Resource provision of the capital construction facility reengineering

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Abstract. The article is devoted to the identification of the need in material, technical, labor, information resources at the stages of life, their effective use as a part of the capital construction reengineering. In this regard, the issues of the formation of resource provision of the capital construction facility reengineering indicators, their documentary presentation, the stages of this business, the distribution of the resource provision functions between the investment-construction participants are established. The relevance and adequacy of the connection between resource supply structure and composition and current construction standards are shown. The basic theoretical aspects of the presentation of the resource provision of the capital construction facility reengineering as aggregate investment flows are stated. The efficiency of the resource supply of the capital construction facility reengineering is established to be connected with the solution of three main tasks: optimizing the composition and structure of resource provision, rational allocation of resources and works, quality assurance. The result of solving the problems may be: a decrease in the cost and duration of reengineering, an increase in the quality of capital construction object. An integrated solution to these problems may lead to a synergistic and multiplicative effect. The close correlation between the reengineering resource supply, scientific and technological progress achievements and development of the construction standards and information management and analysis systems is summarized.

1. Introduction and methods
Due to the limited resources the supply issues are primary for the investment-construction, therefore they are relevant for the reengineering implementation. The lack of resources is observed at all reengineering stages and all its management aspects: from the investment plan and feasibility study to the capital construction facility operation, when resources are necessary for the safe and comfortable environment maintenance [1-5].

With the established procedure for qualifying resources in construction [6], all resources may be grouped in a following way in this context (figure1):

- material resources, which include materials, structures and products, that are used in construction;
- technical resources, they are machinery, mechanisms and equipment, by which works and operations are carried out at the construction site;
- labour resources, they are trained and qualified staff, who directly execute works and services as part of reengineering
- informational resources, which are current information and data, that are necessary and sufficient for making both engineering and managerial decisions as part of the preparation and implementation of reengineering activities.

![Diagram of resources in use](image)

**Figure 1.** Types of resources for the capital construction facility reengineering.

Material, technical and labour resources are standardized, their quality and amount are regulated by the current budget standards. Informational resources are not standardized nowadays, their quality and amount, requirements of data are set in each case according to corporate regulations and established practices of some investment-construction participants. In this regard the first three types of resources will be intended, when considering reengineering resources hereinafter.

2. **Results**

Resource provision of the capital construction facility reengineering has a multilayered structure and complicated composition of elements, it is characterized not only by the indicators transformation, but the order of their calculation (figure 2) [7, 8].

The first step towards identifying resource provision reengineering indicators is performed at the investment plan stage by the owner of the capital construction facility or operating organization, serving as a client of the investment project. A documentary presentation of the resource provision reengineering indicators is executed as a feasibility study, and the basis for calculating these indicators are consolidated indices of costs (e.g. CPS and DPS) and analog objects [9]. Formed in this way cost parameters of reengineering measures form the maximum contract price, that may be adjusted at the design stage, when resource provision is determined with current estimated standards and prices as estimated calculation.
Figure 2. Stages of the formation of resource provision of the capital construction facility reengineering indicators.

The next step to the formation of resource provision reengineering indicators is tender, held by the client. The result of this procedure is the contract cost. The basis of this indicator are counterparty rates and prices.

The final step of identifying resource provision reengineering indicators is an execution stage, when actual cost is formed on the basis of market prices for resources.

It should be pointed, that along with the traditional contract scheme of recovery and quality transformation of the capital construction facility management, a promising engineering scheme may be applied. It provides for the redistribution of functions between the designer, contractor, client and engineering company (figure 2).

The above scheme of the formation of resource provision of the capital construction facility reengineering indicators is reflected in the documentary presentation of these lifecycle stages (figure 3) and includes both economic planning documents, and project, process control and management documentation, primary statistics documents, as well as operational documentary.

Stages of formation of the documents, defining indicators of resource provision of the capital construction facility reengineering, are established by the current standards and guidelines [7, 10].

As it was mentioned above, a client identifies indicators of resource provision of the capital construction facility reengineering as a feasibility study at the pre-investment stage.

The design stage sets a nomenclature of resources and order of their use as a part of the construction management plan (CMP) and estimate documentation, which are then examined as parts of the design documentation.

A contractor forms resource provision indicators in the process control and management documentation (project execution plan (PEP), project management plan (POP)) at the execution stage of the capital construction facility reengineering. That is the part of preparation for construction work. An achievement of the resource provision reengineering indicators is then confirmed by the primary statistics documents of the unified format.

The further operation of the facility is connected with the expenditure of resources to maintain a comfortable and safe environment, they are established on the basis of defect list and identified by estimated calculation.
It may be seen, that the main elements of the reengineering provision methodology are “value”, “price”, “resources”, “standardization” categories, which are important management levers of investment-construction in practice. They ensure rational use of resources and, consequently, increase reengineering efficiency [11-13].

“Value” and “price” categories are also a way to measure labour, materials and technical costs, and also used to implement envisage strategy and tactic goals of the investment-construction sustainable development [11, 14, 15].

In this regard it should be mentioned, that resource provision of the capital construction facility reengineering as part of the investment-construction is characterized by the direction and intensity of the investment flows:

- which are formed between the components of the construction subsystem, i.e. direct costs;
- between the construction and financial planning subsystems and include tax coverage, various deductions, contributions, encumbrances etc.;
- from the construction subsystem to the human resources subsystem. They include salary, as well as costs, associated with the management of construction (i.e. overhead costs);
- which register the costs of logistics (cost of material and technical resources “ex-site warehouse” [11, 14].

3. Discussion
Considering the above information, it may be determined, that the efficiency of resource provision of the capital construction facility reengineering depends on the successful solution of three integrated objectives (figure 4):

- optimization of the composition and structure of resource provision;
- rational allocation of resources and work;
- quality assurance.
Figure 4. The main tasks of forming the efficiency of reengineering.

Each of the objectives has its own statement, various solutions, depending on the conditions for the reengineering measures implementation, and degree of influence on the final result, which is an increase in efficiency of the reengineering resource provision [16-22].

The solution of the first problem is usually connected with the use of more productive technologies and new materials, allowing to obtain the same characteristics of the structural and finishing elements, but with less their expenditure and improve the quality characteristics of these building elements.

The second task is connected with management issues, the solution of which is uniform expenditure of material, technical, labour, financial and informational resources with a predetermined intensity and oriented resource flows.

The solution of the third task is aimed at creating such conditions, when the quality of the construction product meets the necessary standards and user requirements, the volume of the external and internal defective products decreases, not only engineered, but also non-engineered and shadow costs are reduced, and consequently effective consumption of resources increases.

The result of these measures implementation may be appearing of one or several effects, namely:
- decrease of the cost of construction products;
- reduction in the duration of reengineering;
- improving the quality of products and services both in the construction industry, as well as buildings, facilities themselves.

The integrated solution of the tasks, aimed at improving efficiency of the reengineering resource provision, may give a synergetic effect, which may also have a multiplicative effect, spreading its influence on such reengineering fields as resource provision of the quality transformation of technological and business processes, residential development and territories.

4. Conclusions

Thus, when exploring reengineering resource provision issues, it may be concluded, that they have close correlation with the achievements of scientific and technological progress, as well as development of the informational-analytical systems and construction standards. The effectiveness of these elements facilitates making timely and adequate both management and technical decisions and, consequently, promotes the formation, maintenance of a comfortable and safe living environment.

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