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Organizational and economic mechanism for the implementation of complex contractual support for industrial construction projects

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Development of the Russian economy is currently taking place in an ever-changing external environment and uncertainty related to both global economic trends and the sanctions policy against Russia. The requirement for sustainable economic growth in such conditions is provided, among other things, by industrial construction, which creates fixed assets and carries out their reconstruction, expansion and modernization to create conditions for expanded reproduction and increased competitiveness in industry and infrastructural support for industry, in the energy sector, in the field of information and communications, in the field of engineering infrastructure. Modern forms of implementation of highly efficient and effective industrial construction are based on the practice of construction engineering, which is applied at all stages of the life cycle (LC) of investment and construction projects (ICP). An analysis of the current state of the investment and construction activity (ICA) market in the field of industrial construction reveals the imperfection of existing contract support methods at various stages of LC of ICP for industrial construction and insufficient integration of the required adequate forms of engineering under the guidance of a single integrated contractor, which often leads to a delay in the commissioning of capital construction facilities, additional costs incurred by investors and replacement of contractors during the implementation of ICP, followed by judicial resolution of financial disputes between contractors and customers. In addition, the modern competitive environment requires the commissioning of facilities with innovative and effective characteristics that can be provided by an integrated engineering approach that takes into account the relationship between the technological and organizational and managerial environment at all stages of LC of an industrial construction facility that is developing in time and space. Thus, the current problems of the current state of ICA in the field of industrial construction highlights the need to develop the principles of an integrated engineering approach in relation to industrial construction and to develop on their basis an organizational and economic mechanism for the implementation of integrated contractual support for industrial construction projects that increase the economic efficiency and effectiveness of integrated construction contracts (ICC).

Keywords: *complex construction contracts, industrial construction, construction engineering, principles of the engineering approach, organizational and economic mechanism*

INTRODUCTION

The development of any modern economy is based on material production, energy and engineering infrastructure, ensuring its normal functioning and sustainable growth. Since 2019, there has been an increase in the obsolescence of fixed assets (2019 — 37.8 %, 2020 — 39 %, 2021 and 2022 — 40.5 %, 2023 — 41.2 %)[1], which require reconstruction, while the trend of economic production also shows steady growth[2], which indicates an increasing burden on aging fixed assets that need to be reconstructed or decommissioned in the coming years, replacing them with new ones. The assessment of the main factors limiting the growth of production reveals the uncertainty of the economic situation as the main one (31–61 % of the total number of factors for the main types of economic activity in industry)[3]. At the same time, the requirements of economic development determine the need to ensure the growth and expansion of industrial enterprises, their infrastructure, including electricity and heat, information and communications, engineering infrastructure, including residential areas for social and environmental stability. All this is mainly provided by sustainable industrial construction within the framework of expanded reproduction.

An analysis of implemented ICP in industrial construction shows that the commissioning of industrial construction facilities is associated with high risks of delayed commissioning [1–3], exceeding the cost of construction [4, 5], and changing contractors [6–8] during the implementation of ICP. This problem is associated with long project implementation times and financing intensity [9], high labour intensity and staff qualifications, a high proportion of complex and large-sized technological equipment requiring specialized forms of delivery to the construction site, highly professional installation and commissioning supervision, the need to adapt unified organizational, technological and managerial approaches to the unique characteristics of an industrial construction facility, the need to take into account a large number of regulatory and legislative acts, compliance with requirements in the field of environmental and industrial safety, industrial production technologies and technological processes, sanitary and environmental standards, duration and complexity

1 Fixed assets and other non-financial assets. Data from Rosstat: rosstat.gov.ru/folder/14304. (rus.).

2 Industrial production in Russia. 2023: Stat. sat. Rosstat. Moscow, 2023; 13-29. (rus.).

3 Industrial production in Russia. 2023: Stat. sat. Rosstat. Moscow, 2023; 43. (rus.).

of commissioning, and training requirements for operational personnel.

Since an industrial facility is unique in terms of its combination of technical, technological, layout, structural, organizational, environmental and other characteristics (this conclusion can be drawn from a number of works in the field of industrial construction [10–13]), its construction requires unique competencies and experience, which are provided by integrated construction engineering.

The resolution of contradictions between the uniqueness of an industrial construction facility, which must be commissioned within the planned time frame, with the required characteristics and qualifications of performers implementing of ICP at various LC stages should be resolved both at the stage of preparing the selection of a qualified contractor and forms of interaction between project participants, and at the stage of direct implementation of construction contracts through the use of integrated construction engineering based on the principles of developed for industrial construction, This means that contractual support is an important tool for highly efficient and effective ICP implementation. The development of the principles of the engineering approach in relation to industrial construction makes it possible to solve the scientific problem of modeling the organizational and economic mechanisms of contract support for industrial construction.

SCIENTIFIC AND METHODOLOGICAL PRINCIPLES OF ORGANIZATIONAL AND ECONOMIC MODELING OF CONTRACT PROVISION AND IMPLEMENTATION OF ICC IN THE FIELD OF INDUSTRIAL CONSTRUCTION BASED ON THE ENGINEERING APPROACH

The study revealed the nature [14] and features of contract support for industrial construction, which determine the feasibility of developing and implementing an engineering approach that provides a comprehensive solution to innovative tasks for the construction of industrial and infrastructural facilities unique in their content, energy facilities, information and communication facilities, engineering infrastructure facilities, including residential areas.

The analysis of design-oriented engineering models of industrial construction of technically complex facilities allowed the author to develop and propose the principles of an engineering approach in industrial construction (Table 1), the implementation of which makes it possible to increase the effectiveness of complex construction contracts and ICP in general at all stages of the LC of facility.

Table 1. Principles of the engineering project-oriented approach in the implementation of ICC in industrial construction

Principles	Description	Expression
Integration principle	Combining scientific knowledge and experience to solve engineering, technological, organizational, managerial, supervisory, and production tasks to achieve the goals of ICC, the criterion of effectiveness of which is practical implementation with maximum efficiency	Specific weight of the positive and negative effects of integration. Economic effect of integration. Shorter ICC implementation time. Improvement of the technical characteristics of the facility. Increasing the organizational and technological reliability of ICP implementation. Speed of managerial decision-making
Goal setting principle	The focus of engineering activities is on achieving project objectives, strategic corporate and/or government objectives, and stakeholder satisfaction	Percentage of project goals achieved (general, intermediate). Degree of stakeholder satisfaction
Timeliness principle	Compliance with the current state of scientific and technological progress, project requirements and deadlines for the implementation of ICC	Dynamics of increasing the speed of decisions made
Controllability principle	Ensuring the manageability and interconnection of all ICC implementation processes under the supervision of an engineering consultant (project manager) and a project-oriented office	Degree of controllability (completeness). Proportion of output managed results. Percentage of deviations from the set parameters. Project resilience to external influences
Functionality principle	Compliance of engineering solutions with the specific functions of the facility and the elements of ICC implementation (specialization of personnel, technology, processes)	Compliance of engineering solutions with their functional purpose
Rationality principle	Ensuring a more rational use of project and facility resources, the validity of the application of engineering methods and forms, the use of the best means to achieve goals, maximizing the desired result with limited available resources and funds	Solving optimization problems
Modularity (formalization) principle	Accumulation of standard modules (models, mechanisms, solutions) for scalability, taking into account adaptation	Dynamics of accumulation of standard modules
Efficiency principle	Provability of a positive result at the stage of protection of an engineering solution and its implementation	The ratio of result to cost in terms of time, cost and quality
Measurability principle	Engineering results are measurable	In natural terms. In economic indicators (profitability, marginality, labour savings). Stakeholder satisfaction
Innovation principle	Continuous improvement of products and processes	Risk reduction. Cost reduction. Increased efficiency. Reduction of live labour

End of the Table 1

Principles	Description	Expression
Flexibility principle	Ensuring adaptability to constantly changing external and internal factors of ICP implementation	Average changeover time of a technological system relative to the total time of its effective operation (technological flexibility). Organizational flexibility coefficient. Cost-effectiveness of increasing the flexibility of the production system. Proportion of completed change requests and their effectiveness
Customer orientation principle	Engineering solutions are aimed at satisfying the customer of the facility's products or processes and the ICC stakeholders	Customer satisfaction with the result of engineering solutions adopted for implementation
Specialization principle	Engineering provides the accumulation of competencies and work experience in this sector of industrial construction and related sectors	Increase in the proportion of specialists with the required qualifications. Increase in the share of completed projects in this field, climatic and geographical conditions. Increase in the proportion of facilities completed on time without deviations from the original contract price and with guaranteed technological performance
Development principle	Accounting for the variability of the system, its ability to develop, expand, replace parts, and accumulate information	Reflects the interrelationship of all previous principles

Such principles are inextricably linked to project management and construction engineering, which complement each other. The developed principles closely correlate with state standards in the field of construction engineering and project management, including the developed principles of ICP management in the field of industrial construction [15] using integrated contracts such as EPC (engineering, procurement and construction).

In this regard, the most relevant form of implementation of this approach in the construction of industrial facilities is EPC contracting within various boundaries, depending on the needs of the customer, the construction site and the financial and investment schemes of the project, which is characterized by an integrated engineering approach and a project-oriented management paradigm.

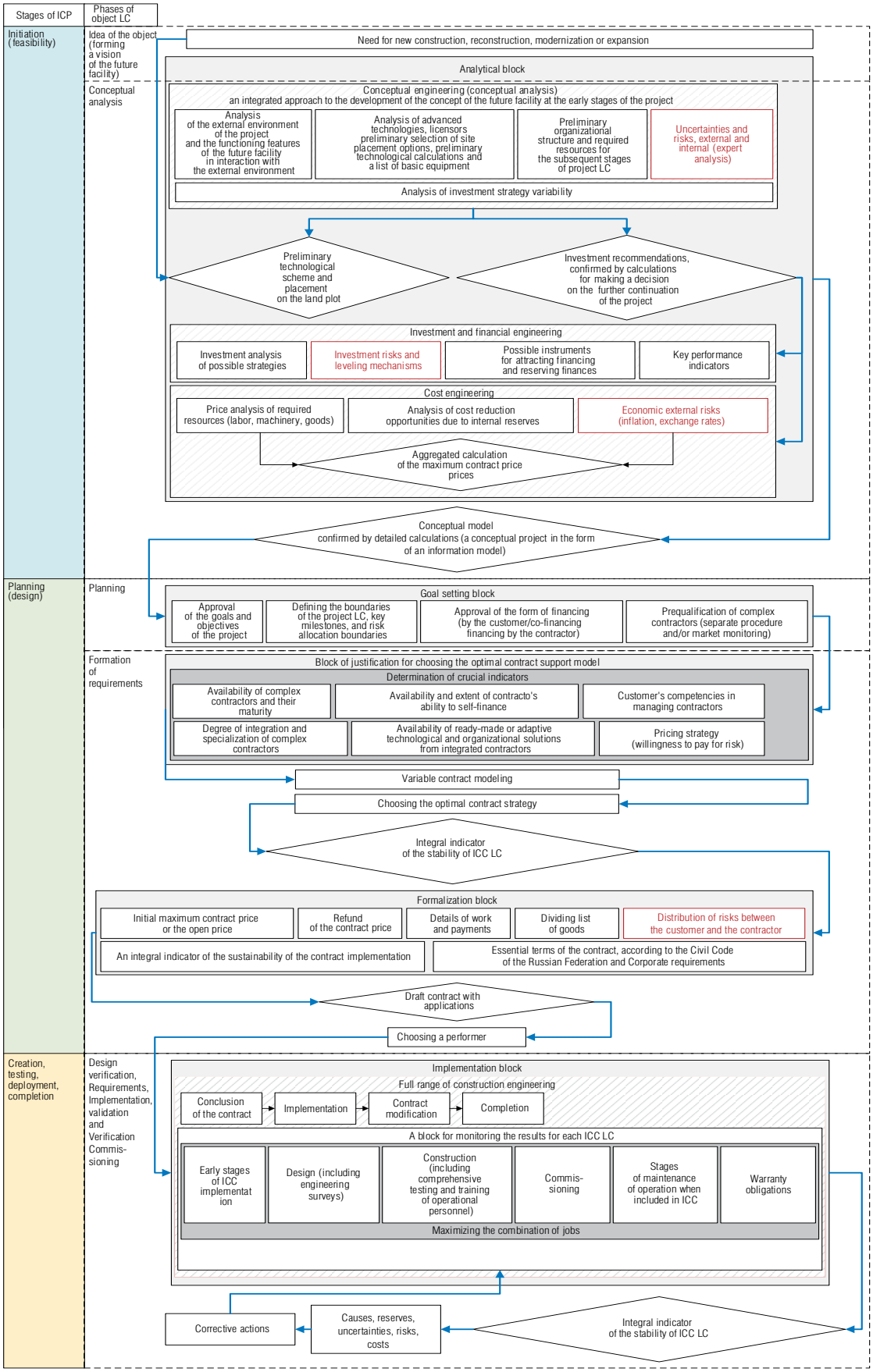
Based on the principles and targets for managing the most significant factors affecting the criteria of efficiency and effectiveness, in order to reduce losses and find reserves to ensure the sustainability of the ICC implementation, the author proposed the following indicators of ICC LC sustainability (Table 2).

Table 2. ICC LC sustainability indicators

Number	ICC LC sustainability indicator	Calculation methods
St_1	Degree of deviations from the planned targets for the completion of the stages	1. According to the mastered volume. 2. By deviation from the planned deadlines. 3. On labour productivity. 4. By generation
St_2	Degree of deviations in quality indicators at the stages of engineering surveys, design, construction, comprehensive testing, personnel training and commissioning	1. Proportion of rejected works or returned for revision. 2. Percentage of changes in the project documentation due to errors or insufficient research at the survey stage. 3. Percentage of deviations from the contract price due to unaccounted expenses
St_3	Degree of utilization of the production system	1. Level of proportionality of staff workload depending on the type and complex of work. 2. Proportion of machines and mechanisms that are idle
St_4	Dynamics of decisions made by the customer when requests for changes are received (speed of response to changes)	1. Percentage of decisions taken by the customer on change requests with deviations from the contractual deadlines for responding to change requests. 2. Percentage of change requests returned to the contractor for revision. 3. Percentage of decisions made by the customer without any requests for changes from the contractor
St_5	Dynamics of changes in the cost of stages	1. Share of changes in the cost of the stages specified in the supplementary agreements in the contract price. 2. Share of the contract price change. 3. Proportion of incomplete development stages during the transition to the next stage
St_6	Customer satisfaction level	1. CSAT by polling. 2. Proportion of complaints from the customer. 3. Proportion of escalated issues at a higher level of the hierarchy in the organization. 4. Stakeholders' satisfaction after achieving the project objectives (intermediate and final)
St_7	Investment intensification	1. Percentage of deviations from the investment schedule. 2. Proportion of overdue payments to executors and sub-executors. 3. Share of reserves used for the investment of the project

End of the Table 2

Number	ICC LC sustainability indicator	Calculation methods
St_8	Dynamics of labour shortage	1. Proportion of staff performing related duties on the project. 2. Percentage of work not completed on time due to lack of staff. 3. Deviation of the number of personnel from the planned targets
St_9	Proportion of changes in technical solutions agreed by the customer affecting the timing and cost	1. Proportion of critical path changes in the calendar and network schedule. 2. Proportion of reserve reductions in non-critical work
St_{10}	Proportion of work suspensions affecting the timing and cost	1. Proportion of work suspensions due to technical reasons. 2. Proportion of work suspensions due to violations of occupational safety and industrial safety. 3. Proportion of work suspensions due to weather conditions. 4. Proportion of work suspensions due to non-delivery of inventory. 5. Proportion of work suspensions due to non-payment. 6. Proportion of work stoppages due to inconsistent flows. 7. Proportion of work suspensions due to social reasons (strike, non-payment of wages, deterioration of working conditions, etc.)
St_{11}	Degree of compliance with government programs	1. Percentage of unfulfilled tasks related to the implementation of government concepts, programs, plans, orders, and investment programs. 2. Percentage of deviations from the planned program indicators
St_{12}	Share of technical supervision and executive authorities' complaints	1. Critical weight of the regulations allowing the suspension of work or activity of the enterprise. 2. Degree of satisfaction of the inspecting and supervisory executive authorities
St_{13}	Percentage of deviations from the terms of the contract	1. Percentage of deviations from the terms of the contract allowing the termination of the contract. 2. Percentage of deviations from the terms of the contract allowing the suspension of financing
St_{14}	Share of replaced sub-executors in the process of ICC implementation	1. Share of replaced sub-executors in the total amount of the contract. 2. Proportion of sub-executors who received a ban on continuing work. 3. Proportion of uncoordinated sub-executors by the customer
St_{15}	Share of implemented innovations that reduce the time, cost or improve the quality of work and the facility itself	1. Share of innovations that shorten construction time. 2. Share of innovations that reduce the cost of ownership of an object. 3. Share of innovations that increase labour productivity. 4. Share of innovations that increase efficiency. 5. Share of innovations that reduce harmful emissions
St_{16}	Proportion of violations of safety, labour protection and industrial safety that led to the suspension of work or fines	1. Proportion of delays in the critical path of the calendar and network schedule due to violations of occupational health and safety, industrial safety. 2. Proportion of fines and penalties due to violations of occupational health and safety, industrial safety
St_{17}	Share of applied penalties in the cost of ICC	1. Critical level of fines and penalties preventing the financing of the project by the contractor. 2. Proportion of claims against the contractor
St_{18}	Proportion of claims and complaints received by the general contractor and subcontractors affecting cost, timing and quality	1. Critical level of claims and complaints that do not allow continued financing of the contractor or sub-executors. 2. Critical level of claims and complaints, which does not allow the use of the results of the work. 3. Critical level of claims and complaints, due to the critical failure of deadlines
St_{19}	Proportion of risks that have resulted in negative changes in the cost, duration, or quality of the project	1. Proportion of documented risks that resulted in an increase in value. 2. Proportion of documented risks that resulted in increased deadlines. 3. Proportion of documented risks that have led to a deterioration in the quality of the facility or work
St_{20}	Percentage of decisions made by the customer for the contractor as part of the fulfillment of the contractor's obligations	1. Percentage of the contractor's obligations fulfilled by the customer. 2. Critical level of decisions (technological, organizational, financial) made by the customer on issues in the contractor's area of responsibility
St_{21}	Percentage of deviations in the delivery time of equipment and materials to the construction site	1. Proportion of delivery time deviations that affected the timing of the critical path. 2. Proportion of delivery time deviations that affected the intensification of flows
St_{22}	Proportion of project goals not achieved (intermediate and final)	1. Percentage of project goals achieved within the planned time frame. 2. Proportion of intermediate goals achieved that affect the achievement of the final goals of the project
St_{23}	Degree of controllability (completeness)	1. Number of calendar and network schedule changes agreed upon by the customer. 2. Number of management decisions made that deviate from the documented deadlines in the project office protocol. 3. Proportion of unforeseen risks that have occurred. 4. Proportion of risks documented by the customer in the contractor's documentation area of responsibility



The mechanism of ICC implementation in industrial construction

The methodological approach to the formation of the ICC implementation mechanism in industrial construction involves further formalization of ICC LC sustainability objective function.

ORGANIZATIONAL AND ECONOMIC MECHANISM FOR THE IMPLEMENTATION OF COMPLEX CONTRACTUAL SUPPORT FOR INDUSTRIAL CONSTRUCTION PROJECTS

To implement the developed approaches within the framework of contract provision and implementation of ICC in industrial construction, a model for choosing optimal contract forms and a mechanism for the formation and implementation of ICC has been formalized (Fig.).

At the stage of project initiation using construction engineering in the early stages of the project (conceptual engineering, investment and financial engineering and cost engineering), the mechanism includes blocks for collecting information about the planned construction site, analysis and evaluation to make a decision on the continuation of the project and the creation of an information and conceptual framework for contract modeling, the preliminary location of the facility and the flow chart, collectively representing the information model of the object. At the stage of requirements development, an integral ICC LC sustainability indicator is formed, which is formalized as an appendix to the contract with the evaluation methodology, for controlling during the implementation and at the end of the project.

In case of deviations from the planned sustainability indicators during the implementation of the ICC at each of the LC stages, a search is carried out for causes, reserves, risks, and an assessment of the costs of corrective actions (Table 3).

As part of the study, it is necessary to carry out a calculated approbation of the developed scientific and methodological provisions for the implementation of the mechanism of integrated contract support and the implementation of projects in the field of industrial

Table 3. Controlling the indicators of organizational and economic efficiency of ICC in industrial construction

Number	ICC LC sustainability indicator	Corrective actions	Pre-project stage	Design/ engineering surveys	Procurement/ delivery	Construction/commissioning
St_1	Degree of deviations from the planned targets for the completion of the stages	Variability depending on the identified causes: managerial, economic, organizational, psychological response	•	•	•	•
St_2	Degree of deviations in quality indicators at the stages of engineering surveys, design, construction, comprehensive testing, personnel training and commissioning	1. Intermediate verification of the results within the framework of the information model of the facility. 2. Conclusion of an agreement with an independent expert organization responsible for regulatory control of documentation and construction control	–	•	•	•
St_3	Degree of utilization of the production system	1. Hiring additional staff. 2. Rational allocation of labour resources. 3. Provision of additional machines and mechanisms. 4. Additional unscheduled financing	–	•	•	•
St_4	Dynamics of decisions made by the customer when requests for changes are received (speed of response to changes)	1. Attracting additional resources to analyze change requests. 2. Staff professional development	•	•	•	•
St_5	Dynamics of changes in the cost of stages	1. Employing additional personnel for cost analysis. 2. Analysis of the causes of under-development and management decision-making	–	•	•	•
St_6	Customer satisfaction level	1. Analysis of the causes of dissatisfaction and ranking according to the degree of impact on the project. 2. Adjusting project objectives and informing stakeholders	•	•	•	•
St_7	Investment intensification	1. Opening of an additional credit line. 2. Financing of sub-executors at the expense of the customer. 3. Analysis of reserves for continued financing. 4. Co-financing	–	•	•	•

Continue of the Table 3

Number	ICC LC sustainability indicator	Corrective actions	Pre-project stage	Design/ engineering surveys	Procurement/ delivery	Construction/commissioning
St_8	Dynamics of labour shortage	1. Creation of an additional structural unit for the search and recruitment of personnel. 2. Retraining and advanced training. 3. Hiring additional sub-executors	–	•	•	•
St_9	Proportion of changes in technical solutions agreed by the customer affecting the timing and cost	1. Analysis of the causes of changes. 2. Ranking of new requirements and rejecting minor ones that do not affect the project objectives	–	•	•	•
St_{10}	Proportion of work suspensions affecting the timing and cost	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	•	•	•
St_{11}	Degree of compliance with government programs	1. Analysis of the compliance of the project objectives with government programs. 2. Analysis of the appropriateness of additional costs for the implementation of government programs. 3. Analysis of the possibility of implementing government programs	•	•	•	•
St_{12}	Share of technical supervision and executive authorities' complaints	1. Strengthening internal oversight. 2. Use of reserves for correcting comments and prescriptions	–	–	–	•
St_{13}	Percentage of deviations from the terms of the contract	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	–	–	–
St_{14}	Share of replaced sub-executors in the process of ICC implementation	1. Strengthening control over the coordination of sub-executors. 2. Strengthening the customer's control over the fulfillment of sub-executors' obligations. 3. Strengthening the customer's control over the fulfillment of the general contractor's obligations to sub-contractors	–	•	•	•
St_{15}	Proportion of violations of safety, labour protection and industrial safety that led to the suspension of work or fines	1. Strengthening internal oversight. 2. Conclusion of an agreement with an independent expert organization responsible for regulatory control of documentation and construction control	–	–	–	•
St_{16}	Share of applied penalties in the cost of ICC	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	•	•	•
St_{17}	Proportion of claims and complaints received by the general contractor and subcontractors affecting cost, timing and quality	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	•	•	•

End of the Table 3

Number	ICC LC sustainability indicator	Corrective actions	Pre-project stage	Design/ engineering surveys	Procure-ment/ delivery	Construc-tion/com-missioning
St_{18}	Proportion of risks that have resulted in negative changes in the cost, duration, or quality of the project	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological reaction	–	•	•	•
St_{29}	Percentage of decisions made by the customer for the contractor as part of the fulfillment of the contractor's obligations	1. Change of performers. 2. Hiring an engineering consulting organization from the field of industrial construction	•	•	•	•
St_{20}	Percentage of deviations in the delivery time of equipment and materials to the construction site	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	–	•	
St_{21}	Proportion of project goals not achieved (intermediate and final)	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	•	•	•	•
St_{22}	Degree of controllability (completeness)	1. Analysis of the reasons for the suspension of work. 2. Variability depending on the identified causes: managerial, economic, organizational, psychological response	–	•	•	•

construction. As part of the testing, it is necessary to form an integral indicator based on an analysis of the specifics of the implementation of a specific ICP in the chosen field of industrial construction, to predict the resulting economic effects achieved by minimizing negative effects at all stages of ICC LC. The calculated effects of the implementation of the developed methodological provisions and practical recommendations will serve as the basis for further improvement of ICP implementation mechanisms in industrial construction.

CONCLUSIONS

1. Development and improvement of the sustainability of ICP in industrial construction under the influence of negative factors should be based on the application of integrated design-oriented engineering approaches to the development and implementation of ICC, including mechanisms for integrating engineering activities and harmonizing the interaction of stakeholders at various stages of the project life cycle, taking into account the introduction of innovations.

2. The most adequate models of construction contracts for the implementation of integrated project-oriented engineering are EPC contracts, which provide advantages over other types of contracts.

3. Developed principles of contract support in the field of industrial construction within the framework of expanded reproduction make it possible to form a target mathematical and economic function of the integral ICC LC sustainability indicator in relation to industrial construction.

4. Developed principles and mechanism aimed at improving the effectiveness of ICP implemented by ICC, taking into account the principles of engineering activities in the field of industrial construction and, in particular, design-oriented management systems, as well as industry-specific features of the construction sector, can ensure the sustainability and development of industrial construction in general.

5. Scientific and practical research results and recommendations can ensure the sustainable growth of domestic engineering in the field of industrial construction and improve competencies in the field of design-oriented systems, harmonizing the interests and goals of ICA participants. The results obtained can be used in the activities of customer enterprises in the field of industrial construction, corporate associations in the field of industry, taking into account their territorial and industry specifics. A promising area of further research is the development of scientific and methodological approaches to assessing the sustainability of ICP in a turbulent economy and the requirements of accelerated industrialization.

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Организационно-экономический механизм реализации комплексного контрактного обеспечения проектов промышленного строительства

В настоящее время развитие отечественной экономики происходит в постоянно меняющейся внешней среде и неопределенности, связанных как с мировыми тенденциями глобальной экономики, так и с санкционной политикой в отношении России. Требование устойчивого экономического роста в таких условиях обеспечивается, в том числе, промышленным строительством, которое создает основные фонды и проводит их реконструкцию, расширение и модернизацию для создания условий расширенного воспроизводства и повышения конкурентоспособности в промышленности и инфраструктурном обеспечении промышленности, в энергетике, в области информации и связи, в сфере создания инженерной инфраструктуры. Современные формы реализации высокоэффективного и результативного промышленного строительства основаны на практике строительного инжиниринга, который применяется на всех этапах жизненного цикла (ЖЦ) инвестиционно-строительных проектов (ИСП). Анализ текущего состояния рынка инвестиционно-строительной деятельности (ИСД) в сфере промышленного строительства вскрывает несовершенство существующих методов контрактного обеспечения на различных этапах ЖЦ ИСП промышленного строительства и недостаточную интеграцию требуемых адекватных форм инжиниринга под руководством единого комплексного подрядчика, что часто приводит к срыву сроков ввода в эксплуатацию объектов капитального строительства, дополнительным затратам инвесторов и замене подрядчиков в процессе реализации ИСП с последующим судебным разрешением финансовых споров между подрядчиками и заказчиками. Кроме того, современная конкурентная среда требует ввода в эксплуатацию объектов с инновационными и эффективными характеристиками, которые могут быть обеспечены комплексным инжиниринговым подходом, учитывающим взаимосвязь технологической и организационно-управленческой среды на всех этапах ЖЦ развивающегося во времени и пространстве объекта промышленного строительства. Таким образом, актуальная проблематика современного состояния ИСД в сфере промышленного строительства выводит на первый план необходимость выработки принципов комплексного инжинирингового подхода применительно к промышленному строительству и разработки на их основе организационно-экономического механизма реализации комплексного контрактного обеспечения проектов промышленного строительства, повышающих экономическую эффективность и результативность комплексных строительных контрактов (КСК).

Ключевые слова: *комплексные строительные контракты, промышленное строительство, строительный инжиниринг, принципы инжинирингового подхода, организационно-экономический механизм*

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Иерусалим. Святой колодец. Л.И. Павлова. Рисунок, тушь, перо.