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ORGANIZATIONAL STRUCTURES OF THE PROJECT MANAGEMENT IN CONSTRUCTION

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The article is devoted to the issue of the transition of domestic construction enterprises to project management, which ensures the adaptation of enterprises to the rapidly changing conditions of the external environment in the market economy.

The relationship between individual units of the organizational structure of project management is established. Particular attention is paid to the engineering analysis of the object, which includes the analysis of the architectural, planning and structural solutions of the building, basic materials, structures, engineering systems and equipment, as well as the choice of work methods.

The possibility of adapting project management structures of foreign construction companies for use in domestic construction organizations in real construction conditions by introducing additional structural divisions and expanding the functional responsibilities of some performers during project implementation is shown.

Keywords: organizational structure of construction, planner, construction manager, estimator, author supervision, technical supervision.

Introduction

In today's market conditions, more and more builders, developers and contracting organizations are switching to project management. They are encouraged to do so by the implementation of modern contracts for the construction of objects, which is the basis of management in construction (Dzhozef Khigni 2021; Bilokon 2024).

The central point around which the organizational structure is formed and management methods are developed is the PROJECT, which in this case is synonymous with the concept of "object". Actually, a contract is concluded for a specific project, a management structure is designed, a staff of managers and support staff is recruited, subcontractors and workers are hired, connections are established with suppliers, and the necessary consulting and service services are engaged (Zel□tser 2019; Kozyk 2022).

To move to project management, first of all, it is necessary to move to the project management structure. As a rule, construction firms distinguish between a corporate structure and a project management structure. If the corporate structure is aimed at managing the firm as a whole, then the project management structure should be aimed at project implementation. The central person of such a structure is the project manager. He is the person responsible for the comprehensive implementation of the project and its financial results. Therefore, the project structure should include specialists who are engaged in engineering analysis, cost of works, planning and scheduling of works, control over the progress and quality of works, control over payment for completed works, project completion with material and technical resources and other general issues related to organization of construction of the facility (Tuhay 2022; Redkin 2019)

In foreign construction practice, the organizational structure of project management depends on the size of the project. Figure 1 shows the organizational structure of a relatively small project (2018).

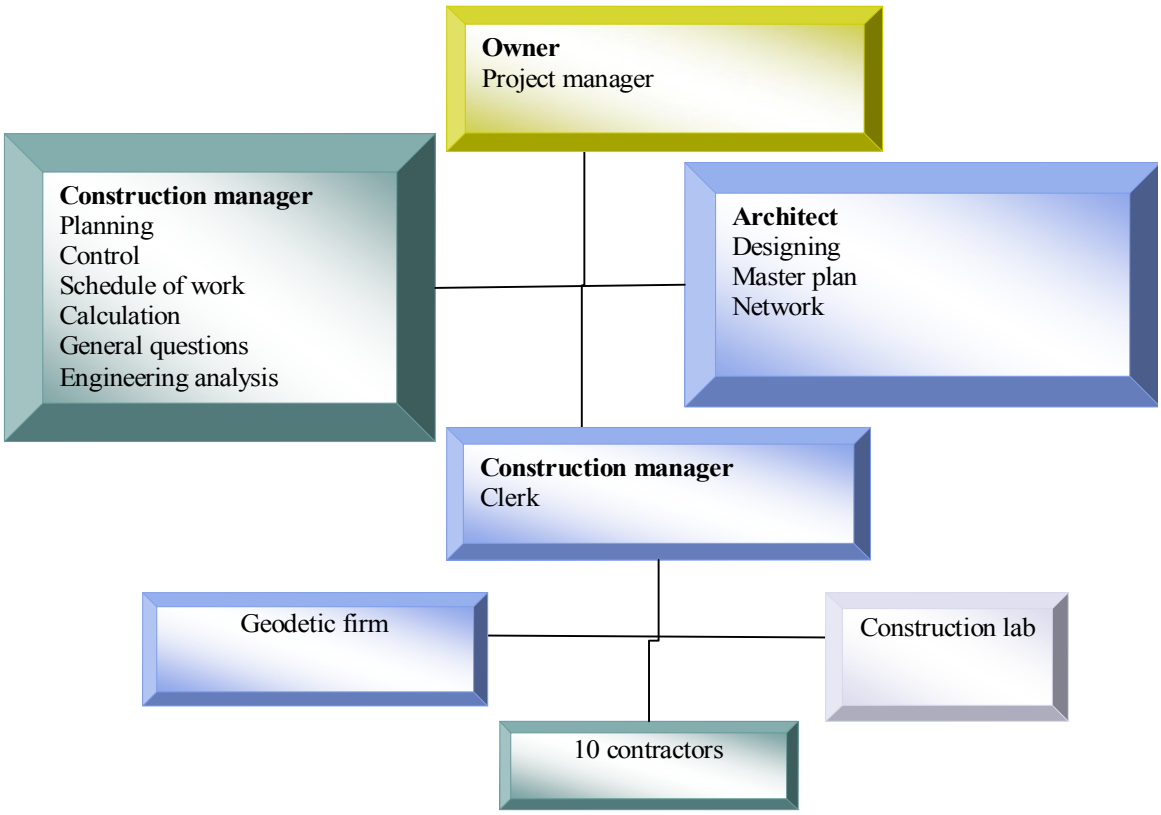

Fig. 1. The organizational structure of the management project of the construction of the object worth 6.3 million dollars.

As can be seen from this structure, the Project Manager coordinates the activities of design works and works on the construction of the object. Its main representative at the facility is the construction manager. His task is to coordinate and coordinate activities at the site of 10 contracting firms that perform construction and assembly and specialized works. In addition, he coordinates the activities of the geodetic firm, which must timely issue all the necessary surveys, bindings of certain elements of the building, and is also involved in the production of executive schemes of certain building structures and engineering and technical systems. The construction manager, according to the DBN A.1.1-1-2009, also coordinates the activities of the construction laboratory, which carries out laboratory quality control of construction, installation and specialized works.

In addition to the construction manager, the project management structure includes specialists engaged in engineering analysis, planning and scheduling of works, control over the quality and cost of works, as well as consideration of general issues. Before starting construction work on a facility, in accordance with the DBN A.2.2-3:2014, a so-called engineering analysis is carried out, which studies in detail the architectural, planning and structural solutions of the building, the main materials, products, structures, engineering systems and equipment adopted. Their analysis is carried out from the point of view of manufacturability, operational characteristics, their cost and logistics. An analysis of the choice of work performance methods is carried out from the point of view of the technological capabilities of contracting organizations, as well as the need for the necessary machines, mechanisms and equipment for the performance of work. The question of the possibility of connecting to existing engineering networks of permanent and temporary energy and other resources to ensure the construction and future operation of the building is being considered.

As a result of the engineering analysis, measures are taken to plan construction works. Defined initial construction data, methods of conducting construction and installation works, necessary volumes of execution and technological processes in construction production allow to formulate specific tasks and

deadlines for their completion. Planning and evaluation of the provision of the facility with building materials, structures, products, etc. is carried out. A plan, algorithm and the scope of works performed by subcontractors are drawn up (Tuhay 2022).

Planning is carried out in the form of a calendar plan or a grid schedule. The use of these planning documents is almost no different from the domestic one. It is excellent that individual specialized specialists—planners—deal with the planning of works. Together with the project manager, they develop the order and schedule of work. After the start of work, planners directly participate in the control of their implementation. The set of works and events differs from domestic practice in extreme detailing of the preparatory work and providing measures. The calculation and construction of the work performance schedule and its adjustment is ensured by the use of modern software, which is included in the integrated documentation system, which is available in real time to all employees of the company, associates and contractors. The calculation of the calendar plan includes the determination of the critical path and the construction term established on its basis, which is the main parameter of the construction contract (Prosnits'kyy 2024).

The reliability of the initial data is ensured by databases, the most valuable of which is created by the company itself based on reports on completed similar works and objects.

The noted features are also characteristic of medium and large construction firms. At the initial stage, the work schedule is drawn up in a condensed form, and then in more detail. Detailing ends at the stage of preparation for construction and assembly works. As necessary, plans are adjusted, recalculated and distributed. Preference is given to grid-calendar graphs, which combine the advantages of visuality of linear calendar plans and provability based on cause-and-effect relationships of grids. All calculations and graphing are carried out with the help of modern software and the most common programs of Primavera Sistems, Inc. P3/P4 (Prosnits□kyy 2024).

An estimator deals with the analysis of the cost of the completed works. This is an employee who, as can be seen from Fig. 1., verifies the conformity of the actually performed works submitted for payment of the invoice, i.e. the principle - "what we get for what we spent" is fulfilled. The concept of the cost of completed works includes three elements - scope of work, schedule and budget - and should answer three questions: if the project will be carried out at the previous level, when will it be completed; based on the plan and actual execution, what amount will be needed to complete the entire project; how long it will take. Control over the cost of the completed works is carried out using appropriate indexes.

SPC is the ratio of the actual cost of the work performed at the moment and the planned cost of the work at the moment. If the SPC is less than 1, it means that the project is behind schedule.

CPI - represents the ratio of the cost created as a result of the performance of works and the actual costs. CPI is the most significant indicator for budget control, which requires monitoring. The value of the index is less than 1 means irreversible losses and only when the problem is recognized and the rest of the work is "aggressively" conducted, there may be an opportunity to correct the negative result (Sidney M. Levy 2018).

The control process begins with the establishment of final limits on the cost and terms of work. Time control includes monitoring the time to complete the work and the required resources. Detailed control can be implemented using the grid method of the critical path, and total control by calendar plans with more or less detail, depending on the reporting indicators.

The control system is most effective when its level corresponds to the significance of the work, and the performers know that their actions are under constant observation. The control system requires the collection, storage and analysis of information, and the higher its level, the more expensive it is (Sidney M. Levy 2018).

Cost control must be carried out due to the influence of factors caused by changes in the cost of the project. It includes monitoring of cost indicators in order to identify deviations from the budget, managing changes in order to achieve the planned indicators of the budget and informing all interested parties about the progress of project implementation from the perspective of budget implementation (Sidney M. Levy 2018).

Organizational structures used in the practice of domestic construction are somewhat different from organizational structures used in foreign construction. An example of the organizational structure used for project management during the construction of real estate is shown in Fig. 2.

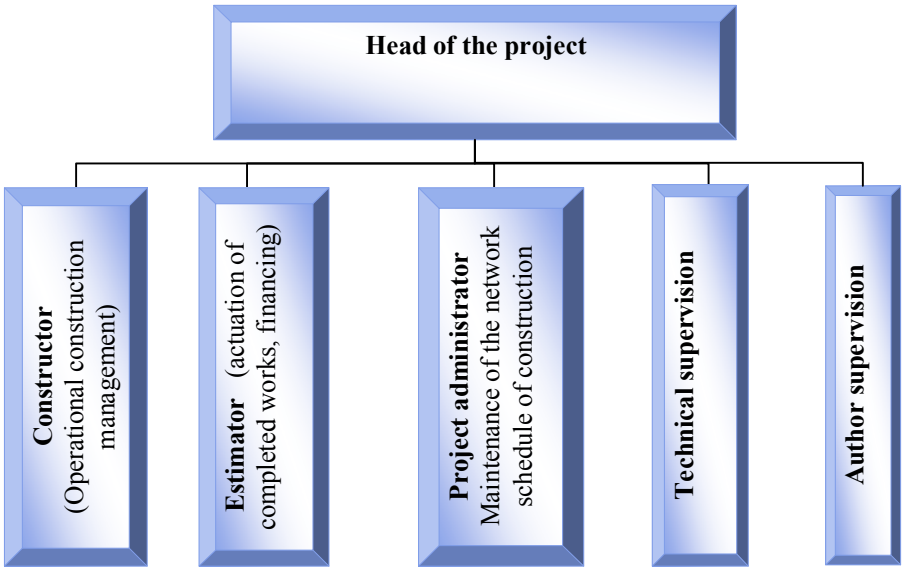

Fig. 2. Organizational structure of domestic construction project management

As can be seen from this structure, the construction manager is the project manager. He is subordinate to the builder or construction deputy, who carries out all operational management of the construction of the facility in accordance with the DBN A.3.1-5:2016. Together with the project administrator, he plans the progress of work, coordinates the activities of executors and subcontractors, monitors the progress and quality of work, adjusts work plans in accordance with changes occurring on the construction site. In addition, he monitors the timely and complete supply of materials, products and structures. An important part of his work is control over the use of construction equipment and mechanisms on the construction site.

The project administrator develops and maintains the construction grid schedule and, together with the builder, makes changes and corrections to the work schedule. Takes part in the actuation of completed works, keeps a file of the construction object, deals with paperwork with subcontractors, controls the scope of completed works on the part of the customer.

The estimator-financier is responsible for the cost indicators of the project, he makes sure that the cost of the work does not exceed the estimated cost or the contractual price for a certain type of work. For this purpose, he draws up the act of completed works for the reporting period, where he controls the price per unit of production and keeps a cumulative record of the cost of completed works. In addition, if any additional works arise, the estimator participates in the pricing of these additional works and, as part of the commission, signs the act for additional works. Control of the cost of materials and structures is carried out as follows: in the corporate structure there is a department of material and technical support, which purchases material and technical resources on the basis of tender procedures or price comparison, and the estimator-financier controls the conformity of the prices laid down in the estimate or the contractual price for this type works The estimator-financier takes part in the financing of the completed works, prepares invoices for payment and submits them for signature to the project manager. Maintains a cumulative list of payments for completed works by contractors and subcontractors.

The structure of project management by domestic firms also includes technical and author's supervision of the construction of the facility. These two types of control are organized by the customer and therefore subordinate to the project manager. (Postanova Kabinetu Ministriv)

Author's supervision is carried out by the architect - the author of the architectural object project, other developers of the approved project or authorized persons (hereinafter referred to as the general designer) in accordance with the legislation, the DBN A.2.2-4-2003 and the contract with the customer (developer) throughout the entire construction period and provides for control over the compliance of construction and installation works.

Technical supervision is provided by the customer (developer) during the entire construction of the facility in order to control compliance with project decisions and the requirements of state standards, building codes and regulations, as well as the quality and scope of work performed during construction or changes (in particular, by introducing Design and estimate documentation) of such an object (Tekhnichnyy nahlyad 2018).

The author's supervision controls the conformity of the completed work in the project documentation by keeping a journal of the author's supervision, where all comments and deviations from the project are recorded. In addition, changes to the project documentation are made in this journal. Drawings of these changes are sent to the contractor through the customer (project manager). Remarks and changes written in the author's supervision log are mandatory, controlled by the customer, and the log itself (stitched and numbered) is submitted to the commission when the object is put into operation.

Technical supervision, together with the builder, checks the volume and quality of the work performed in accordance with the project and current norms and rules. For this, they have the following tools:

First, the technical supervision has the right to make entries in the general Journal of work execution, as well as control and make changes in specialized journals for certain types of work, which are mandatory for the performance of all contracting organizations.

Secondly, the representative of technical supervision signs acts of hidden works and executive schemes, in which he confirms the scope, quality and compliance with the project documentation.

Thirdly, technical supervision, together with the builder, performs incoming quality control of materials, controls the log of incoming control and checks certificates and quality passports for supplied materials, products and structures. Including controls test protocols of samples of building materials, which were carried out by laboratory control.

Fourthly, together with the builder and the estimator, he signs the acts of the completed works, where he records the volume and quality of the completed works and keeps a cumulative record of the completed works in accordance with the design and estimate documentation.

Payment for the work performed by subcontractors is one of the main directions of the project manager's work. As a rule, payment for completed works is made on a monthly basis, therefore, at the end of the month, contractors prepare acts of completed works (KB-2 form), where the list, volumes and cost of completed works are written in accordance with the estimate documentation. These documents are approved by the estimator and the engineer of the technical department, which manages this object or a certain type of work, and, in the absence of comments and the presence of a full set of executive documentation, are submitted to the project manager for signature.

Materials and methods

Organizational structures of project management were used for the comparison foreign and domestic construction companies. Defined functional and organizational duties relationship between units of the organizational structure.

The article uses the legislative and regulatory framework in the field of design and construction of investment facilities in Ukraine. Information on the organizational structures of project management in the practice of foreign and domestic firms is also used. An analysis of functional responsibilities and organizational relationships between individual divisions of organizational structures is carried out.

A comparative analysis was conducted and the features of organizational structures of project management in foreign and domestic construction practice were established. The advantages and disadvantages of organizational structures of project management were noted.

Ways of adapting and making changes to existing organizational structures of project management to improve the efficiency and quality of construction and installation works have been identified.

Results and discussion

As a result of comparing the organizational structure of the foreign firm and the domestic one, we see that the latter is more adapted to the real conditions of construction in and the requirements of DBN A. 3. 1.-5:2006 "Organization of construction production".

However, it should be noted that one of the key issues in the management of construction projects, namely engineering analysis, in the domestic management structure is carried out beyond this structure and is carried out within the framework of the corporate structure with the involvement of the project manager. Such distribution, on the one hand, allows to attract qualified specialists of the central office of the corporation, and on the other hand, complicates the solution of operational technical decisions that arise during the implementation of the project. Although the author's supervision is included in this project management structure, there is no full-fledged presence of representatives of the project organization, which will also lead to a decrease in the efficiency of decision-making.

The project management structure of the domestic firm also lacks geodetic and laboratory control, which can negatively affect the quality and speed of performing geodetic works, control of incoming materials, and timely preparation of executive documentation (executive schemes and material test protocols).

In foreign companies, separate specialists, called work planners, are engaged in planning and monitoring the progress of implementation and making corrections, which is a separate specialization in management. In the structure of the domestic organization, such a clear specialization is not followed and these functions are entrusted to the manager and administrator of the project. The lack of such specialization and specialists of this profile is a weak link in the management of the implementation of the domestic construction project.

The disadvantage of the project management structure in domestic construction / see Fig. 2/ there is also a lack of a full-fledged economic analysis in the process of project implementation. In the project management structure of the domestic company, an estimator is provided in the staff, who is engaged in the actuation and financing of the completed works. He does not control the procurement of material resources and contract works. Thus, if in the structure of a foreign company the estimator is engaged in the analysis of the cost of works, then in the structure of the domestic organization his functions are limited and in fact the economic analysis and financial indicators are taken outside the scope of the project management structure. It is also important that this analysis be carried out in the process of project implementation in online mode, so that there is an opportunity to adjust financial indicators when they deviate from the planned ones. Without conducting such an analysis, the project manager does not see the effectiveness of his work and the work of the entire project management team and cannot properly motivate the project staff in accordance with the goals achieved.

The absence in the organizational structure in Fig. 2 of a specialist supplier of material and technical resources does not allow the project manager to quickly solve the issue of the complete supply of material and technical resources for construction, the purchase of certain types of materials and products, as well as to control the prices of materials, products and structures.

Making the above-mentioned changes in the project management structure would significantly increase the effectiveness of project implementation management and achieve more significant economic indicators.

Conclusions

The article shows that the basis of effective project management in construction is the creation of an organizational management structure. The organizational structure is built on the basis of a matrix of responsibility of functional responsibilities of specialists involved in the project management process. An

analysis of management structures in foreign and domestic practice of construction project management is carried out. Significant differences between these structures are caused by the regulatory framework for the organization of domestic construction. Effective interaction of specialists involved in the implementation of the project, in accordance with the adopted organizational structure, will contribute to achieving the goals of the project implementation.

Prospects for further research

Further scientific research will be devoted to the issues of conducting engineering analysis of construction objects considered as a project; planning of work on project implementation using IT tools and a database of domestic construction enterprises; conducting tenders for the procurement of construction and installation works, as well as materials, products and equipment for the construction of objects; contracting of construction projects; analysis of the cost of work performed, as well as control of the cost and terms of work; quality control during the execution of construction, installation and specialized works.

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ОРГАНІЗАЦІЙНІ СТРУКТУРИ ПРОЕКТНОГО УПРАВЛІННЯ В БУДІВНИЦТВІ

Стаття призначена питанню переходу вітчизняних будівельних підприємств до проектного управління, яке забезпечує адаптацію підприємств до швидкозмінних умов зовнішнього середовища в ринковій економіці.

Першим кроком до проектного управління є необхідність переходу до проектної структури управління підприємством. Така структура управління, як правило, поділяється на корпоративну структуру і структуру управління проектом. Корпоративна структура спрямована на управління підприємством вцілому, а структура управління проектом повинна бути направлена на управління конкретного проекту (об'єкту).

У статті проведено порівняльний аналіз та встановлено відмінні характеристики організаційних структур управління проектом в зарубіжній і вітчизняній практиці будівництва. Відзначено переваги і недоліки організаційних структур управління проектом. Показані шляхи вдосконалення організаційних структур управління проектом з метою підвищення ефективності управлянням будівництва. Показано взаємозв'язок між окремими підрозділами організаційної структури управління проектом, визначено їх функціональні обов'язки. Особлива увага приділена аналізу фінансових та економічних показників, а також термінів виконання робіт підчас реалізації проекту з метою виявлення відхилень і своєчасного корегування для досягнення планових показників собівартості і терміну будівництва.

Показана можливість адаптації структур управління проектом зарубіжних будівельних фірм для використання у вітчизняних будівельних організаціях в реальних умовах будівництва, шляхом введенням додаткових структурних одиниць і розширення функціональних обов'язків деяких виконавців при реалізації проекту. Визначено шляхи такої адаптації і внесення змін до існуючих організаційних структур управління проектом для покращення ефективності і якості будівельно-монтажних робіт.

Ключові слова: організаційна структура будівництва, планувальник, керівник будівництва, кошторисник, авторський нагляд, технічний нагляд.