

Research on the Transformation and Upgrading of Construction Industry under the Background of "Internet Plus"

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Abstract

In July 2015, the State Council issued the "Guiding Opinions on Actively Promoting "Internet Plus" Action", and China entered the era of Internet+. As a pillar industry for economic development, manufacturing industry faces the urgent need for transformation and upgrading in the context of the Internet+. This article combines the development status of the construction industry, analyzes the deficiencies of traditional construction methods, and studies the inevitable development mode of transformation and upgrading of prefabricated buildings. Based on this, it combines BIM technology and 3D printing technology to the future direction of the construction industry. Looking ahead.

Keywords

Construction industry; Fabricated building; BIM technology; 3D printing.

1. The background of the construction industry

After decades of rapid development of the construction industry, the growth rate of the industry has slowed down significantly since 2011. The year-on-year growth rate of the total output value of the construction industry in China was only 2.3% in 2015, which is the lowest value since 2000. On January 18, 2018, the National Bureau of Statistics announced that the nation's total output value of the construction industry in 2017 reached 214.0 billion yuan, a year-on-year growth rate of 10.5%, but still far below the Compound Annual Growth Rate of about 20% in the past 20 years. At present, China is in a period of rapid urbanization. In 2017, the urbanization rate of the entire population has increased from 47.50% in 2010 to 58.52%. The "13th Five-Year Plan" outlines that by 2020, the urbanization rate in China will reach 60%, and it is expected that by 2030, the urbanization rate in China will reach about 70%. Compared with developed countries, the urbanization rate in China is still at a relatively low level.^[1] The continuous increase of urbanization rate has directly promoted the rapid development of the construction industry. Therefore, although the construction industry is still in a bottleneck period, it also faces unprecedented opportunities for development.

However, the overall labor productivity in the construction industry in China is generally low, the problem of resources and energy consumption is serious, construction environmental pollution problems are increasingly prominent, the quality of construction workers is low, the construction life is short, and there are many problems in the quality and safety of construction projects. These problems are all related to the fact that China's construction industry has always been a labor-intensive industry and uses more traditional technologies for production. Therefore, the construction industry needs a more advanced production method to change the status quo. Especially under the background of Internet+, the combination of the Internet and traditional industries has become an inevitable trend.^[2]

On February 22, 2016, the State Council issued the "Guidance Opinions on the Development of Prefabricated Buildings", which requires that prefabricated concrete structures, steel structures, and modern wood structures be fabricated according to local conditions, and strive to use a period of time

of about 10 years to make prefabricated buildings. The proportion of buildings in the newly constructed buildings reached 30%.^[3]

There are many advantages of prefabricated buildings, and the country is also strongly advocating such building methods. However, with the promotion of this new technology, many problems are gradually exposed. At this time, we also need to think about some new countermeasures to solve these problems.

2. Prefabricated buildings to improve the traditional construction industry pain points

At present, the construction industry in China mainly adopts the on-site pouring method. This traditional method requires a lot of labor and time, and the site is chaotic and difficult to manage. The prefabricated buildings will be completed in a large number of building components in the workshop, the site only need to spliced and assembled, the construction speed, but also saves a lot of labor, but also better guarantee the construction quality, but also more energy-saving and environmental protection. Compared to traditional construction methods, prefabricated buildings have the following advantages:

- (1) Improve production efficiency. The components of the prefabricated building are mass-produced on the factory floor and will not be affected by the weather at the construction site. At the same time, part of the production process will be reduced, and the time utilization rate will be greatly improved.
- (2) Reduce labor costs. Construction workers are aging so much that young people are reluctant to do dirty work such as building walls. The traditional wall-building method of building a wall with a length of 8 meters and a height of 3 meters requires two workers to work for 4-5 hours, which is slow, time-consuming and laborious. The use of prefabricated construction produces a high degree of mechanization, which can reduce the number of construction workers on site and reduce the safety hazards of many workers.
- (3) Increased construction quality. The quality of construction site personnel is uneven, management is difficult, construction quality is greatly limited, and prefabricated buildings are pre-manufactured on the factory floor, with controllability, pre-adjustment of production conditions and guarantee of wall quality.
- (4) Protect the environment and save energy. Traditional construction methods require large amounts of water and wood, and dust and noise pollution. The production of prefabricated buildings does not require scaffolding, bamboo-wood springboards, nylon protective nets, and other facilities, reducing a large amount of construction waste, construction sewage, and construction site dust. Energy saving and environmental protection.^[4]

3. The combination of prefabricated buildings and BIM optimizes the construction process.

The full English name of BIM is Building Information Modeling. BIM uses 3D modeling to add relevant information generated during the entire life cycle of the construction project to the 3D model, and controls, manages and manages the design, production, construction, decoration, and management processes, and completes the project at each stage. Continuously update existing databases, and finally establish a multidimensional data model. Through the establishment of a multidimensional data model, information related to various phases of the project is integrated through an information model to build an information platform that can be shared by all parties. For prefabricated technology, the BIM platform can effectively increase the efficiency of the entire process from design, production to construction^[5].

- (1) Improve efficiency at the design stage. Professional design engineers can upload design plans to the BIM database for information integration, communicate information with component manufacturers, and can also better combine the needs of the constructors and design different types of models.

(2) Improve production quality at the production stage. Assembled building adopts the parts of workshop production and assembly to form the whole building. Once the production of components fails, the design cannot be reflected and the construction cannot be carried out. Therefore, the production quality and precision are more required to complete the assembly on site. There is a big error in the traditional method of plastering and building walls. However, BIM 3D modeling and building visualization can achieve "What you see is what you get".

(3) Use BIM for cost budgeting. The traditional cost calculation requires a lot of manpower and material resources, which affects the normal construction of the schedule, and it is prone to mistakes and losses to the project. However, with BIM technology, the cost personnel can provide a full range of engineering data through BIM modeling and improve the cost accuracy.

(4) Help with construction project management. In the construction phase, BIM's 4D visualization management is used to integrate human, material, and financial resources for communication among all parties. This can ensure the smooth progress of the project, follow-up construction, and integrate project data, so that the owners and leaders can understand the progress of the project^[6].

(5) BIM helps reduce construction costs. As we all know, the cost is always the concern of the construction party. With BIM technology, the controllability of the cost will be greatly improved. Establish a 3D model and database on the construction site, transfer cost data to the data model, coordinate projects to avoid conflicts, reduce rework, dismantle, save a lot of labor costs and raw material costs, and generate huge benefits.

4. 3D printing technology helps the construction industry

At present, the country's respected BIM plus assembly building model has been promoted. Both internal and external bearing walls, laminated plates, balconies, air conditioning panels, stairs, prefabricated beams, and prefabricated columns can all be pre-manufactured^[7]. However, although prefabricated buildings can make all components manufactured in advance in the factory, they also have a large amount of logistics transportation costs, and they can only be transported in small pieces. In addition, not all walls can be manufactured ahead of time, transported for on-site assembly, such as non-retaining walls such as non-reinforced brittle wall, easily destroyed during transportation damage, so most of them still use traditional artificial wall Manufacturing takes time and effort. In addition, the molds of prefabricated buildings are fixed, and production workshops are required to be mass-produced. It is difficult to complete the diversified construction needs of the current market, and it is even more difficult to complete some individual customizations. The application of 3D printing technology to the construction market can make up for areas that prefabricated buildings cannot achieve, and can even have a major impact on the future home improvement and personalized product markets^[8].

4.1 3D printing rapid prototyping non-load bearing wall

With the rapid development of China's construction industry, the amount of wall construction has been increasing year by year, and non-bearing walls account for 62.2% of the total construction area of houses. Most of these are artificial structures, and the market for non-bearing wall construction is very broad. In addition, most of the real estate market in China sells only rough housing that has only undergone initial renovations. It needs to undergo a second renovation and the existing building layout will not be able to satisfy residents.

The use of non-bearing-wall 3D rapid prototyping technology and equipment can greatly improve construction conditions, improve construction efficiency, and solve the problem of difficult pre-manufacture of non-load-bearing walls. In addition, the equipment has a compact design structure, flexible construction site movement, and greatly reduced Labor intensity, to solve the aging of the construction market, and other advantages.

The existing 3D building wall equipment consists of a mixer, a grouting machine and a telescopic template. When it is used, it is first assembled according to the requirements of the wall size, and the template is automatically connected to the main machine and the auxiliary machine. After the mixer

feeds on the ground, the mixer starts to stir, and the mixing bucket starts to rise. After the maximum height is reached, the discharge valve is opened to release the slurry. After the pulp is released, the mixing bucket is lowered to the lowest point and the material is added until the first layer of the template is poured completely. After the first layer of the wall is solidified, the height of the template is increased, and the above process is repeated until the entire wall is poured and the equipment is miniaturized to facilitate entry into the construction site [9].

The traditional way to build a non-bearing wall with a length of 8m and a height of 3m requires two workers to work for 4-5 hours. With this method of building a wall, only one person can work for one hour and quickly form a non-bearing wall., greatly reducing construction time and labor costs, raw materials for industrial waste fly ash, energy saving and environmental protection. Construction companies and construction companies can put 3D rapid prototyping technology and equipment for non-load-bearing walls into the construction site to improve construction efficiency and safety and reduce labor costs. In addition, regardless of rough houses, new houses or second-hand houses, users can personalize and customize their homes to create more innovative ideas and create a favorite family structure.

4.2 Home improvement market: 3D printing + block chain

In addition to 3D rapid prototyping equipment, it is also possible to create distributed manufacturing sites for building and home improvement 3D printing. On this basis, 100 components can be produced at 100 distributed manufacturing sites, and there is no need for warehousing and logistics. BIM can also be used as a 3D printing designer platform. Customers can communicate with designers on the platform according to their own decorative needs, design their own models, and realize innovative ideas and personalization.

Connecting online designers directly with users can save a lot of intermediate links. For example, if you want to customize a sofa, you only need to upload design requirements on the platform to achieve global distributed, collaborative design and manufacturing. All parts are delivered home, you can assemble into a complete sofa.

Personalized production will gradually become mainstream, which requires a higher flexible production capacity, can adapt to production requirements more quickly, produce optimal resource allocation methods, and use the combination of distributed manufacturing and big data to promote the new development of the home improvement market. .

5. Conclusion

In the context of the Internet+, the transformation and upgrading of the construction industry will continue to focus on prefabricated architecture and BIM technology. As the emerging Internet technology, 3D printing will be used in the construction industry to bring into play its precise characteristics, diverse materials and environmental protection. The traditional construction method of the construction industry has constrained the designer's ideas. 3D printing can turn imaginations into possible, has huge market potential and industry competitiveness. In the near future, 3D printing can help the development of the construction industry and become the construction market. A big weapon.

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