INNOVATIVE TECHNOLOGIES IN IMPROVING THE ORGANIZATION OF CONSTRUCTION OF MAIN GAS TRANSPORTATION NETWORKS

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Abstract. *The results of the study of the technology of construction of buildings and structures from the position of establishing the level of interaction of technologically interrelated works are presented. It is shown that in order to increase the efficiency of the process of interconnection of works in space and in time during the construction of an object, it is necessary to establish a quantitative correspondence between interrelated works.*

Index terms: *facility construction technology, work interconnection, quantitative correspondence, volumetric ratio, technologically interrelated work.*

Introduction

The term "technology" was first introduced in 1772 by I. Beckmann, a professor at the University of Göttingen, to denote a handicraft art that includes professional skills and empirical ideas about tools and labor operations. Translated from Greek, the word 'Chessie' is defined as art, skill, skill.

The name "technology" was also given to the discipline that studies these phenomena and processes used in the processing (processing) of various media. The generality of the approach to the subject of research in technology also predetermined the expansion of the types of processed (processed) media, which began to include not only material resources (metal, chemicals, plant products, including wood, plastics, glass, mineral raw materials, agricultural processing products), but also intangible resources (information, design and scientific developments, shows, art, lawmaking, management, financial and insurance services, etc.).[1]

The task of the technology is to determine and use in wide practice the most effective production methods and methods associated with the course of physical, chemical, mechanical, commercial, social, ecological and other processes occurring during the transformation of processed media from one type to another.

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Analysis and results

Technology is usually viewed in relation to a particular industry. In construction, this is a construction production technology (JV). There are several options for determining the JV technology. Here is one of them. SP technology is a functional system that includes resources (time, labor and material), as well as restrictions and rules for their interaction to achieve a given result - the performance of certain types of work, processes and elements of construction projects [1].

According to this definition, as well as other data [2;3], JV technology is a combination of two subsystems: technology of construction processes and technology of construction of buildings and structures.

As a scientific discipline, construction technology, which deals with the study of construction processes, as well as physical and other laws that affect the characteristics of products and labor productivity, is a highly developed area of knowledge. The existing literature on technology describes in great detail the methods of performing certain types of work and very little information about the laws governing the construction of an object as an integral process. This state of affairs cannot be satisfactory, since construction products are, first of all, ready-to-use construction objects, therefore, technology should accumulate, first of all, knowledge about the construction of buildings and structures in general, and only then about the construction and processing of their individual elements.

Let us consider the features of the technology for the construction of buildings and structures, which the authors propose to call the "technology of object

construction", since this name reflects the essence of the interaction of construction processes.[2]

During the construction of objects, even simple and standard ones, a large number of construction and production enterprises of various specializations are involved, many different materials, parts, products, structures are used that have more than one structural and technological characteristics. During the production of construction work, hundreds of technological processes and operations are carried out, characterized by various parameters and indicators.

In addition, construction and installation work (CMP) is subject to a large number of factors, the main of which are climatic, weather and regional conditions, the level of qualifications of workers and engineering and management personnel, the availability of the necessary material and technical resources and technical means.[3]

Therefore, the main thing in the construction technology of objects, which combines simple and complex technological processes, is the level of interaction of these processes, their interconnection in space and time in order to obtain products in the form of buildings and structures. And the temporary, labor and material resources, as mentioned above in the definition of the joint venture technology, are only auxiliary elements necessary for the implementation of these processes.

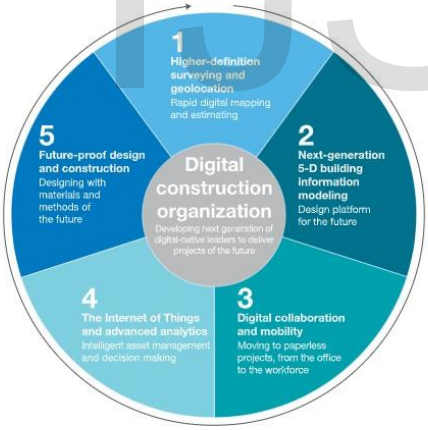

Fig.1. Digital construction organization https://www.imaginovation.net/blog/construction-industry-technology-trends/

The interconnection of all construction and installation work and special works during the construction of an object is the main procedure necessary for the implementation of not only the management functions "planning" and "organization", but also other functions, both general and private. And in order to solve this important problem, it is necessary to analyze the content of the facility construction technology from the standpoint of working out the internal relationship between works. The previously considered process of identifying internal connections ended, as a rule, with the establishment of the technological sequence of the object's work. This was the end of the facility construction technology, and arrow diagrams, topology of network diagrams and other forms served as a display of the technological sequence [4]. For comparison, let us turn to the technology of industrial production, in particular to the conveyor technology used in the automotive industry. Here, the principle of technology formation is based not only on a strict sequence of technologically related work, but also on the creation of conditions for performing a certain amount of work within the planned time at each operation. In other words, without performing a specific amount of work, expressed in value or in kind, at the previous operation it is impossible to perform work at the next operation, that is, there is a rigid volumetric relationship between technologically interrelated works. Of course, for construction, which is a specific industry, the use of the conveyor method during the construction of an object cannot satisfy. The element-by-element succession of technologically related works leads to a significant increase in the duration of construction. But for combined production, typical for the construction of an object, in order to establish the level of closeness of interaction between construction technologically related works, it is necessary to determine the quantitative relationships between them, as in conveyor production, allowing them to plan their implementation.

As an illustration of this formulation of the question and its solution, one can cite the example of assembling prefabricated foundations for columns, assembling columns and assembling crossbars, considered in [5].

These three works are in the technological sequence in which they are listed: without mounting the foundations, it is impossible to install columns, etc. But if you use only this sequence for planning, it turns out that it is necessary to plan first the installation of all foundations, then all columns and etc. Such sequential planning will lead to a significant increase in the duration of the work in comparison with the combined method. But for combined production, in order to create continuity of the process, it is necessary to establish a strict quantitative correspondence between technologically related works, which allows planning or execution of subsequent work, taking into account a certain amount of work performed on the previous work.

Electrical work is technologically dependent on such work as the installation of partitions and finishing work. This means that the beginning of electrical work is associated with the beginning of the installation of partitions, and the beginning of finishing work - with the beginning of electrical work. At the same time, the quantitative side determines the volumes of the ratio of this dependence, that is, what volume should be planned (or previously completed) during the installation of partitions so that it is possible to plan a unit of volume in the production of electrical work, and accordingly what

volume should be planned (or earlier completed) in the production of electrical work, so that you can plan the unit of volume in the production of finishing work. To complete the electrical work, it is necessary to perform the technologically necessary volume, which dictates the technologically necessary lag of the subsequent work from the previous one. Similarly, with the end of finishing work.[2]

The construction situations described above are not an example of the analysis of specific technologies of construction processes, and the authors emphasize this, but are fragments of the construction technology of the entire facility, describing combinations of various technologically related works. Their difference in design features. In the first case, these are prefabricated reinforced concrete structures, in the second, a set of stone structures, special designs and finishes.

There are many such combinations when building an object. The purpose of their description is to determine the physical essence of the interaction of technologically related work, the factors that affect the level of this interaction.

Thus, the result of the study of the construction technology of the facility is the conclusion that it is necessary to determine the quantitative ratio to establish the level of closeness of interaction between construction technology-related works. This conclusion is confirmed by the results of other studies in the field of studying the technology of construction of buildings and structures [5]. It is quite logical that the next step in studying and solving this problem is the formation of a mechanism for calculating the quantitative ratio. This requires the development of a method for determining quantitative volumes. This task is complex and laborious, requiring consideration of such indicators as continuity, uniformity, rhythm, combination, and intensity. In addition, it is necessary to take into account the technological requirements, design features, the degree of mechanization and the purpose of construction work, the nature of the processes, their significance, etc. volumes.[5]

A new technology is a form of technology that is more developed and automated relative to its predecessor in this social aspect [8]. It is about new technologies that they speak, first of all, when it comes to the scientific and technical process, which is understood as a constant process of improving tools and objects of labor, the introduction of progressive technology and effective forms of organization, including in the field of construction production.

An important area of scientific and technological progress is the further formation of the mechanization of construction production. Mechanization of work saves labor resources, shortens construction time, improves working conditions [9].

Today, one of the key problems associated with the implementation of investment and construction projects is the disruption of the terms of commissioning of construction objects, which entails an increase in the cost of the final cost of the project and, as a rule, worsens the quality of construction.

Compliance with the terms of the construction of the facility is the most important strategic task on the part of the organization that has undertaken the obligations for the construction of the facility. Failure to comply with the established time interval is a significant drawback arising in the process of production and economic activities. The study of this problem is relevant at the present time, because the consequences of failure to meet deadlines can have a negative impact on the current financial condition of the company, namely:

- refusal of clients from cooperation;
- a decline in reputation;
- establishment of fines and sanctions arising from non-compliance with contractual obligations;
- receiving losses that have a significant impact on the financial condition of the enterprise as a whole.

The process of organizing construction production is a versatile and multidimensional activity, therefore, to solve organizational problems, an approach to management is required that will allow cover all areas of activity of an economic entity in the construction industry.

Professionalism, quality and adherence to construction deadlines are considered the main characteristics of the business reputation of business entities in this industry, the deterioration of at least one of these indicators entails financial losses for all participants in the construction process.

The tasks solved by managers in the process of organizing construction production, as a rule, relate to several areas of activity at once: engineering, management, information and economic. Therefore, the development of innovative approaches to this process is one of the most urgent tasks in the construction industry [10].

At present, the demand for gas and oil products is increasing in increasing volume, and therefore the demand for trunk gas transmission networks is growing from year to year. The construction of a main gas pipeline is a very laborious process that requires serious organizational and managerial work and large material costs.[6]

The main gas pipeline is an industrial and transport complex that includes the pipeline itself (linear-extended object - linear part) and a complex of structures in the form of pumping or compressor stations, emergency repair points and other objects, which are commonly called concentrated (ground) structures. At the present stage, the construction and overhaul of trunk gas transmission networks is an independent construction industry, which has the following main features of advanced industrial production:

- comprehensive mechanization of work based on modern technology;

- Mass use of parts, blocks, assemblies and structures manufactured at enterprises of the construction industry and industrial enterprises;

- the flow of performance of all types of construction and installation and special works as the main form of production organization;

- the use of modern methods and tools for planning and production management;

- the maximum level of manufacturability of production processes.[7]

Reliable and efficient operation of gas transmission systems, their

timely development, taking into account the growing market demands, is one of the priority tasks of PJSC Gazprom, the solution of which allows it to fulfill its obligations to provide consumers with natural gas.

One of the key areas for the implementation of this task is the use of new, modern technical solutions, advanced techniques, products and materials used in the construction and repair of gas pipelines, which ensure high quality, safety, shorten construction time, and increase the service life of gas transmission systems.[11]

In accordance with the structure of the main pipeline, the construction of its linear and concentrated facilities is usually carried out by complex mobile construction and installation flows.[8]

In the construction industry under consideration, it is necessary to accurately control the execution of work and keep within the construction time of the facility. Thus, there is a need for constant monitoring of construction production.

From an economic point of view, failure to meet construction deadlines results in losses that have a negative impact on the overall financial condition of the company. In order to avoid them, there is a need to improve the existing system of organizing the construction and repair of gas transmission networks. This includes consideration of all factors that have a direct or indirect impact on the timing of the construction and repair of main gas pipelines, such as:

- the work of the organizational and management personnel of the enterprise;

- the latest achievements of science and technology in the construction of the main gas pipeline;

- the main production assets of the enterprise.

The study of the site's activities made it possible to identify a number of reasons causing the delay in construction.

1) A high degree of equipment wear and tear, due to which the downtime of machines, machinery and equipment increases. First of all, the most demanded machines and equipment wear out. In this construction industry, these are excavators, pipe layers, diesel power plants. The wear rate of these types of machines in the area is from 79 to 82%.[10]

2) Lack of automation and mechanization of the technological process, which slows down the progress of the entire construction process, in particular, welding and assembly works. Welding is one of the leading processes in line construction. Consequently, the improvement of the existing system of welding works can speed up the technological process several times, i.e. to reduce the risks of non-fulfillment of obligations under contracts and compliance with construction deadlines.

3) Imperfect work organization system and lack of mutual understanding between the site management and the head office, which has a negative impact on managerial decision-making and on work in general.[12]

In order to eliminate the identified shortcomings at the work site, within the framework of this study, measures are proposed that will improve the current state of the company as a whole, since the identified problems are inherent in the remaining six areas that are part of the organizational structure of the company.

Welding and assembly work is a laborious technological process that directly affects the execution of work on time. At the moment, the sites do not have modern automated equipment that could speed up the construction and installation work. In particular, this applies to the welding unit used at site No. 2, with the help of which manual welding is carried out, which is characterized by a low productivity in comparison with analogues on the welding equipment market. It is proposed to replace the welding unit and, as a result, to change the welding technology to a more automated method, to semi-automatic and automatic welding. The choice of equipment was carried out on the basis of online catalogs of welding equipment.

It should also be noted that the use of pipe-welding bases makes it possible to work without hindrance in any weather conditions, which speaks of ensuring comfortable working conditions for the brigade.

The M300 C welding head also has a number of positive aspects. Firstly, the unit provides accurate and high-quality work, and also has a small size, which allows you to quickly get down to work when performing similar work. Secondly, the use of a semi-automatic welding system ensures the reliability of the welded seam and the lowest consumption of the deposited metal due to less spatter, in contrast to manual welding with electrodes.[11]

Conclusions

In summary, to the use of new technologies, one of the effective solutions to reduce unplanned downtime of equipment, due to its unsatisfactory condition, is the introduction of scheduled preventive maintenance of machinery, equipment and equipment. This measure will allow to prevent in advance the breakdown of fixed assets, preservation of parts and parts in good condition through scheduled maintenance and overhaul.

Lack of discipline, labor standards, corporate culture and a favorable climate in the team can significantly slow down the implementation of technological innovations. Therefore, it is proposed to use also a number of measures that contribute to the rational organization of labor in order to eliminate delays that affect the progress of projects. In particular, the establishment of a system of interaction between the head office and the sites, stimulation of labor through the payment of bonuses in connection with the early deadlines for the execution of work, as well as ensuring labor safety at construction sites.

The tools for improving the organization of labor considered in this article can be used in the implementation of construction and installation work in the field of gas transmission networks not only for the enterprise in question, but also for a number of other enterprises in the industry that have similar problems in their activities.

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