

TECHNOLOGY AND ORGANIZATION OF CONSTRUCTION

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DEVELOPMENT OF TYPES OF FORMATION OF ORGANIZATIONAL AND TECHNOLOGICAL SYSTEM OF REAL ESTATE RECONSTRUCTION

Problem statement. Basic issues of formation of organizational and technological system of real estate reconstruction are considered in the context of multi-criteria selection of optimum organizational and technological solutions, with the most stable type being chosen.

Results and conclusions. Specific characteristics of reconstruction objects are classified in close detail, which makes it possible to differentiate three types of formation of organizational and technological system, a combined type being preferred. Consideration of the combined type as the subject of investigation allows the generalized model of related organizational and technological systems formation to be formalized at real estate reconstruction.

Keywords: reconstruction, organizational and technological system, organizational and technological system reliability, real estate.

Introduction

Real estate operation is closely related to measures intended to maintain their operational characteristics during the whole life cycle.

Nowadays, problems involving organization of reconstruction as a system are of great importance. System approach stems from the complexity of organization and technological processes at the stage of real estate reconstruction [1]. Therefore, development of the technique of formation of organization and technological system of reconstruction and solution of attendant optimization problems are of prime importance.

1. Classification of attributes of formation of organization and technological systems

Production processes related to real estate reconstruction are influenced by the factors describing conditions of their organization:

- time and space overlapping of construction processes;
- limited area of building site;
- specific conditions related to limited possibility of mechanization of construction processes and necessity to perform special types of construction and assembling operations.

To assess the influence of these factors on reconstruction, we used appropriate system of indicators (Table 1).

Table 1

Classification of the objects of reconstruction according
to type of construction and assembling operations

Classification criterion	Types of operations
Type of the object of reconstruction	rebuilding of existing buildings and facilities, with cessation of principal activity or without it
Organization conditions of building erection (reconstruction)	1) on development-free area; 2) instead of demolished buildings and facilities; 3) without buildings and facilities demolition
Type of allocation of working area	1) reconstruction with cessation of functional or technological process of the object of real estate (resettlement of tenants, cessation of production process); 2) reconstruction with partial cessation of functional or technological process (temporary resettlement of tenants, change of production process schedule);

End of Table 1

Classification criterion	Types of operations
Type of allocation of working area	3) reconstruction without cessation of functional or technological process
Order of priority of construction sites	1) existing buildings, facilities are demolished partially with the use of residuals for the purposes of construction; 2) existing buildings, facilities are demolished completely for new buildings to be erected; 3) existing buildings, facilities are demolished after construction of new ones
Nature of change in architectural-and-planning and structural solutions	1) without changes in architectural-and-planning and structural designs of existing building and facilities; 2) without changes in architectural-and-planning and structural designs of existing building and facilities
Type of change in architectural-and-planning and structural solutions	1) building up; 2) heightening; 3) extension; 4) integration; 5) building out; 6) hauling; 7) rearrangement
Nature of change in structural design of existing buildings	1) without changing the structures; 2) with changing the structures; 3) without structure reinforcement; 4) with structure reinforcement; 5) without structure disassembly; 6) with structure disassembly
Types of variable structures	1) bases of buildings, facilities; 2) foundations; 3) columns; 4) walls; 5) partitions; 6) ceilings; 7) envelopes; 8) roofings

Before the beginning of reconstruction operations on building production preparation should be performed in the scope which provides for execution of works on the object by the target and with specified quality.

The basis of the process of preparation is the execution of works on organization and technological provision of object reconstruction. This allows to minimize losses in principal activity of the

object during reconstruction. Principal works on object preparation for reconstruction should be performed by customer (enterprise directorate, municipal services or operation organizations).

By the character of building operations objects of reconstruction are classified into simple, complex and ultra complex objects (Table 2). This characteristic is used to describe design solutions in assessment of appropriateness of reconstruction, in determination of conditions of building operations and in preliminary estimate of costs.

Table 2

Classification of the objects
of reconstruction by their complexity

Classification criteria	Complexity of reconstruction object		
	Low	Medium	High
Structure of the object and architectural and planning solutions	Several standard buildings or one building with plain architectural and planning solutions	Several nonstandard buildings and facilities with repeated parameters of principal clearance diagrams or one nonstandard building	Great number of different buildings and facilities or one large building with different nonstandard architectural and planning solutions
Structural solutions for buildings and facilities	Standard structures which are used for mass construction and allow one to perform building and construction works with industrial methods	Various combinations of individual and standard structures which require simple technologies of building production	Individual structures related to substitution or reinforcement of foundations, bearing structures which require development of specialized technologies of building production
Limited area of building site	Normal conditions	Tight conditions	Particularly tight conditions
Density of area development	Low	Medium	High

End of Table 1

Classification criteria	Complexity of reconstruction object		
	Low	Medium	High
Operation activity of the objects under reconstruction	Works are performed in buildings vacated during work production	Operation of reconstructed objects is interrupted for limited time (period), object operates with restrictions	Operation of the object is not interrupted during production of building and construction works
Number of elements in territory and conditions of operation of infrastructure	Little number of the elements of infrastructure which do not require their protection or transfer during reconstruction	There are utility systems which operate during reconstruction or require their protection or transfer to a small extent	There are great number of utility systems which operate during reconstruction or require their protection or transfer

Any reconstruction is associated with cessation of the use of existing buildings for some period of time. During this period main process (release of production or rendering of municipal services) is reduced or ceased. To compensate economic losses, customer either creates production reserves providing for purchasers' needs during reconstruction or solves the problem of transfer of the process of its creation to the other production sites in advance.

The reserve of building production is the reserve which provides for customer supply with production during cessation of production or object operation. Reserve of building materials, structures, equipment and products can be created in advance during preparation for reconstruction at the expense of intensification of production or of the other sources.

There are different variants of organization of release of production or rendering of services during building and construction works as well. Most commonly, transfer of the process of production to the other constant or temporary production sites is performed in preparatory period.

2. Types of formation of organization and technological system

Development of the models of basic types of formation of organization and technological system of real estate reconstruction requires to take into consideration development the

stages of production processes and levels at which losses of organization and technological reliability occur.

The first type of formation of the system of real estate reconstruction is *production type*. The reduction of losses results in increasing organization and technological reliability of reconstruction processes as the number of development stages of production processes and losses at the stage boundaries decrease. However, constant change of external conditions leads to the fact that system cannot react quickly to changes.

The second type is *industrial type*. The system of real estate reconstruction is formed with consideration for the influence of production factors at the level of real estate object and organization and technological system of enterprise which performs works. Formation and consolidation of existing technological and production links, performing of technological closed cycle of building production are essential.

The third — *combined* – type of real estate reconstruction system allows one to achieve maximum possible organization and technological reliability of reconstruction processes. To shift to combined type of reconstruction system formation, conditions in external and internal environments of building system should be changed beforehand. In unprepared conditions transition will give worse result than any other type.

Each type has its own field of effective use which is characterized by certain scope of production, peculiarities of building system formation, external environment conditions. Under poor loading of enterprise capacities, incomplete use of resource potential enterprises have to solve their local problems. Building system can obtain additional effects if conditions for transition to combined type are provided.

3. Optimization methods of the combined pattern of organizational technological system model

The application of the combined type presupposes the formation of the reconstruction system of property objects which is carried out at the four basic levels:

1. Revelation of the rational interaction between the integral blocks of property objects function parameters and external factors of construction industry (A_1, A_2, A_3, A_4).
2. Determination and selection of the patterns of the reconstruction of property objects B_j .

3. Inclusion of the level interactions between A_i and B_j .
4. Inclusion of the external changes and the construction production peculiarities.

The general model of the formation of the reconstruction system of property objects is presented in the figure below.

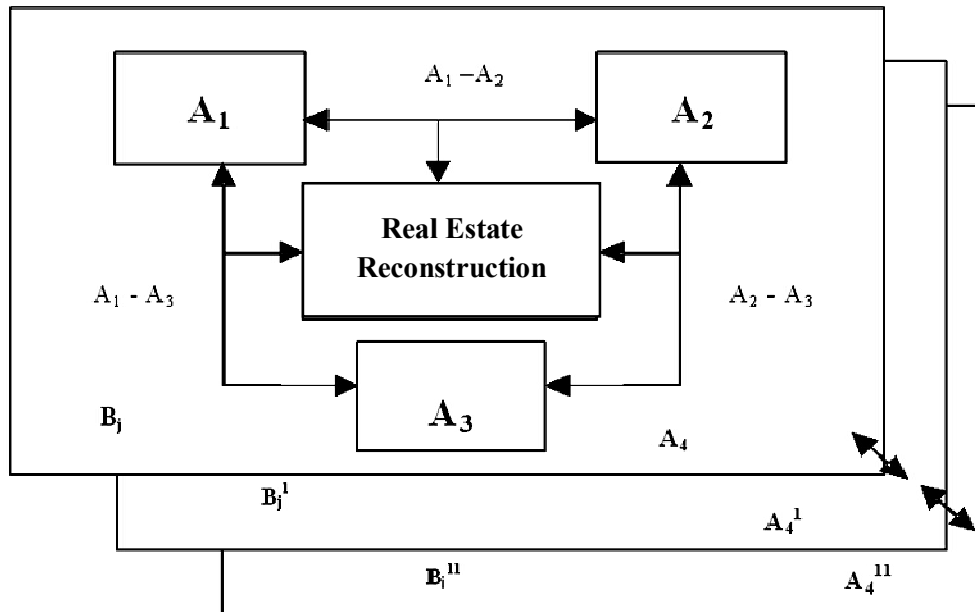


Fig. 1. The general model of the formation

of the organizational technological reconstruction system of property objects:

- A_1 is the characteristics of property objects; A_2 is the characteristics of the building system potential;
- A_3 is the characteristics of the functioning conditions of the building system and property objects;
- A_4 is organizational technological reliability of reconstruction processes;
- B_j is the patterns of the reconstruction system of property objects

The realization of the certain tasks is to be performed on the basis of the selection of the rational organizational schemes of property objects reconstruction at the following main stages (Table 3):

- 1) the formation of the organizational technological reconstruction system;
- 2) the selection of the rational patterns with the consideration of the assessment criterion system;
- 3) the formation of the system of the stable patterns of the organizational technological reconstruction system;
- 4) the selection of the stable pattern with the consideration of the assessment criterion system.

Table 3

Selection of the type of formation of organizational and technological system of real estate reconstruction

I stage	II stage	III stage	IV stage
$Y_1 = f(X_i; X_j; R_i; B_i; A_1, A_2, A_3, A_4)$ $Y_2 = f(X_i; X_j; R_i; B_i; A_1, A_2, A_3, A_4)$... $Y_i = f(X_i; X_j; R_i; B_i; A_1, A_2, A_3, A_4)$	$\sum S_i \rightarrow \min;$ $\sum R_i \rightarrow \min;$ $\sum t_i \rightarrow \min;$ $\sum \mathcal{O}_i \rightarrow \max;$ $\sum V_i \rightarrow \max;$ $\sum l_j, \sum l_i \rightarrow \min;$ $Y_{Pi} \rightarrow \max;$ $Y_i \rightarrow \text{opt}$	$Y_i = f(Y_i^{F1}, Y_i^{F2}, Y_i^{F3})$ $Y_1 = f(X_i; X_j; R_i; G_i; B_i; A_1, A_2, A_3, A_4)$ $Y_2 = f(X_i; X_j; R_i; G_i; B_i; A_1, A_2, A_3, A_4)$ $Y_i = f(X_i; X_j; R_i; G_i; B_i; A_1, A_2, A_3, A_4)$	$Y^F \text{opt}$

Stage I. The selection of the possible patterns of the organizational schemes at the expense of the external and internal factors $X_i; X_j$, the production resources R_i , the pattern of the development of the reconstruction system of property objects B_i , the integral blocks of its development parameters A_1, A_2, A_3, A_4 .

Stage II. The selection of the possible optimal patterns of the organizational schemes according to the following criteria:

$$\left. \begin{aligned} &\sum S_i \rightarrow \min; \\ &\sum R_i \rightarrow \min; \\ &\sum t_i \rightarrow \min \\ &\sum \mathcal{O}_i \rightarrow \max \\ &\sum V_i \rightarrow \max \\ &\sum l_j \sum l_i \rightarrow \min \end{aligned} \right\} \equiv G_i \rightarrow \text{opt},$$

where S_i is the expenses; R_i is the resources; t_i is the time; \mathcal{O}_i is efficiency; V_i is the amount of the operations performed; l_i, l_j are distances within and beyond the limits of the daily transportation availability, G_i is flexibility.

Stage III. The selection of possible patterns of the organizational schemes at the expense of the foreseen external and internal factors $X_i; X_j$, the production resources R_i , the pattern of the development of the reconstruction system of property objects B_i , the integral blocks of its development parameters A_1, A_2, A_3, A_4 .

Stage IV. The patterns of the organizational schemes selected are examined according to the above criteria. An optimal pattern Y^{Fopt} is selected.

Thus the formation of the organizational technological reconstruction system of property objects according to the basic stages allows to find the effective solutions for the property reconstruction taking into account the flexibility, credibility, reliability, adequacy, which makes it viable in the constantly changing external and internal conditions of a property object functioning and the building system and it also helps to enhance the organizational technological reliability of repair-and-renewal and reconstruction operations on property objects.

Conclusions

1. The result of the arrangement of the organizational technological reconstruction processes is a detailed classification of their main qualitative properties which laid the basis for the optimization model parameters.
2. The detailed classification of the common features of property objects allowed to find out the three patterns of the formation of the organizational technological reconstruction system. The combined pattern is viewed as the most effective one.
3. The formation of the combined pattern as a model largely reflects the prospective optimization method according to the macrocriteria selected during the previous analysis.
4. The method of the selection of the stable pattern of the formation of the organizational technological reconstruction takes into accounts such factors as:
 - expenses,
 - resources,
 - time,
 - efficiency,
 - flexibility,
 - the amount of the operations performed,

- distances within and beyond the limits of the daily transportation availability

which allow to reflect adequately the external and internal influence on the formation of the system presented.

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