Formation of the organizational-managerial model of renovation of urban territories

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Abstract. The pace of modern urban development dictates special requirements for the structure of zoning and the designation of the territories of megacities. Formed requirements for the objects of residential and recreational areas, urban infrastructure and communications facilities. A special role in the issue of improving the comfort of the urban environment, is the process of renovation of production areas. One of the main principles of urban planning is the location of production in the outskirts of cities and settlements. However, with the development of urban areas, once located at the disposal of production, are surrounded by residential and administrative-office blocks. This "neighborhood" not only causes discomfort to residents, but also creates an excessive environmental burden on the environment. In addition, the territory of the city, and especially large megacities, have a much higher cadastral value of land, and, therefore, create an additional tax burden on production, as added value to the output. All these elements make the products uncompetitive, especially in comparison with similar products produced outside the metropolitan area. Thus, the process of output of production beyond the city limits is actually cyclical and uninterrupted. Territories that remain after the withdrawal of production facilities are subject to comprehensive analysis, taking into account the social needs of the city, and further renovation.

1 Introduction

Renovation of industrial areas located within the existing urban environment, the process is multifactorial and extremely complex, feasible exclusively to a large structure with an established hierarchical, deterministic organization. The article is devoted to the study and formation of the basic principles of the creation and functioning of such a structure. Also, the principles of optimization of the organizational and technological structure of the company, based on the algorithm of interrelations of various parameters described by the above mathematical models, are given.

2 Materials and methods

An organization implementing an integrated industrial territory renovation project is reviewed on the basis of information provided by the Customer and available research data.

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Analysis of efficiency of the organization's operations and development of a corresponding organizational structure that integrates and coordinates the activities of a great number of the company's personnel and supports timely implementation of the assigned tasks in accordance with appropriate quality, financial and other resource-based indicators, requires a review of available documentation, collection of information related to the main directions and ensuring coherent conceptual links between them in the form of strategic initiatives (Figure 1).

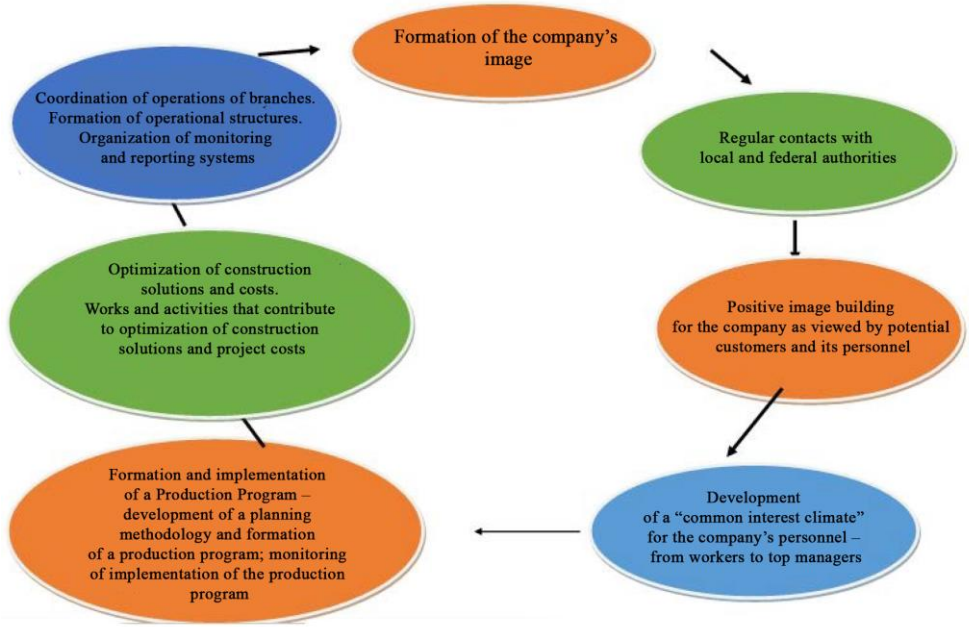

Fig. 1. Strategic initiatives.

The whole process of preparation and implementation of an industrial territory renovation project, due to its complex and challenging nature, should be divided into separate stages. In this context, a project is understood as the overall scope of operations to be carried out in the renovation of industrial territories and all auxiliary works associated therewith. The project concept is developed as an aggregation of its objectives; functional and spacing solutions as the core of the whole project; the project's external environment; the parties involved in the project; distribution of tasks, responsibilities and risks assumed by each participant. The company can be concurrently involved in several projects with similar characteristics (for example, civil construction, road construction, industrial construction, construction of utilities) [1]. Therefore, an integrated organizational structure can be formalized with separate operations identified within it (Figure 2).

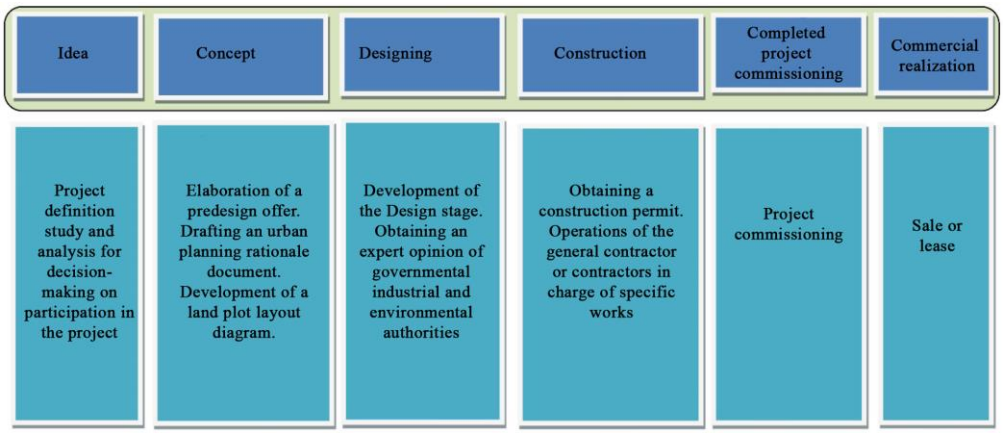

Fig. 2. Technological operations at various stages of a development project.

Due to the fact that large-scale systems participating in industrial territory renovation projects are characterized by hierarchical structures with various numbers of levels and different objective functions (functional efficiency criteria), the systemic optimization required for finding the most efficient solutions should involve multiple levels and multiple criteria and take into account the links in structural and functional subsystems. However, an appropriate degree of assessment of such links still remains beyond the integrated analysis capabilities due to difficulties of processing of sizable volumes of information. Nevertheless, recent developments include the elaboration of new equipment, formation of automated information banks, systematization of data on links in large-scale multilevel construction systems, and generation of capabilities of processing great bodies of data by supercomputers. Thus, the required prerequisites for and conditions of systemic optimization of industrial territory renovation projects have been ensured. Practical implementation can be as follows.

Classic task-setting in optimization of an organizational and technological structure is focused on identification of parameters of the system described by a mathematical model and links between elements in the form of:

$$R\,(x_1 \ldots x_n) \le 0 \tag{1}$$

where the objective function F would acquire an extreme value

$$F\,(x_1 \ldots x_n) = F_{\min/\max} \tag{2}$$

with i = 1, …, n — number of elements in the system.

Formation of analytical links between the multilevel system elements under review is associated with considerable labor costs. It is a challenging exercise, which is not always expedient or possible. A much more efficient approach is creating alternative system elements to be assessed by a certain criterion followed by synthesizing the selected elements into a system like it is done in practice. However, despite the assumptions and simplifications of this approach, the task continues to be quite complicated and labor-intensive. Nevertheless, a methodical solution is possible using systemic analysis methods in the following sequence:

- Formulate a task of finding an optimum solution;
- Identify separate system elements – all factors of potential influence on the outcome;

- Create an alternative objective tree taking into account the great variability at all hierarchy levels;
- Assess the systemic optimization criteria for generating alternative organizational and technological solutions;
- Analyze the resulting alternatives in the objective tree and eliminate redundant variants leaving the main ones;
- Using the objective tree, synthesize the system, i.e. generate a solution to the integrated task.

The objective function of a multicriteria assessment of a certain level variant in the objective tree looks as follows:

$$F_j = \sum_{i=1}^{n} \beta_i \delta_i, i = 1, \ldots, k \quad (3)$$

The system criterion for all elements of n levels can be expressed as follows:

$$\Phi_j = \sum_{j=1}^{m} F_j, j = 1, \ldots, k \quad (4)$$

with k – number of criteria; β_i – weighting factor; – criterion; m – number of variants.

Review of alternative solutions and comparison of system criteria of variants make it possible to select certain objective tree elements with extreme criteria values, i.e. perform a systemic multicriteria and multilevel optimization and choose the most efficient solution [2].

Raising the efficiency of implementation of industrial territory repurposing projects requires new economically viable and progressive organizational and technological solutions in the performance of works. This is why great importance is attached to scientific, technological and economic forecasts in designing, information modelling and construction and installation works in industrial territory renovation projects, as well as the use of such forecasts in practical operations. Science-based forecasting allows for a preliminary assessment of efficiency of application of proposed design, organizational and technological solutions and contributes to a higher quality of the project implementation in general.

An organizational and technological system is designed by using managerial modules that characterize production, technical and technological links as means of implementation of industrial territory renovation and repurposing projects. An organizational system of such macrostructure should meet the following requirements:

- Reflecting the organizational, technological and resource-based links among individual project elements;
- Constituting a basis for planning the whole scope of works in the implementation of the company's projects;
- Being flexible, responsive and easily adaptable to possible changes in design solutions while preserving the basic structural elements and links [3].

This is how the organizational structure of an industrial territory renovation project creating a unified interrelation among the basic modules and stages can be formed into a coherent organizational block.

The principles of development of corporate organizational structures are based on common managerial, analytical and monitoring modules, as well as the possibility of an immediate response and changing the systems' flexible links [4].

To analyze the given organizational and technological system of the company and the formation of organizational and technological modules, it is necessary to fulfill a number of tasks:

Identify the features of the organizational and technological system.

Analysis of the schematic image of the company's organizational and technological system.

Analysis of the organization of work execution, including the procedure for setting tasks, managing the implementation of tasks, coordinating the interaction between departments.

- Analysis of responsibility division.
- Organization of information interaction.
- Problem areas.

The modern concept of forming a system of companies implementing large-scale projects is based on the inclusion in the stages of construction of the whole package of works:

- Related to the preparation for construction;
- Analysis of project documentation;
- Formation of work production schedules;
- Planning of production needs for resources, machines and mechanisms, personnel;
- Planning of work financing requirements;
- Work production;
- Current handover of completed works to the customer;
- Handover of the facility to the customer;
- Participation in the facility commissioning.

Thus, the hierarchical deterministic structure of the organization involved in the renovation of industrial territories must correspond to the company's given organizational and technological system for ensuring reliability, flexibility and sustainability.

Each of the major stages of project implementation is divided into separate phases, which, in turn, are subdivided into more specific tasks [5]. In accordance with a whole number of conditions and factors determined by project objectives, its external environment, the parameters of the facility, a list of the project participants is formed, where each one carries a certain function for the completion of project tasks. The formation of the system has a modular principle, based on the identification and description of individual typical process modules. The modular construction of the project system allows to improve the visualization, increase flexibility in planning, monitoring and possible adjustment of the whole project as a whole, as well as of its individual elements, and simplify information flows throughout the whole construction system [6].

Underlying the formation of organizational and technological modules are:

- Analysis of current business processes.
- Identification the main problems of the business processes and formation of proposals for local improvements.
- Simulation of business processes and definition of controlled characteristics.
- Definition of an action plan for implementing the processes.
- Algorithm for solving the management task.

Assigning a person responsible for each stage of the process. The appointment of a supervisor for each business process who will manage the process, administer the allocated resources and be responsible for the results in quantitative and qualitative terms, report on the results [7].

Determination of the inputs of the process and suppliers for each of them, the results that will be obtained in the outcome and the target segment of consumption.

Development, documentation and description of the sequence of actions (technology) for the implementation of the process, the introduction of relevant provisions in the job descriptions for the staff. Development of flow charts for business processes [8].

System control of sequential execution of actions. Development of process control elements. Specification of tasks, development of a system of indicators and related reporting, types, forms and method of motivation of executors and the owner.

To develop the organizational and technological system of the organization, it is necessary to perform the following steps:

- Preliminary division of the production process into stages.
- Establishment of process modules.
- Development of a reference version of the system with the integration of modules.
- Modeling of organizational and technological system options.
- Estimation and selection of the best option of the system.

Further correction of the solution considering the dynamics of the external and internal environment of the project.

Structuring the production process of the project, identifying structural elements in its composition allows creation of a visual model on the basis of which the company's organizational system can be formed [9]. Building the organizational and technological system of the company from the modules and further work with individual modules based on an established coordination and synchronization procedures is one of the most important principles of integrating the stages of construction in large projects [10].

Thus, the construction of the organizational and technological system of the organization generally includes:

- Identification of key activities by key factors.
- Definition under selected key activities of tasks to achieve the objectives
- Building a system of value chains that unite all key activities into a logically integrated interaction scheme in the business process.
- Combining types of activities into areas of activities and selecting the structural departments responsible for the area and type of activity.
- Schematic representation of the company's organizational and technological system.
- Regulation of the organizational and technological system.

As part of the work on the formation of the company's organizational and technological system, recommendations are developed on implementing changes that will allow the efficiency of the organization's activities to be improved significantly, including [11]:

- Recommendations for changing the management system.
- Recommendations for changing the management style.
- Recommendations for changing the work procedures of projects.
- Recommendations on the regulation of functional procedures.
- The task of organizational management is to create an information system that provides effective monitoring of project indicators, assessment of the difference between their designed and actual values, decision making and possible adjustments, coordination of the interaction of project participants on this basis, creation, update and transfer of the project information base, and its use in all structural elements of the project.

In order to ensure that all project participants work in accordance with the contractual deadlines and costs and to achieve the maximum efficiency of the company's activities, it is necessary to [9]:

- develop the composition of the main departments, establish clear relationships between them, distribute rights and responsibilities.
- develop regulations on the business process of interaction between departments.
- organize effective information support.
- organize an effective system of accounting and control over the progress of work, use of resources.
- inform department specialists of new processes.

• inform the specialists of the other departments about those changes.

The concept of forming a complex of a construction project for the renovation of industrial territories is based on the following practical approaches to achieving the final result as shown in Figure 3, and consists in the following [12]:

• Coordination and interaction of all project participants that have one common goal, but individual tasks, interests and responsibilities;

• Forming a flexible system for managing the progress of the production process with broad independence of its executors and with strict control of intermediate and final indicators;

• Minimal possible losses of time for auxiliary routine procedures with a clear organization of the system of accounting, storage and use of the information base at all levels of management.

The development of forecasts with regards to renovation of industrial territories, justification and selection of optimal and promising options for the development of urban territories, which can save labor, financial, material and energy resources, can be realized by using relevant mathematical models and software [13]. Forecasting, justification and decision making are labor-intensive processes that require significant labor costs, as well as bespoke professional skills of project designers and can only be realized in cooperation with process planners.

Based on the results of the analysis of the organizational structure of the company, we obtain a unified algorithm for the implementation of the project for the renovation of the industrial territories (Figure 3).

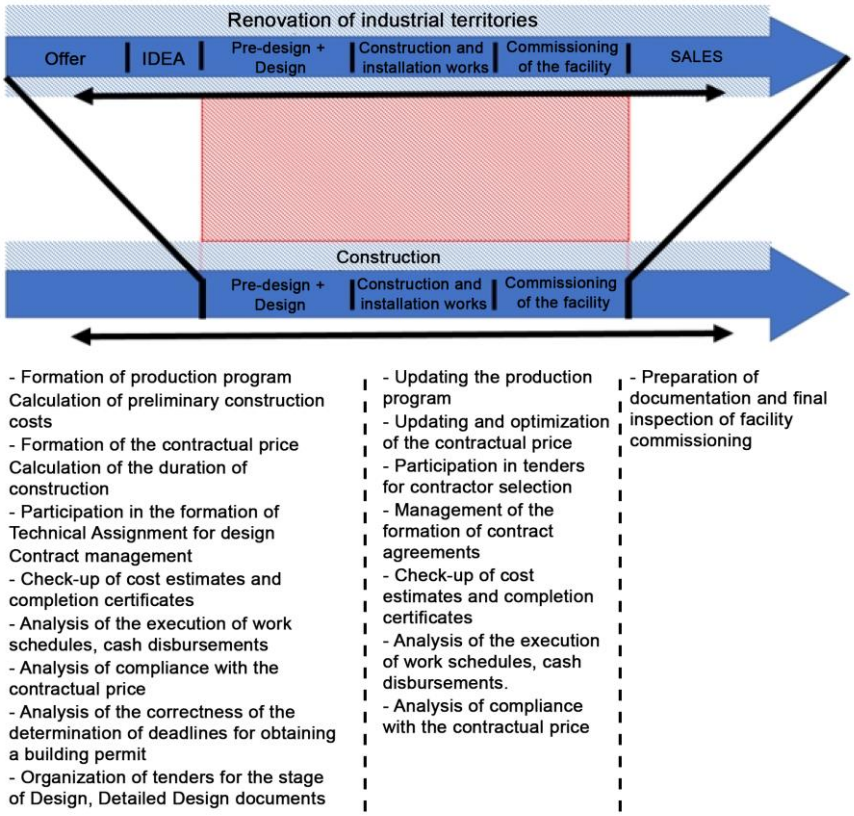

Fig. 3. Algorithm for the implementation of the project for the renovation of industrial territories.

3 Conclusion

Thus, the creation of a rational structure of production processes, ensuring the compliance of design solutions, technical means and qualifications of executors is possible when conducting a broad analysis of all works performed at the enterprise [14].

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