Use of Reengineering in Construction

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Abstract. The article discusses the use of the methodology of reengineering in the investment-construction. The goals, tasks, various options for their solution, application areas of reengineering in construction are identified, as well as its basic principles and development directions are formulated in the article. In this regard, it is assumed, that practical use of reengineering methodology will contribute to the creating of the comfortable and safe living environment, as well as competitive advantages of the building construction organizations, aimed at the reduction of cost and terms of works realization, increase of productivity and production quality. Works of foreign and domestic scientists are used as initial materials on the research issues, and functional and structural analysis are taken as cognition methods. In this regard, a retrospective of reengineering is investigated, a definition of this concept and its qualifications (“capital construction facility reengineering”, “business process reengineering”, “technological process reengineering”) are given, and directions for use in the investment-construction activities are established. At the corporate level, there are three types of reengineering: business processes, technological processes and capital construction facility. The article presents the distribution of these types of reengineering on the timeline of the investment-construction, as well as the distribution of participants by types of reengineering, the volumetric nature of reengineering is noted. It is shown, that a specific type of reengineering is the reengineering of territories and buildings and possible directions of its impulse are presented. Considering the sectoral level as the highest level in the hierarchy, the possible options for initiating reengineering “top-down” and “bottom-up” are established, and factors influencing this process are identified.

1. Introduction
Modern production systems organization paradigm is characterized by use of methods of its quality transformation – reengineering.

There are two basic definitions of reengineering in special literature [1-6]:

- turning around enterprises, organizations, companies through moving engineering to a new level;
- modernization activity of the previously implemented engineering solutions of the functioning facility.

One way or another, reengineering is considered as a quality transformation of the solutions, having anthropotechnical genesis (technical, technological, organizational, management, etc.).

The term of reengineering, connected with the scientists M. Hammer and J. Champy, initially being applied to business processes and meaning “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of
performance, such as cost, quality, service, and speed”, got a new impetus and sound in the conditions of scientific and technological progress acceleration and increasing competition.

2. Materials and methods
In the foreign theory and practice of management business process is considered a set of procedures, which are ordered in time and space. Some nomenclature of resources is used at the beginning of this process and a valuable for the consumer product or service is created at the end. Business processes can interact with each other in the ambient, the nature of this interaction is determined by their features:

- individual works are grouped into complexes to optimize staff schedule and technical facility nomenclature, as well as to combine and perform in parallel different kinds of works
- performers make their own decisions, that allows to reduce reaction time and the cost of work or services and respond promptly to changes in the consumer request,
- the decision point is approaching to the initial problem location
- the number and time of inspections reduces, the rate of regulatory influences increases
- the project management is implemented, that leads to the decentralization and transfer of the operational decision-making to the separate unit level, but at the same time the centralization of the corporate information is ensured.

3. Results and discussions
To ensure the above statements reengineering procedures should assume:

- an innovative approach, application of the advanced achievements of scientific and technological progress
- restructuring and optimization of the regulated system or facility organization
- intensification of activities, radical improvement of the cost-performance indexes of the regulated system or facility

As practice shows, reengineering is focused on solving organizations’ crisis and development problems, when accumulated contradictions lead to the competitiveness decline and loss of consumers, so an application of methods of reengineering is expedient in the following cases, when there are:

- crisis state of the system or object, which is determined by the low production or service quality and high costs
- negative trends in the development of a system or facility, downtrend of the main cost-performance indexes
- the urgent need for competitiveness and competitive advantages

Thus, the goal of reengineering is to find a new trajectory of the system or facility development, characterizing by stability, reliability and efficiency. To reach this goal it is necessary to implement a set of measures and procedures, characterizing by certain stages:

- defining a new goal and new tasks;
- determining the real condition of the system or facility;
- formulation of a new concept for the development of a system or facility, based on restructuring, intensification and optimization of the organization, forming an effective information and analytical support of the production and commercial activity.

Use of reengineering in construction has good perspectives, connected both with traditional application as investment-construction business process reengineering [7-10] and new directions of use at the corporate level [11, 12]: capital construction facility reengineering and technological process reengineering.

These three types of reengineering, being implemented within the framework of the investment construction activity may have a specific distribution of the reengineering types according to the stages of the life circle of the capital construction facility. This distribution is presented in the figure 1.
As it was mentioned above, business process reengineering is focused on the project management transformation and affects all stages of the investment project from the pre-investment research to the facility liquidation.

Technological process reengineering is connected with the enhancement of labour practices, operations based on the performance increase, reduced materials consumption, increase of automation in total costs and covers the stages and stages of the investment project, connected with the changes in shape of the construction objects, i.e. stages of construction and operation.

Capital construction facility reengineering is the alteration of the qualitative and quantitative characteristics of the building, facility at the operation stages in the form of reconstruction, technical re-equipment, repurposing and renovation, as well as their complete or partial integration. Considering this, it may be stated, that capital construction facility reengineering is regarded as one of the elements of the urban development.

Except presented on the figure 1 reengineering measures of the corporate level involve quality transformations of the organization, for example: structure transformations by means of application of project management and engineering construction scheme, as well as virtual offices when designing. [13-17]

Depending on the reengineering type initiator and stakeholders may be different subjects and participants of the investment construction activity (table 1).

Table 1. Distribution of participants in the investment construction by type of reengineering.

| Participant of the IC | Client company | Engineering company | Designer | Contractor | Maintenance organization |
|-----------------------|----------------|---------------------|----------|------------|--------------------------|
| Reengineering types   |                |                     |          |            |                          |
| Business process reengineering (within the framework of the investment project) | + | + | a | a | a |
| Technological process reengineering | - | + | - | + | - |
| Capital construction facility reengineering | + | + | + | + | + |

* - may implement their own business processes reengineering in the organization.
The initiator of the business processes reengineering within the framework of the investment project implementation may be both client, interested in the rapid effect of its implementation, and engineering company, to which the client has delegated not only its technical, but also management decision-making functions at all stages of the life cycle (i.e. engineering management scheme). Other participants of the investment project may implement their own business processes reengineering within their competences in the project or particular business entity.

Stakeholders in the implementation of technological process reengineering are its direct performers, i.e. contractors and engineering organizations. This fact is explained by the fact, that such measures are often the only competitive factor, an effective element of the formation of competitive advantages of the contractor or engineering organization.

The initiator of the capital construction facility reengineering may be either maintenance organization, or client within its investment project. But at the same time besides those mentioned above, the rest participants of the investment construction activity, such as designer, contractor, engineering company, will be involved in the process of capital construction facility reengineering. The nature of the participation of each subject is determined by its functions and distribution of competences within the framework of the current investment project.

Reengineering has a spatial nature, it may be considered not only horizontally according to its functions, but may be qualified vertically to show its hierarchy, as well as grouped by territorial zoning.

**Figure 2.** The hierarchy of reengineering activities and the variability of regulatory impacts.
The highest level in the reengineering hierarchy is the sectoral one, which is the source of direct regulation of the investment construction activities by means of rationing and administrative tools to achieve macroeconomic, socio-economic, sectoral goals (case 1, figure 2).

Reengineering measures may also have an opposite “upwards” direction of transformations, starting with the specific facilities and technological processes, requiring correspondingly an increase of operational efficiency and competitiveness of the construction, ending with the necessity of legislative and regulatory enforcement of the advanced corporate initiatives, practices, technologies etc. (case 2, figure 2).

A specific type of reengineering, do not included into the above classification, is a land use and development reengineering, the objects of research and transformation of which are either objects, that are not “capital construction facility”, or buildings and facilities groups, complexes. An example of land use reengineering is reclamation, and land development is reconstruction and renovation of the territory development.

When exploring this qualification, it may be stated, that it will have the same direction of prompting reengineering activities (case 1 and 2, figure 2).

It should also be noted, that simultaneous presence of the cases 1 and 2 (figure 2) is possible, when interests of the state and private sector coincide, and as a consequence, a synergistic and multiplicative effects, affecting not only the investment construction sector, can occur.

4. Conclusions and discussion

Based on the above it can be concluded, that reengineering mechanism efficiency directly depends on the quality of the informational and analytical work: promptitude, reliability, adequacy and sufficiency of the data for decision-making, type design, unification and standardization of the design, organizational and technological and management measures within the framework of the capital construction facility reengineering and technological process reengineering.

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