Specifications of construction in China in 2019-2020

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Abstract. China is currently building entire cities, and new settlements are rapidly being built. It is important to note that the ideology of construction has undergone significant changes. If earlier the high rate of construction was due to a large number of cheap labor, and the quality suffered, today the emphasis is on the quality of construction work and materials. For this purpose, China has trained specialists-professionals who have received the best education and passed training in construction companies in different countries of the world, so today Chinese young engineers can teach their foreign colleagues how to innovate in the field of construction. The successful development of the construction industry is facilitated by strict state control, and the fact that almost all construction equipment of modern samples is produced by China itself and does not depend on foreign investment. This, in turn, contributes to an increase in sales of construction vehicles to other countries. Today, after many years of development of construction industrialization, BIM technologies have become widespread, which has determined the acceleration of the growth of modular and industrial development. It is no secret that the Chinese economy is developing rapidly. Of course, effective development of the economy, industry and agriculture is impossible without the development of construction, services and infrastructure.

Keywords: information modeling concept, modular construction, large-scale construction, state control, high-rise buildings, planned economy, high-speed construction

1. Introduction
Due to China's strong interest in modular construction, the integration of BIM technology is seen as a strategy for expanding the market.

Applying the concept of building information modeling (BIM) provides many advantages for virtual design, including the use of 3D laser scanners for data collection, as well as the use of a robotic total station. BIM is a good way to improve construction efficiency by optimizing the construction schedule [1].

Modular construction with BIM support is based on the modularity of building components and is applied more often to high-rise buildings [2]. After the architectural project is ready, the specialists start creating a structural model by selecting the appropriate modules that will be analyzed using the software.

Today, this modular technology is widely used for the arrangement of large areas, for the placement of warehouses, retail premises, hospitals, and hotels. The technology is based on the use of light metal
structures and sandwich panels. An important task is to prepare a platform for the Foundation, where a light metal frame and sandwich panels are being built, to which the engineering infrastructure is brought, taking into account the safety requirements [3].

The nearest practice in Wuhan has shown that innovations in modular construction using BIM give high quality in a short time of construction.

China demonstrated modern achievements in construction back in 2003, when the "XIAOTANGSHAN" hospital was built in Beijing in the shortest possible time during the fight against the SARS virus.

In connection with the coronavirus epidemic in China, thanks to the rapid construction in Wuhan, a modern medical center "HOSHENSHAN" for 1000 places, with an area of 34 thousand m², was built in 10 days [4]. The center is built of two-story modular container-type blocks using standard projects and modular structures that can be expanded to increase space if necessary. This method allows you to quickly, effectively, and most importantly inexpensive to solve problems of high-speed construction.

Despite the virus epidemic, construction in China continues. In February 2020, the construction of the metro in Beijing resumed, and a permanent orbital station is under construction, which is expected to be completed in 2023. It will consist of several modules and will have a volume of 160 m³ [5].

China's membership in the world trade organization gave an impetus to the modernization of its own equipment and the development of new technologies. Many models of cranes and excavators were developed from scratch and put into mass production. China also shows good results in the field of export and import of engineering products.

2. Research questions

The main sector of the construction industry in China is: cement production; production of flat glass; production of bricks; mining and processing of limestone and gypsum; production of ceramics [6].

More recently, the US was the leader in the construction industry all over the world, and now China is the first in this industry [7].

The growth rate of cement production in China as the main building material is indicative (Fig. 1).

![Figure 1. Growth rates of cement production](image_url)

Today, China is a world leader not only in high-speed construction, but also in the construction of high-rise buildings. In 2019 appeared in China 15 skyscrapers above 200 m. This is 11.9 percent of the total global quantity. An example is The Tianjin CTF financial center, which was built in 2019. Its height is 530 m (Tianjin CTF), and the Shanghai tower is 634 m high and has an area of 380 m² [8]. All high-rise buildings are built near transport hubs [9].
In recent years, China has surprised the world with its large-scale construction projects, high skyscrapers and endless bridges, for example, the Qingdao bridge is 42.5 km, the Tianxingzhou bridge over the Yangtze river is the longest screw bridge with road and rail traffic [10].

The state and local regional authorities exercise total control over construction, including road construction [11]. The contractor invests only its own funds in the construction, and investors pay the contractor only after the object is put into operation. This often motivates construction companies to perform work in the shortest possible time and at a high quality level.

China is a confident leader in the production of building materials, housing, roads, and power plants [12].

3. Materials and methods
In recent years, China has overtaken all countries in the world in terms of housing construction [14].

The state strategy for 2014-2020 assumes maintaining high rates of urbanization of the population. The main issues of housing policy are the problem of empty housing in villages and the shortage of housing in cities. The urbanization program for 2014-2020 focuses on the construction of affordable
housing at the expense of the Federal budget [15]. As part of this national program, construction is progressing rapidly, and many apartments are being rented out ahead of schedule.

The housing market in China is characterized by an active role of the state in its regulation. More than 80% of the construction market is occupied by private construction companies. State-owned companies are mainly engaged in infrastructure construction. Almost 40% of construction is carried out through the reconstruction of built-up areas.

The work used General scientific methods of cognition: induction and deduction, progress from the abstract to the concrete, analysis and synthesis, explanation, analogy, comparison.

4. Results
The fact that construction in China has its own characteristics associated with the planned and market economy is determined. The important role of state control in the construction industry is noted.

5. Discussion
China's construction industry is developing at a tremendous pace. Analysis of the success of construction in China allows us to note the specifics of economic development, which is based on the planned economy.

6. Conclusion
The incredible speed of construction in China is already perceived by some experts in the field of construction as the norm. In 2018-2019 alone, more than half of the world's skyscrapers were built in China. It is necessary to name the reasons that contribute to the rapid development of the construction industry, including: close attention and control by the state; own production of construction equipment (up to the most complex complexes for the construction of high-rise buildings); high motivation of developers themselves and strict discipline; the emergence of Chinese highly professional specialists who received quality education abroad; the absence of corruption and planned high-speed construction.

Perhaps the secret of success in the construction industry of the PRC is not just the number of people and equipment, but rather specific approach, which are not only quantitative but also qualitative indicators.

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