технологій. Проведено ґрунтовний аналіз проведених досліджень у сфері управління інфраструктурними проєктами та ідентифіковано її невирішену частину. Проведено аналіз предметної галузі стану реалізації інфраструктурних проєктів на регіональному рівні; термінологічної основи наукового дослідження; системи нормативно-правових актів у сфері фінансового регулювання інфраструктурних проєктів та програм на регіональному рівні та стандартів з управління проєктами; міжнародний досвід реалізації програм на регіональному рівні; сучасних підходів до управління інфраструктурними проєктами та програмами на регіональному рівні. Розроблено науково-прикладну концепцію гібридного управління інфраструктурними проєктами та програмами на регіональному рівні засобами конвергенції систем знань з управління проєктами. Описане проєктне середовище інфраструктурних проєктів і програм на регіональному рівні, що включає ядро впровадження та функціонування інфраструктурних проєктів та програм засобами гібридних технологій на регіональному рівні, та чотири блоки, що лежать в основі формування набору параметрів та значень таких проєктів та програм. Визначено, що складність інфраструктурних проєктів і програм територіальної системи визначає проблему управління проєктами, а відповідно і складність проєктів. Таким чином комплексними проєктами є проєкти з високим рівнем невизначеності вхідних даних, високою ймовірністю чи величиною потенційних ризиків та необхідністю використання різних підходів у реалізації проєктів, у тому числі із залученням відносно великої кількості експертів у різних галузях спеціалізації. Науково обґрунтовані методи та механізми гібридного управління інфраструктурними проєктами та програмами на регіональному рівні дають змогу визначити і реалізувати можливі заходи з покращення ситуації в регіоні та вдосконалити організаційну і функціональну структури управління ресурсами.

**Ключові слова:** інфраструктурний проєкт; управління проєктами; проєктне середовище; гібридні технології.

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## МОДЕЛИ УПРАВЛЕНИЯ ИНФРАСТРУКТУРНЫМИ ПРОЕКТАМИ СРЕДСТВАМИ ГИБРИДНЫХ ТЕХНОЛОГИЙ

В научной статье решена актуальная научно-прикладная задача разработки моделей управления инфраструктурными проектами средствами гибридных технологий. Проведен обстоятельный анализ проведенных исследований в сфере управления инфраструктурными проектами и идентифицирована ее нерешенная часть. Проведен анализ предметной области состояния реализации инфраструктурных проектов на региональном уровне; терминологической базы научного исследования; системы нормативно правовых актов в сфере финансового регулирования инфраструктурных проектов и программ на региональном уровне и стандартов по управлению проектами; международный опыт реализации программ на региональном уровне; современных подходов к управлению инфраструктурными проектами и программами на региональном уровне. Разработана научно-прикладная концепция гибридного управления инфраструктурными проектами и программами на региональном уровне средствами конвергенции систем знаний по управлению проектами. Описанная проектная среда инфраструктурных проектов и программ на региональном уровне, включающая ядро внедрения и функционирования инфраструктурных проектов и программ средствами гибридных технологий на региональном уровне, и четыре блока, лежащие в основе формирования набора параметров и значений таких проектов и программ. Установлено, что сложность инфраструктурных проектов и программ территориальной системы определяет проблему управления проектами, а соответственно и сложность проектов. Таким образом, комплексными проектами являются объекты с высоким уровнем неопределенности входных данных, высокой вероятностью или величиной потенциальных рисков и необходимостью использования различных подходов в реализации проектов, в том числе с привлечением относительно большого количества экспертов в различных отраслях специализации. Научно обоснованные методы и механизмы гибридного управления инфраструктурными проектами и программами на региональном уровне позволяют определить и реализовать возможные меры по улучшению ситуации в регионе и усовершенствовать организационную и функциональную структуру управления ресурсами.

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**Introduction.** Today in Ukraine and the world in the context of new trends in infrastructure project management it is advisable to use hybrid management technologies, which have proven themselves as best practices in large-scale global projects such as the Eurotunnel under the English Channel. Hybrid technologies in this version allow you to integrate the values of all stakeholders of these projects. In Ukraine, a large-scale state program "Large Construction" is being implemented, which is aimed at building transport, educational, social and sports infrastructure. The large number of stakeholders of this program, the complexity of hierarchical links between them at the regional, public and private sectors requires the use of hybrid management technologies.

#### Analysis of recent research and publications.

Implementation of infrastructure projects is a complex process that is formed by clearly structuring the stages of project implementation, taking into account various parameters and obtaining a project product. A number of domestic and foreign scientists, including S.D. Bushuyev, O.B. Zachko, Yu. P. Rak, O.V. Sydorhuk, R.T. Ratushny and others, dealt with issues and problems of implementation of projects, programs and portfolios of infrastructure projects in Ukraine and the world [1-5, 11-12].

Scientific research of Bushuyev S.D. consider methods and models to integrate different approaches to flexible project management and programs on the example of construction projects and ensure their sustainability in rapid and even critical changes in internal and external environment and trends in the short and long term, taking into account the dynamics and adequate response and providing compensation for changes in project manager management processes [1-3].

In the research of Sydorhuk O.V., Ratushnyi R.T. are analyzed the features of knowledge for the organization and application of project and operational activities of hybrid project management, as well as system links between them, which determine the quality of management process and decision making.

Based on domestic and foreign experience, it can be said that ensuring the effective functioning of any complex infrastructure project or program, including regional or territorial systems, is achieved by converging mechanisms of proactive and reactive management.

**The purpose of the research.** The aim of the article is to develop new, hybrid models of infrastructure project management and programs using classical and flexible project management methodologies.

**Main part.** We consider the structure of infrastructure projects and programs in the regional context as the development of a highly efficient hybrid system that includes a feasibility study and decision-making process. The content of such a comprehensive optimization approach is that the design process takes into account the whole set of values of situations and decisions

when choosing the best project environment and, accordingly, projects and programs in it.

Table 1 - Scientific schools of infrastructure project management

Researcher	Object of research	Scientific result
Bushuyev S.D.	<ul style="list-style-type: none"> <li>- Management of infrastructure programs based on hybrid methodology;</li> <li>- Management of creative potential of the project team;</li> <li>- Convergence in the formation of innovative methods and models of project management.</li> </ul>	<ul style="list-style-type: none"> <li>- Tools for the feasibility of using convergence in the formation of innovative methods and models of project management;</li> <li>- Requirements for the level of competence of project participants and cognitive models of knowledge accumulation;</li> <li>- Terminological tools of the paradigm of convergent approach;</li> <li>- Innovation in project management.</li> </ul>
Kozyr B.Yu.	<ul style="list-style-type: none"> <li>- Industrial object and its infrastructural program of development of the Mykolayiv plant of bakery products on the basis of hybridization technology;</li> <li>- Erosion of competencies of innovative projects.</li> </ul>	<ul style="list-style-type: none"> <li>- Model of adaptive system of hybrid dual control;</li> <li>- Hybrid project management methodology;</li> <li>- Genom model of hybrid methodology for managing infrastructure programs.</li> </ul>
Sydorchuk O.V., Ratushnyi R.T.	<ul style="list-style-type: none"> <li>- Creation of a unique product as a project goal and the result of a combination of operational and project activities (hybrid).</li> </ul>	<ul style="list-style-type: none"> <li>- Methodology of combining project and operational management of hybrid projects.</li> </ul>
Neizvestnyi S.I.	<ul style="list-style-type: none"> <li>- Convergent technologies for the development of methodological management of digitalization projects.</li> </ul>	<ul style="list-style-type: none"> <li>- Convergent technologies and synergistic effect of increasing management efficiency.</li> </ul>
Verenych O.	<ul style="list-style-type: none"> <li>- Project management and their impact on economic development;</li> <li>- Infrastructure projects and programs in turbulent environments.</li> </ul>	<ul style="list-style-type: none"> <li>- Economic and mathematical modeling in project and program management;</li> <li>- Information approach in the management of infrastructure projects and programs.</li> </ul>

As a rule, at the first stage at the level of the technical task of designing a convergent system for the formation of infrastructure projects and programs at the regional level use verbal-deductive or verbal-logical

modules. However, these models are practically invisible and not at all suitable for carrying out certain formal transformations of the topology in automatic mode.

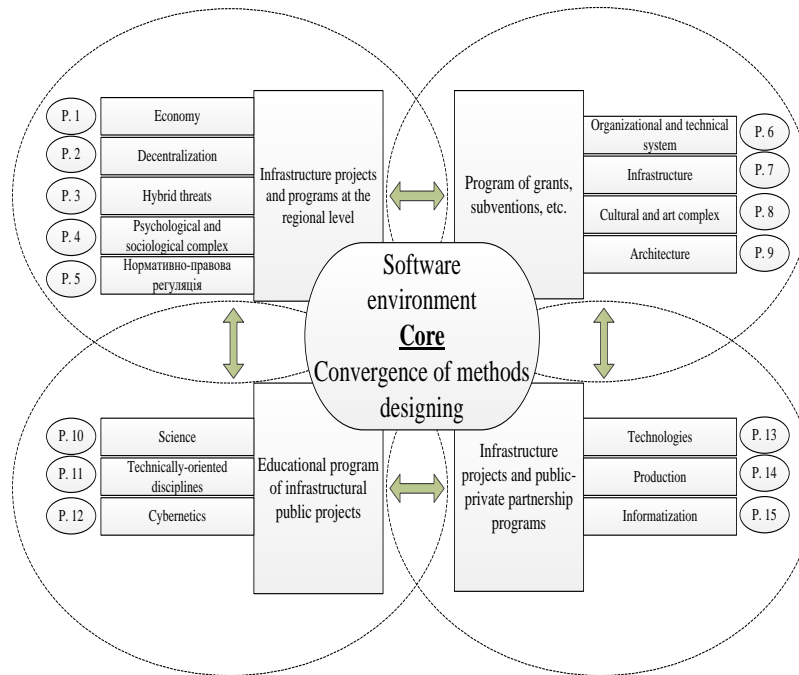


Fig. 1. Project environment of infrastructure projects and programs at the regional level:

where P. 1, ..., P. 15 - the set of values of projects and programs

Current project management methodologies such as PMBOK, P2M, PRINCE2, IPMA and ISO standards do not take into account such a component of hybrid management.

Elements of the theory of hybrid management of infrastructure projects and programs at the regional level, presented in the paper, complement and interconnect with existing areas of project management, such as quality management, risk management. The quality of the project is a subjective characteristic, so this property does not fully reflect the essence of development. Risk in the narrow sense is the probability of an undesirable and in most cases resource-intensive event in the project. The concept of risk does not go beyond the duration of the infrastructure project, as shown by the analysis of most information resources. The theory of hybrid management of infrastructure projects and programs at the regional level involves providing a set of measures at the planning stage of the project in order to ensure sustainable development at the stage of operation of the project product, result or service.

Priority is given to the generalization of theoretical and applied provisions of hybrid management of infrastructure projects and programs at the regional level based on the separation of a new branch of hybrid management in project management. This is achieved by clarifying different approaches to the management of infrastructure projects and programs in crisis situations using convergent technologies that form a new theory of hybrid management of infrastructure projects and programs at the regional level.

The essence of hybrid management of infrastructure projects and programs at the regional level is to decompose the concept of system development both at the hierarchical levels of complex systems (project, project product, project team) and at the concept of "regional or territorial socio-economic system" (territorial, regional, national, cross - border, international).

In fact, the complexity and complexity of infrastructure projects is the root cause of the problem of hybrid program management, as such projects or their programs are implemented and implemented in order to progress in the state of development at the regional level. The complexity of infrastructure projects and programs may be related to the complexity of the project product being created or generated at the stage of project implementation or finalization.

The complexity of infrastructure projects and programs of the territorial system determines the problem of project management, and accordingly the complexity of projects. Complex projects include projects with a high level of uncertainty of input data, high probability or magnitude of potential risks and the need to use different approaches in project implementation, including the involvement of a relatively large number of experts in various fields of specialization. The following key points need to be taken into account during the implementation of complex infrastructure projects:

- high level of uncertainty of the input data of the infrastructure project, which triggers the probability of a large number of ways to achieve the goal of the project (results);

- the need to attract a large number of specialists, experts, professionals from different fields of activity;

- a high degree of influence of risk factors, which is likely to lead to a wider variation of unforeseen results.

Thus, the actual convergent approaches make it possible to take into account in the cognitive model of hybrid management of infrastructure projects and the program of parameters of complexity (complexity), which can be identified by formalizing its main components. Construction of models of this type of complex organizational and technical systems as a means of forecasting can be based on an approach based on modifications of known models.

The considered problem of hybrid management of infrastructure projects and programs at the regional level enabled the development of a cognitive model of hybrid management of hybrid infrastructure projects and programs at the regional level, which allows to obtain a synergistic effect from the point of view of system development - post-project state.

**Conclusions.** In the given article the actual scientific and applied research on development of models of hybrid management of infrastructure projects is carried out. The main scientific results of the study correspond to the purpose of the work and give grounds for the following conclusions:

A thorough analysis of the scientific state of the problem of management of infrastructure projects and programs, which gives grounds for the assertion of the lack of scientific justification for the use of hybrid technologies for project and program management. It is shown that modern systems of knowledge and methodologies of project and program management are not sufficiently integrated into infrastructure projects and programs at the regional level.

Benchmarking of reactive mechanisms for managing infrastructure projects and programs in Ukraine and the world.

A mechanism for hybrid management of infrastructure projects and programs at the regional level has been developed. It is substantiated that the specifics of implementation The concept of convergence of knowledge on project management

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