The influence of the technological and organizational factors on the construction process

I Yu Zilberova, K S Petrov, Al Fatla Abdullah Neama Mohsen
Don State Technical University, 1 Gagarin square, Rostov-on-Don, 344002, Russia

E-mail: zilberova2011@yandex.ru

Abstract. The article identifies the groups of factors that influence the process of building construction. The influence of the buildings’ construction specifics was taken into account. It was established that the necessary and sufficient for assessing the specifics of building construction issue is to take into account the factors that have the most significant impact, namely: the effect of construction site tightness; the factors complicating the structures’ transport; the factors complicating the structures’ enlarged assembly; the factors complicating the structures’ installation; the factors of production technology; the factors describing the construction planning.

Introduction
The construction of the object can be carried out with different duration and cost, according to various organizational and technological schemes, due to many factors interconnected by some dependencies, affecting the construction process in different ways [1]. Each of the factors, in turn, can also be characterized by the several features.

The correlation analysis makes it possible to qualitatively and quantitatively assess the relationship between the measured indicators under the influence of a large number of factors on the construction parameters, their specific weight in the factors’ aggregate [2]. The analysis of the results of the expert assessment, in the presence of a sufficiently agreed opinion of experts, makes it possible to identify and group the factors that have a significant impact on the duration and cost of the construction, on the choice of various organizational and technological construction schemes [3]. To move to these types of analysis, it is necessary to systematize the factors of construction objects.

Materials and research methods
An analysis of the construction production functioning allowed us to identify the most common factors for all the construction types [4], which affect the process of the construction objects to varying degrees.

The factors complicating the technological schemes choice for the construction of buildings:
1. A group of factors constraining the construction site:
   - The presence in the area of the nearby operating enterprises, engineering support systems of the building under construction, the occupancy of the area by the existing buildings, basements (shelters, metro, etc.);
   - Limited accessibility to the installation area due to adjoining existing buildings;
   - Work in the cramped conditions of the built-up part of the settlements [5].
2. A group of factors complicating the structures’ transportation:
   - The presence of existing transport routes in the production area;
   - Limit the fitability of large vehicles in the inner courtyard road network;
   - The road intersections with permanent existing roads;
   - The need for dead-end sections of the intra-construction roads;
   - The need for the special structures to move the building mechanisms through obstacles;
   - The device and content of the temporary roads [6].

3. A factor complicating the storage and enlarged assembly of structures:
   - Insufficient space for organizing the storage and assembly zones near the building to be installed.

4. A group of factors complicating the structures’ installation:
   - Increased heterogeneity, balance and small volume of the mounted structures;
   - Distribution of mounting volumes across the building’s different sections;
   - Insufficient amount of work in certain areas to organize a long-term installation flow;
   - The need for temporary enclosing structures and restrictions;
   - The need to develop special technological equipment;
   - The need for additional (during installation) retooling of construction machines and mechanisms and their rearrangements.

5. Group of factors of organization and construction production technology:
   - The need for the construction training;
   - Scope of work;
   - The nature and conditions of work;
   - The need for the phased work;
   - The need for additional fences and safety measures;
   - Presence of shortened construction deadlines;
   - Lack of initial design documentation;
   - The need for environmental protection.

6. The factor describing the buildings’ space-planning decisions.
   The studies of the factors’ influence on the industrial facilities construction process in rail transport [7]. For example, for the workshops of locomotive and car depots (Bataysk), the influence of the following specific factors was taken into account:
   - tightness in the conditions of the train traffic (measured depending on the number of train pairs per day), which requires the organization of technological “windows” in train schedules;
   - constraint in the conditions of work in the area of the contact network power lines (significant limitations on the operation of jib cranes);
   - island and coastal location of the buildings relative to paths.

Let us summarize the main factors in the construction of construction projects:
   - Technological factors (resources):
     1. Scope of work.
     2. Quality of work.
     3. Technical and operational characteristics of the resources used.
     4. Resource performance.
     5. Production technology.
     6. The complexity of the constructional technical and regulatory conditions.
       - Organizational factors (time):
         1. Organizational and technological schemes of work.
         2. Resource performance.
         3. Quantitative, qualitative and temporal characteristics of the resources used.
         4. External and internal conditions for the resources use.
5. The work duration [8].
   - Economic factors (cost):
     1. Implementation costs.
     2. Input and output cash flow.
     3. Conditions of a contract.
     4. Loan conditions.

   The practice of erecting the construction objects testifies [9] that the characteristic features and semantic content of some technological and organizational factors are similar to each other. It should be noted that in the system of managerial influences on the construction of the construction object, two streams prevail [10]: one is the production and technological in the space “workload - time”, the other in the field of economic analysis “time - cost” and “workload – cost”. In this regard, it is much more convenient to group the factors as it is shown in the Table №1.

**Table 1.** Organizational, technological and economic factors of the construction projects

| Organizational and technological factors | Economic forces |
|-----------------------------------------|-----------------|
| 1. Scope and technology of work.         | 1. Implementation costs. |
| 2. Quality of work.                      | 2. Input and output cash flow. |
| 3. Technical and economic characteristics of the resources used. | 3. The terms of the contract. |
| 4. External and internal conditions for the use of resources, including indirect factors. | 4. Credit conditions. |
| 5. Organizational and technological workflow schemes, quantitative and temporal characteristics of the resources used. | |
| 6. The resource productivity.            | |
| 7. The work duration.                    | |
| RESOURCES n n n n n                     | PRICE n n n n n |
| n n n n n n | T I M E n n n n n |

n - uncertainty.

As it can be seen from the Table №1, each of the erection factors can be attributed to one of two main flows of the managerial influences. So, it is possible to combine the technological and organizational factors into a large group of organizational and technological factors. The connecting link between the control flows operating in an environment of uncertainty and, accordingly, the groups of factors (Table No. 1) is the most important parameter of construction - time (duration).

**Summary**

Thus, based on expert assessments and logical conclusions, the groups of factors that influence the process of building construction have been identified. The analysis took into account the influence of the buildings’ construction specifics. It was established that the necessary and sufficient way for assessing the building construction specifics is to take into account the factors that have the most significant impact, namely: the construction site tightness effect; the factors complicating the transport of structures; the factors complicating the enlarged assembly of structures; the factors complicating the installation of structures; the factors of the production technology; the factors describing the buildings’ planning.
References

[1] Naoum, S 2001 People and Organizational Management in Construction (Thomas Telford Publishing).

[2] Zilberova I, Petrov K, Artsishevsky M Actual Problems of Management Quality Control of a Construction Company *IOP Conference Series: Materials Science and Engineering* **753** (3). Information on https://iopscience.iop.org/article/10.1088/1757-899X/753/4/042020.

[3] Zavadkas E K 1987 Comprehensive assessment and selection of resource-saving solutions in construction (Vilnius, Moxlas) 209.

[4] Kostyuchenko V V 2016 Organizational and technological system of the production apparatus of construction works *Engineering Bulletin of the Don* **4**. Information on http://ivdon.ru/ru/magazine/archive/n4y2016/3920.

[5] Petrov K S, Efisko D E, Upland V S 2017 Modern approaches to the modernization of construction organization processes *Engineering Bulletin of the Don* **1**. Information on ivdon.ru/ru/magazine/archive/n4y2016/3920.

[6] Monastyrenko V A 2008 Effective organization of the construction process *Engineering Bulletin of the Don* **2**. Information on ivdon.ru/ru/magazine/archive/n4y2016/3920.

[7] Lapidus A, Zakieva N, Grankina D, Avakov A The principle of determining the values of building system's organizational and technological reliability *IOP Conference Series: Materials Science and Engineering* **698** (2).

[8] Mikhaylova E Probabilistic assessment of the buildings and structures construction duration *IOP Conference Series: Materials Science and Engineering* **698** (5).

[9] Mirgorodskaya E O, Novoselova I V, Steiner V Y 2018 Organizational and Managerial Failures in the Development of the Housing Industry in Russia *Materials Science Forum* **931** 1160-1164.

[10] Stepanov A E 2019 The flow method of organizing work when constructing monolithic structures of residential buildings *Science and Business: Development Paths* **5**.