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ANALYSIS OF ENGINEERING SERVICES OF THE CONSTRUCTION SECTOR IN THE REPUBLIC OF AZERBAIJAN

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Introduction. In 1981, the American Society of Civil Engineers (ASCE) published the "Guidelines for the Utilization of Engineering Services". This document analyzes the provision of engineering consultations, provides a classification of engineering services, outlines the procedure for selecting an engineer, and discusses other relevant issues.

The analysis of the services provided by companies offering modern engineering consultations revealed that the guidelines of the ASCE have been translated into the legislation of contemporary engineering. It incorporates the following eight groups within itself:

1. Direct individual services. This covers individual consultants with specific expertise, as well as those preparing legal procedures, participating and representing in courts, and those researching and preparing engineering-technical issues.

2. Additional technical-economic research and financial economic comparisons. These services are provided before project approval, involving the analysis of conditions, comparison of several possible options, including environmental considerations, exploitation costs, financial aspects, and issues related to expected revenues. The results are used to determine the feasibility of the construction of the object.

3. Studying the potential of planning. This involves the preparation of master plans and long-term development programs for regions (cities), taking into account external conditions.

4. Evaluation and calculation of costs. These services encompass the analysis of capital, operational, and current expenditures, including the examination of credit rates.

5. Assistance in financial matters. This involves providing advice and recommendations on financial issues and financing matters.

6. Construction management. Using management strategies and making decisions at different construction stages are included in this category of services.

7. Inspection, testing of equipment and materials. These services include the acceptance of equipment in the factories of manufacturing companies and testing of materials used by contractors in construction sites.

8. Operating services. Following the building phase, an engineering consulting firm, acting as the project author at the client's request, assumes operational responsibility for the object.

Objectives of the article. The engineering services complex can be expanded according to the client's request. The expansion can be supported by specialized companies in the later stages of the construction of the facility, as well as the realization of the products developed at that facility [1].

It should be noted that practical experience in the field of construction engineering has significantly developed in Azerbaijan in recent years. This development is attributed to the rapid growth of the construction

sector, resulting from the increase in oil revenues. [3]. One of the most important factors contributing to the development of this sector is the increase in the country's engineering and technical workforce. In the aforementioned time frame, ten significant engineering firms in the building industry have emerged in Azerbaijan in recent years. These businesses directly prepare projects for different construction objects and offer upkeep and services.

The main material of the study. The construction sector has witnessed a notable trend in the last ten years: the rapid development of technology improvements. All phases of the construction process, including project planning and preparation as well as the actual construction process, have been thoroughly computer modeled in a timely manner.

The cost of construction projects can be lowered by 20–30% with the efficient use of computer modeling.

The most recent BIM models are based on a 3D approach, which includes three-dimensional geometric data of built objects as well as shapes, other information, and data about different tangible resources and construction materials (like building materials, equipment and labor) used in the project's execution. Furthermore, the information in these BIM models includes information about when tasks are completed, how auxiliary objects are constructed and repaired, components of long-term financial forecasting, and when completed objects are put into use.

The nexus of electronics, robots, and additive manufacturing gives rise to the newest innovations in construction technology. Here, we are discussing 3D printing technologies for panel and modular house construction, as well as robotized robots.

It should be mentioned that the workforce's lack of specialized training is one of the primary causes of Azerbaijan's construction industry's notable technological gap when compared to Turkish, European, and Russian construction enterprises. Consequently, this impedes the advancement and decelerates the adoption of novel materials and technologies. Therefore, it can be concluded that the amount of innovation in technology used in the construction industry is almost nonexistent. Administrative obstacles are one of the things impeding the growth of the construction industry in Azerbaijan, according to the "Doing Business" international assessment. The country's ability to build more infrastructure and implement technologies more widely is hampered by administrative issues. The present strategy stipulates increased liberalization of the construction industry and a reduction in the role of the state, according to an examination of developments in state regulation of the sector. It should be mentioned that the adoption of cutting-edge building technology and the application of contemporary state regulations are the only ways that such a plan may be successful. By using these strategies, the nation's construction output may be greatly increased, and the adoption of innovations can be encouraged, which lessens the reliance on the degree of specialized training. One technology that comes to mind when discussing international experience is the *Dincel Construction System* [6].

This specific technical system has been designed and developed by an Australian engineer. It is made of robust and long-lasting polymer panels that function as both columns and wall elements when filled with concrete, offering resistance to fire. These polymer pillars are simple to hand-install and can be made to fit any length and shape of wall and column combination. Furthermore, material leftovers can be readily combined with the primary material thanks to this method.

By cutting this polymer-based material to match the specifications of a particular concrete construction object in the manufacturing facility, new building material can be created. When compared to monolithic reinforced concrete buildings, this technology allows for a significant cost reduction in the construction of wall and column assemblies in a very short amount of time.

In this context, the concrete slabs known as "Holedeck" are also worth mentioning. Compared to conventional reinforced concrete slabs, this technology allows for the use of 55% less concrete thanks to the voids [5]. In the "Holedeck" system, specially assembled matrices from polypropylene, floors for concrete are used. Technological voids make it possible to place part of engineering communications in the slabs themselves (electrical conduits, ventilation system).

Studies show that a number of technologies, methods to enhance the strength of concrete, technologies that facilitate horizontal concrete drilling in field settings, and the use of dry non-fired large volumes of long-lasting, high-quality steel in humid environments are not sufficiently applied in our country's construction industry.

A unique state program must be developed in order to implement cutting-edge technologies in the building industry. It is currently impractical to see the nation's innovation-stimulation mechanism for the building industry functioning properly in practice.

Today, developers and construction firms are not particularly interested in investigating and implementing innovations on a large scale. The implementation of managerial and technological advances is prioritized in Azerbaijan's economic growth agenda.

It is worth noting the activity of the national engineering company "Hidrotranslayihe".There is no analogue of this company in the countries of the Commonwealth of Independent States (CIS). The complex intersection projects of transportation routes are prepared by this company, particularly at the intersection of Heydar Aliyev and Ziya Bunyadov avenues, located at the Scientific Research Center.

The transportation network includes:

– 9 bridges;

– Access to the bridge;

– The total area of highways as an important part of road junctions and network is 3145.0 meters.

It should be noted that the project includes a road bridge with a main span length (L) of 56.0 meters, featuring a suspended roadway with parabolic metal arches. This is the first time that the company has designed a cable-stayed bridge with a vent structure in Azerbaijan. The main span of the cable-stayed bridge is 36.0 meters, and the height of the bridge column is 98.0 meters above ground level.

The following infrastructure objects have been utilized in other projects of the company [4]:

– Passage on Tbilisi Avenue and H. Zardabi Street ("20 Yanvar" Metro Station);

– Designing a two-way railway bridge at the Excelsior Hotel;

– Designing a railway bridge over the Kura River at the 73rd km of the Saloglu-Poylu distance;

– Construction of bridges and crossings on the Baku-Samur highway, a component of the North-South corridor, at the 28+000 km to 89+000 km distance;

– Designing a bridge over the Tovuz River on the road passing near the city of Tovuz;

– Restoration of the highway, part of the "West-East" corridor of the Great Silk Road;

– The bridge on the Talachay highway in the Zaqatala district;

– Defense measures in Ilisu village of Gakh district. Passage on the Hamam river in the village of Ilisu;

– Designing the bridge over the Kura River on the Jalilabad-Astara highway;

– Designing the bridge on the Hacigabul-Horadiz road;

– Designing the road project for the Alat-Qazi Mammad highway;

– Project encompassing measures to protect the road in the Pirallahi settlement from coastal erosion caused by sea waters.

In all the projects mentioned, new technologies have been utilized in compliance with international standards, especially ISO 9001-2011 standards.

Thus, the conducted analyses indicate that a wide range of engineering technologies are being utilized in the construction sector of the Republic of Azerbaijan.

The development of this sector in the country has accelerated the construction of new buildings, improved environmental conditions, enhanced the quality of structures and buildings, and provided opportunity for individuals in the industry to earn more money.

Conclusions. Engineering covers a wide range of activities, including engineering consultancy services, research, analysis, development of project feasibility studies, creation of suggestions for product sales in any field.

The engineering services complex can be expanded according to the client's request. The expansion can be supported by specialized companies in the later stages of the construction of the facility, as well as the realization of the products developed at that facility.

Ten significant engineering firms in the building industry have emerged in Azerbaijan in recent years. These businesses directly prepare projects for different construction objects and offer upkeep and services.

Studies show that a number of technologies, methods to enhance the strength of concrete, technologies that facilitate horizontal concrete drilling in field settings, and the use of dry non-fired large volumes of long-lasting, high-quality steel in humid environments are not sufficiently applied in our country's construction industry.

A unique state program must be developed in order to implement cutting-edge technologies in the building industry.

The analyses conducted indicate that the widespread use of engineering technologies in the construction sector of the Republic of Azerbaijan has boosted the acceleration of the construction of new building projects, improved ecological conditions, enhanced the quality of buildings and structures, and opened up prospects for sector workers' pay to rise.

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Gasimov Ruslan İskandar, Ph.D. student, Azerbaijan Architecture and Construction University. **Analysis of engineering services of the construction sector in the Republic of Azerbaijan.**

Engineering as a sector of the market economy arose a century and a half ago in Great Britain, when the services of engineers, in demand by industrialists for the construction of new factories and the modernization of existing ones, began to be sold for the first time. In this regard, engineering was understood as the provision of services for the creation and operation of industrial facilities and infrastructure. Market size represents the revenue generated from various types of services such as product development, process engineering, automation related services and asset management related services offered by market players. The article reveals the essence of engineering and identifies groups of services of companies providing engineering consultations, defines the subject area and specific practical problems, the solution of which is engineering; the functional dependencies of participants in engineering activities in construction are indicated. The tasks, subject area and classification of engineering in construction are presented, taking into account the main stages of the implementation of an investment and construction project. The place of the engineering company in the system of interaction between participants in investment and construction activities is indicated. The need for a clear definition and delimitation of the functions of participants in engineering activities in construction in order to comply with contractual discipline is shown. Thereafter, by examining the activities of contemporary engineering consulting organizations, the evolution of ASCE guidelines under current engineering law was highlighted. The article attributes success only to the application of these tactics, that is, dependence on the components of modern state law and the use of advanced technologies in construction. All this allows us to significantly expand the volume of construction work in the country and stimulate the use of innovation. It is indicated that the significance of the results obtained for the construction industry lies in a comprehensive analysis as an integral part of investment and construction activities, as well as in determining the range of participants and the nature of their functional dependence. This is necessary to identify the potential for development and improvement of the engineering system in construction.

Key words: engineering, engineering consultations, construction industry, technological advancement, transport network, infrastructure facilities.