Article

Prospects for the application of modern wood construction in China based on SWOT analysis: Towards socially sustainable cities

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Abstract: ***Background:*** The "green, harmonious, and sustainable" concept is popular today. The building demand in China is also increasing. The wood is an environmentally friendly building material. The Chinese government has recently started promoting the use of wood frames in the building industry. ***Purpose:*** The development of the timber frame construction industry is slow. Due to the late start of wood frame construction, the related industries lack technology and regulations. This study proposes systematic measures for the wood frame construction industry in China. ***Methods:*** This research reviews the current developments in the Chinese wood frame construction industry, using questionnaires and data to define its internal and external environment. It uses the SWOT analysis method for analysis. It summarizes the advantages and disadvantages of the Chinese wood framing industry's sustainable development at present opportunities and challenges. ***Results:*** The article systematically suggests government support and talent cultivation, increasing publicity and science education, improving regulations, and improving standards and supervision systems. ***Conclusion:*** The market for wood-frame construction in China is very broad. The development of wood-frame construction will enhance the development of related technologies and policies. It is an important step in the sustainable development of the Chinese construction industry.

Keywords: Wood-Frame Construction, SWOT Method, Systematic Suggestions, Green Building Materials, Sustainable Development

1. Introduction

1.1 Research Background

In recent years, global climate change has received attention worldwide. In 2015, countries signed The Paris Agreement. This means these countries will take relevant measures to deal with climate change after 2020. China will boost its national contribution, enact stricter laws and regulations, strive to reach the lowest CO2 emissions by 2030, and become carbon neutral by 2060 (Xi, 2020). In China, the construction industry is an important pillar. However, it is currently facing serious environmental problems. The foremost is the high energy consumption, occupying 50% of the country's total energy consumption (Gong, 2019). Secondly, there is greater environmental pollution. To reduce its carbon footprint, the Chinese government has made great efforts to develop green energy-saving technologies and promote green buildings by introducing relevant policies (Xu, 2018). Wood-frame buildings are more environmentally friendly compared with other building materials and structures. Their total direct (daily operation of the building), indirect (transport of building materials), and hidden carbon emissions (carbon emissions of the wood itself) are relatively small.

Wood is a renewable, recyclable building material that is theoretically green and can sequester carbon. It can be reused and processed without significant carbon emissions. Wood as a building material is important in regulating the environment and climate. Developing wood as a building material is an important step toward low-carbon emissions. It is a sustainable development route for the domestic construction industry. Modern processed wood has excellent performance. Firstly, the wood building is fire resistant. This is achieved by controlled burning of the wood. This controlled burning forms a protective film on the wood's surface. This prevents oxygen from entering the wood and protects it from burning. Fire resistance and flame retardancy values are mostly used to illustrate material's fire performance/resistance. Based on experimental data, the fire resistance of timber structures is 1.3 and 1.7 times higher than steel structures and concrete structures, respectively (Sun, 2021). The wood's strength per unit mass is also higher than other materials. The strength-to-weight ratio of general reinforced concrete is 251.3. However, the strength-to-weight ratio of wood is 351.8, indicating wood's high strength (Sun, 2021). In ancient China, a complete system of wood-frame construction was established. However, modern wood-frame construction in China has been stagnant. This is because China's population growth, deforestation, and land reclamation over the past century have reduced the wood supply. Subsequently, key universities stopped offering wood construction courses, leaving the discipline stagnant and reducing professionals for at least 20 years (Shi, 2006).

1.2 Research Purpose

This study aims to illustrate the importance of wood-frame buildings in reducing carbon footprint in China. The general public has misconceptions about wood-frame buildings due to insufficient publicity/knowledge. Firstly, most people believe that it destroys forest resources, and secondly, wood-frame buildings' are not as strong as other structures. These misconceptions have hindered the wood-frame building industry's development. Since little information is available in the existing literature, this paper attempts to fill gaps through the dynamics of the wood frame construction industry.

1.3 Research objective

In this paper, a random survey was conducted online, targeting relevant people. By analyzing the specific situation and the understanding of the survey respondents, we can understand the general public's view of wood frame construction. Using CNKI and other platforms, we studied relevant literature to understand the current stage of Chinese modern wood structure technology and other development dynamics. We macroscopically summarized the current situation of the wood structure construction industry.

1.2 Research method

This paper designed a questionnaire/survey for collecting internal and external factors affecting the promotion of wood construction. It used SWOT analysis to analyze the status of the wood construction industry based on the questionnaire survey and literature research. It obtained/proposed a suitable strategy for applying wood construction by combining it with the SWOT strategy analysis. SWOT analysis can be used to analyze the relevant construction industry's development path (Wu, 2018).

2. Literature Review

2.1 The dynamics of wood construction in the context of carbon peak and carbon neutrality goals

"Low carbon emissions" has gradually become the focus worldwide. Many countries are committed to developing a low-carbon economy, low-carbon living, and low-carbon design. For example, the Roadmap 2050 is a long-term plan for a low-carbon economy in the European Union. It places energy efficiency, energy conservation, and emission reduction at the forefront. In Sweden, the Climate Commission proposes that 80 percent of buildings (including the existing buildings) could be retrofitted and upgraded to energy-efficient buildings by 2050 (Yu, 2020). Due to abundant forests and improved wood processing technology, modern wood construction has been vigorously developed in Europe, America, Japan, Canada, and other countries and regions. Modern western wood frame buildings are divided into light, ordinary, and heavy wood frame buildings (Shi, 2006). These wood structures have high strength, earthquake resistance, fire resistance, and good insulation properties. They are widely used in industrial and commercial buildings. Foreign countries are still on the wood structure building technology for new research and exploration. The research and actual construction projects related to medium and high-rise wood structure buildings are also increasing yearly. The local government built Australia's tallest timber structure in Brisbane, Australia. It is 45m high with 10 floors. In 2019, Norway built an 85.4m building with a CLT panel structure. It is the tallest timber structure building at present.

The Chinese government is also focusing on the development of low-carbon buildings. In September 2021, the Opinions of the State Council of the Central Committee of the Communist Party of China provided a comprehensive and systematic plan for peak carbon and carbon neutrality targets. The construction sector is one of the most important carbon emission areas. China's existing building area is more than 40 billion square meters, and the yearly construction rate is about 2 billion square meters. With 13% annual consumption of building materials, the total energy consumption of buildings has reached 50 percent of the country's total energy consumption. (Forest Industry, 2019). The timber industry is green and low-carbon, with low energy consumption and environmental pollution. The Department of Building Energy Efficiency and Science and Technology issued a notice to use modern wood construction technology. It is an important attempt to achieve energy conservation and emission reduction goals in the construction industry. It is also an important strategy for dealing with climate change. The housing and urban-rural planning authorities should comprehensively understand the advantages of contemporary wood construction, energy conservation, and earthquake resistance. The relevant departments should publicize and promote this technology (Building Science and Technology, 2018). Universities and research institutes that research wood-frame buildings are cooperating. However, the research is still in its infancy with different research directions and focuses. For example, Tongji University's research focuses on the seismic performance of wood structures, while the Wood Structure Research Centre of Harbin Institute of Technology focuses on the structural design of wood structure buildings. It is important to ensure the supply capacity of timber resources and optimize the energy consumption structure under China's current "double carbon" target (Lao, 2021).

Wang (2017) provided a more detailed discussion of the research progress of the new generation of heavy-duty CLT wood buildings at home and abroad. Ningbo Sino-Canada Low-Carbon New Technology Research Institute represents China's first prefabricated timber components assembly line. It aligns with China's actuality and owns independent intellectual property rights. It has been developed to compensate for China's shortcomings in this area. Raw materials and technology provide the background for developing wood-frame construction in China. The increase in population density in large cities and the continuous development of material technology have promoted the development of multi-story wood-frame buildings (He, 2019). However, the standard codes for modern wood-frame construction need improvement. Also, the wood-frame construction industry lacks momentum. Yue (2015) argued that China's wood-frame construction lacks independent innovation and relies

heavily on imports. The industrial development of heavy wood-frame construction needs to be further strengthened to improve market competitiveness (Yue, 2015). The government should publicize wood construction, develop the timber market, subsidize the timber market, stimulate the related economy's development, and strengthen the cultivation of talents related to wood construction.

2.2 The Impact of Timber-frame Buildings on urban carbon emissions

The starting point for constructing an urban ecological civilization is the harmonious development of the natural environment and the human habitat. Wooden buildings should be promoted due to low energy consumption, low pollution, low carbon sequestration, and other characteristics. Based on experiments, wooden buildings can save energy and reduce emissions (Yuan, 2011). Trees have a high carbon sink capacity, with an average of 1.9 tonnes of carbon dioxide absorbed per tonne of wood. The construction of national forest cities is expected to benefit greatly from converting building materials into wood. It will also contribute to resource conservation and the successful transformation of the construction industry (Wang, 2020). Using wood on a large scale to construct new buildings could reduce global carbon emissions by 9 percent per annum between 2020 and 2030 (Austin, 2020). This will, in turn, limit the global temperature increase to less than 1.5 degrees Celsius. Austin assumed that 50 percent of new urban construction is dominated by multi-story or high-rise buildings (Austin, 2020). He calculated that replacing traditional building structures with wood could reduce carbon emissions by 69 percent. Future urbanization and population growth will result in high demand for more residential buildings, commercial buildings, and supporting infrastructure (Churkina, 2020). They studied the long-term carbon storage potential of high-rise engineered wood structures in metropolitan areas. Churkina found that long-term carbon storage in timber frame structures can be achieved using stronger architectural detailing. This extends building's service life, conserves resources, encourages the reuse and recycling of old timber, enlivens the global timber market, and promotes the sustainable management of forests.

2.3 Policy and Government Functions

As a new and promising building material, various countries have introduced laws and regulations to promote timber frame construction. Milestone investigated the regulations in some countries (Milestone, 2019). Finland has national plans for timber frame (2011-2015) and wood construction. (2016-2021) Norway has an innovation plan and a plan for a new bio-economy. (2017-2019) Sweden has a national forest plan and a wood and forest sector research strategy. Increasing the profitability of the woodworking sector and the competitiveness of wood as a construction material is the primary goal of all initiatives. However, these measures also have several shortcomings, such as stricter fire safety regulations, lack of active promotion by local authorities, discriminatory practices by insurance companies, and increased additional costs for timber construction (Maniak, 2021).

Policies should consider macro and micro levels. Luo (2017) studied Chinese and Japanese consumers' willingness to pay for modern timber structures. He found that Japanese consumers prefer homes to hotels. This could be due to the higher knowledge level of Japanese consumers. This could also be the reason for Japan's high proportion of timber-frame buildings. Therefore, the government should be open and inclusive in introducing laws and regulations to promote timber frame construction. The Ministry of Industry and Information Technology and the Ministry of Housing and Urban-Rural Development issued the Action Plan for Promoting the Production and Application of Green Building Materials (2016). It proposes promoting wood-frame construction in cities and towns. In the same year, the General Office of the State Council's Guidance on the Vigorous Development of Assembled Buildings also proposes promoting

wood-frame construction in suitable places. There has been a fundamental change in the country's situation and understanding. Environmental protection and the reduction in greenhouse gases are becoming essential prerequisites. As an advanced heavy timber material, CLT has also received national support but has faced many obstacles (Ge, 2023). Liao (2017) indicates that due to advancements in processing technology, small poplars native to China can be used as raw materials for CLT timber. In 2019, the China Construction Industry Press published the Cross-Laminated Timber (CLT) Structural Technology Guide, which makes domestic wood structure design specifications. The Chinese government is pursuing green, low-carbon development in line with global trends. Low-carbon development is a key strategy for China's economic, social, and ecological civilization development. It is a crucial step toward effectively reducing greenhouse gas emissions (Yang, 2022).

3. SWOT analysis of the wood frame construction industry

3.1 Questionnaire design and analysis of results

The questionnaire consists of three aspects: the profile of the respondents, the knowledge of wood architecture, and the evaluation of wood architecture from three aspects. The survey targets are non-professionals related to architecture, design enterprises, consulting organizations, schools, clients, and other units related to architecture. For the degree of understanding of wood construction, the respondents were inquired about their understanding of it and familiarity with the current building structure. The respondents' views on the pros and cons of wood frame buildings were collected for the public's comments on wood frames. A total of 100 copies were distributed via the internet. A total of 100 valid questionnaires were received. Specific analyses are presented below.

Figure 1 shows that most residents only live in wooden buildings and are unaware of modern development dynamics. Figure 1 also shows that most survey respondents only know the traditional, modern building structure. They are not clear about the specific structure of modern wood structure. It can be inferred that the current promotion of modern wood structure building is not ideal, and most of the research respondents don't know the development status of modern wood structures.

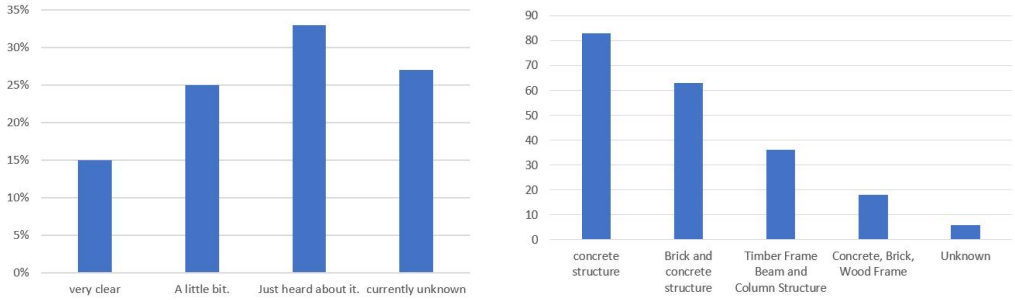

Figure 1: Situation of understanding of wood-frame construction and modern building structures

This survey used an open-ended questioning format. Therefore, the respondents gave inconsistent answers. Figure 2 shows that most people agree that houses built with wood have an aesthetic value and are in line with environmental protection. Also, people recognize the naturalness and comfort of modern wooden buildings. However, the advantages of wood construction over other structures are not mentioned.

On the other hand, Figure 2 shows that people generally agree that wood-framed houses are more prone to fire, and the other mentioned disadvantages almost always contradict the advantages of modern wood-framed construction. It implies that many people do not understand the performance of modern wood-framed buildings. These are some of the problems preventing the development of modern wood-framed

buildings in the Chinese market. The results should be offered in a logical sequence given the most important contents.

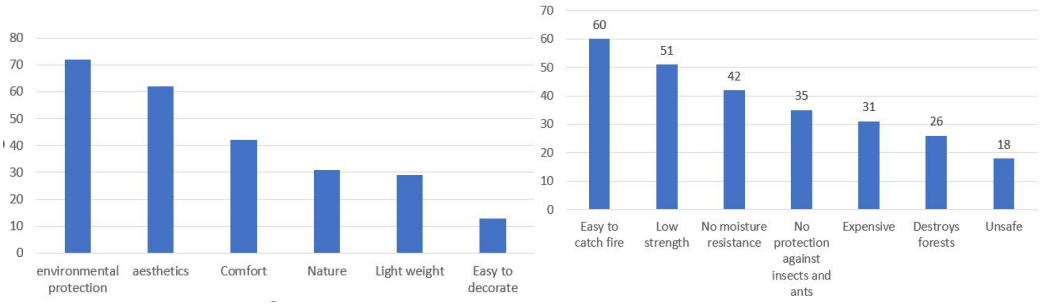

Figure 2: Positive and Passive comments on wood-frame construction

3.2 Existing Research on the Factors of Advantage in the Application of Wooden Buildings

3.2.1 Promoting the development of green industry

Wood frame construction requires ample timber and related technical support, which in turn requires a large amount of labor and technical support for the cultivation, processing, and transportation (Chen, 2014). During 2014-2015, the wood-frame construction progress in China was relatively slow due to the general downturn in real estate and the constraints on small property housing development. Since then, the development focus has shifted from the housing industry to the culture, tourism, clubs, and public facilities industries. The overall market share/market size in the construction industry is increasing. Also, the market size of China's timber frame industry is expanding. The wood frame industry is divided into upstream, processing, and downstream industries, forming a complete industrial system. It is shown in Figure 3.

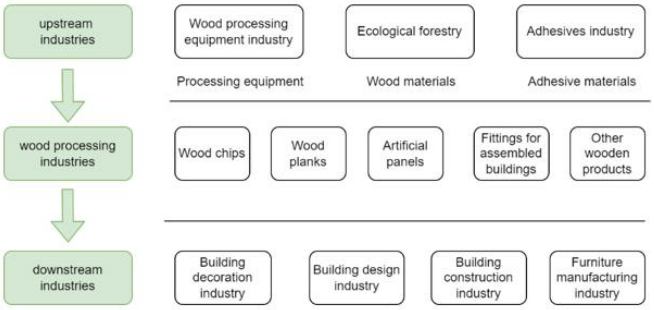

Figure 3: Industries related to timber construction

As shown in Figure 4, from 2014-2018, China's wood construction market grew from 12.71 billion yuan to 17.44 billion yuan, with a compound annual growth rate of 8.2%. In the next five years, under the encouragement of policies such as the Opinions of the General Office of the State Council on Promoting the Continuous and Healthy Development of the Construction Industry and the Guiding Opinions of the General Office of the State Council on Vigorously Developing Assembled Buildings, China's cultural tourism (Zhu, 2016). This rapid development of the wood structure construction industry will reach 28.93 billion yuan in five years.

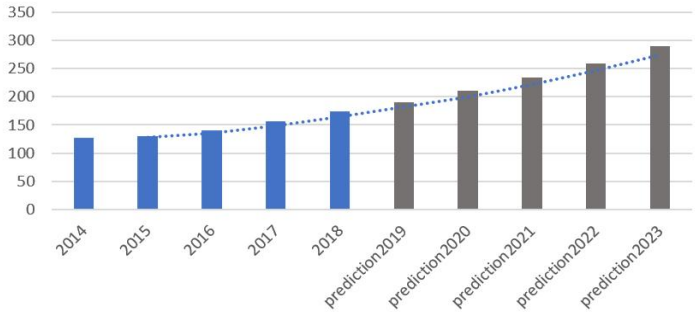

Figure 4: Market size of timber frame construction industry in China

3.2.2 Increase employment opportunities in timber frame-related industries

According to the data of "China Modern Wood Structure Building Market Research 2018", China's wood structure enterprise industry development is wood structure building, and its related enterprises numbered about 300. More than 80% are private enterprises with a few state-owned and foreign-funded enterprises. The number of wood structure enterprises in the northern and eastern coasts accounts for more than 70% of 232 enterprises continuously producing and operating wood-structure products (China's Wood Structure Building Group Industry Enterprise Directory). Registered wood structure building enterprises are increasing yearly <cite here>. The jobs related to wood-frame buildings require specialized talents, such as architects and engineers, manufacturing and installation, logistics and transportation, building maintenance and management due to the increasingly mature energy and wood-frame building technologies. A large number of employment opportunities are available.

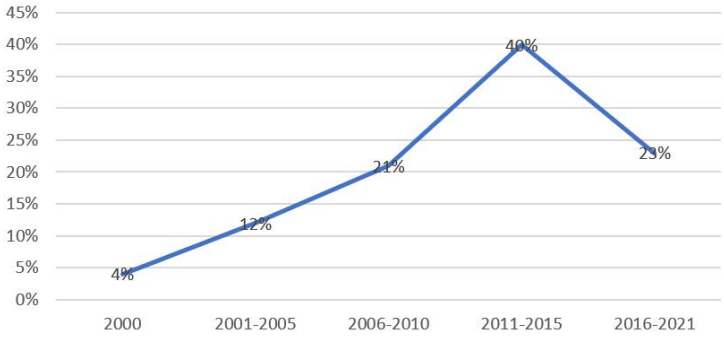

Figure 5: Market size of timber frame construction industry in China

3.2.3 Promoting sustainable and relevant technologies and policies

Promoting modern wood structures means that China's wood structure building norms will be constantly updated and improved. It will also promote green technology development. In recent years, the Ministry of Housing and Urban-Rural Development (MOHURD) has formulated and improved a series of norms and standards related to wood-framed buildings and wood products, gradually forming a complete technical standard system. In August 2015, the Ministry of Industry and Information Technology (MIIT) and the Ministry of Housing and Urban-Rural Development (MOHURD) issued an Action Programme for Promoting the Production and Application of Green Building Materials. It proposes promoting wood-framed buildings in cities and towns, especially agricultural buildings. In February 2016, The State Council issued Several Opinions of the Central Committee of the Communist Party of China and the State Council on Further Strengthening the Management of Urban Planning and Construction, proposed advocating modern wood-frame buildings and assembled wood-frame buildings. It requires compliance with the eight-pronged policy of applicability, economy, greenness,

and aesthetics. The same year, the State Forestry Administration issued the Circular on Vigorously Promoting the Development of Forest Experience and Forest Wellness, which emphasized adopting wood-framed buildings for forest tourism. In 2017, the Ministry of Housing and Urban-Rural Development issued the Action Plan for the 13th Five-Year Plan for Assembled Buildings. It identifies the key development areas and formulates a national development plan for a wood-framed building. The Ministry of Housing and Urban-Rural Development also issued the Action Plan for the 13th Five-Year Plan for Assembly Buildings. Compared with advanced countries, such as Europe and the United States, China's relevant standards and norms are still significantly behind. Therefore, the vigorous promotion of modern wood-frame construction will encourage the country to improve further and implement the policies of wood-frame building approval and design specifications. It will accelerate China's wood-frame buildings' commercialization and marketization process (Wang, 2016).

The development of modern wood structure buildings promotes the development of related technologies. Many educational institutions and organizations have been actively researching and providing education related to wood-frame buildings. Nanjing Forestry University, Inner Mongolia Agricultural University, and Central South Forestry University of Science and Technology have set up teaching programs to cultivate talents specializing in wood-frame construction and materials-related disciplines. Nanjing University of Technology has established a mechanism for assessing the rolling shear performance of CLT. Tongji University has developed a seismic design method for steel and wood hybrid structures. Harbin Institute of Technology has created/developed a method for determining the strength design indexes of wood and wood products. The new wood structure technologies have further enhanced the industry ' s core competitiveness and independent innovation ability.

3.3 Existing Research on Disadvantageous Factors in Wooden Building Applications

There is no complete industrial chain in China, and the wood construction industry's upstream and downstream industrial chain is not yet perfect. The fast-growing species planted artificially can hardly meet construction needs. It led to the stagnation of construction timber treatment technology and the modern timber industry. Several modern wood structure building components and other related wood structure enterprises exist in China. However, the ability to conduct research and development is urgently required. Most of these enterprises are too small in scale and lack effective resource integration.

The current domestic policy planning has some issues. There is some resistance to the advancement of wood-frame buildings. At the national level, documents such as "Opinions on Promoting the Continuous and Healthy Development of the Construction Industry" encourage the development of wood-frame buildings under local conditions. However, the current local policy documents of provinces and cities have not formed specific, feasible regulations and measures or formulated planning objectives. Among the local documents, only the General Office of Jilin Provincial People's Government's "Guidance on Promoting the Development of the Wooden Structure Building Industry" has an exhaustive plan for wooden structure buildings. However, other provinces still lack the details of implementation, which also considerably impacts the industry players. The scale of China's wood construction industry is still very small. In 2018, China's wood construction companies reached more than 1,200, but its market size is less than 20 billion yuan. This shows that China's wood construction industry is small-scale and decentralized. It has yet to become an industry with a certain degree of influence. Most timber frame construction companies do not exhibit self-restraint or self-development posture.

The research on engineering materials lags behind developed countries and regions. This leads to a perception that wood-frame construction still uses traditional materials

and is prone to fires. The non-development of China's wood-frame building industry resulted in low market recognition. In addition, the current application scenarios are mostly cultural tourism buildings, clubs, and other scenarios. This creates an impression that these buildings belong to the high-end market. There is an impression that they cannot meet ordinary owners' pursuit of economic benefits and high cost-effectiveness, leading to low market recognition of traditional wood structure buildings.

3.4 SWOT Analysis for Wooden Building Applications

SWOT analysis can be used to assess new directions for organizations and industries. It can also be used with the AHP to provide quantitative assistance (Zheng, 2016). It categorizes the object ' s influencing factors into strengths, weaknesses, opportunities, and threats (Dou, 2021). As a green building, modern wood construction is not sufficiently/adequately used in the domestic environment. Based on the questionnaire and literature results, this paper/research/study makes a SWOT analysis criteria for wood frame buildings, as shown in Table 1.

Table 1 SWOT analysis of the timber frame construction industry

Strength	Weakness
●Wide domestic market ●Wooden buildings offer good performance ●Improving the green building industry ●Increase employment opportunities in related industries ●Stimulate the development of relevant science and technology and policies	●Lack of resources per capita ●Technologically backward ●Fewer actual projects ●Inadequate market regulation
Opportunity	**Threat**
●National policy support ●Wood construction related codes are constantly updated ●Regulations introduced for the timber frame market	●Lack of talent and research institutions ●Lack of core technology leads to high costs ●Lack of publicity and insufficient awareness of timber frame

3.4.1 Strengths

Firstly, regarding commercial performance, the wood construction industry in China has just started. The number of wood-framed houses built is less than one-thousandth of the overall number of houses in the country. Wood is a green, low-carbon, environmentally friendly material with good performance. The future of China's wood-framed construction market will continue to develop rapidly.

The development of wood frame construction will promote other industries. It can stimulate other green building industries, increase employment opportunities, and stimulate the benign development of the construction industry. It will improve wood-frame technology and promote promulgating relevant laws and regulations.

3.4.2 Weakness

China has one of the world's largest artificial forests. The total area of the forest is large. However, China's population is huge, and per capita timber resources are scarce. The per capita possession is very low so import is inevitable.

China's and developed countries' wood structures have a big gap. Countries such as Canada, Japan, and other countries and regions have formed a set of mature wood structure building technologies and theories. Under China's industrialization and urbanization, the steel and cement industries have rapidly developed. However, the wood structure building technology development has come to a standstill. This induces less research practice and insufficient comprehensive and systematic research.

Due to the late start of wood construction in China, the current wood construction companies have a very low level of technology and techniques. Many illegal business people can exploit this opportunity to manufacture inferior goods, bringing significant

safety hazards. It also makes consumers suspicious of the wood construction products, hindering China's wood construction development.

3.4.3 Opportunity

The primary opportunity for promoting wood-frame buildings in the construction industry is related to supporting national policies. Wood-frame buildings can be regarded as green buildings. They can effectively reduce carbon emissions in wood processing, forest planting, and wood management industries. To implement the strategic policy of comprehensively promoting ecological civilization, China's Ministry of Housing and Urban Construction issued a Circular on the Pilot Work of Low-Carbon Provinces, Regions, and Cities in 2010, and the Circular on the Technical Rules for the Evaluation of Green Industrial Buildings in 2015, among others. These policy/legal documents challenge China's energy conservation and emission reduction efforts. This played a huge role in promoting the development of the wood-building industry (Xing, 2022).

Secondly, the relevant national departments have improved the standards and specifications for on-site construction of wood construction and improved the understanding of wood construction. International standards exist for sawn timber, glued laminated timber, and particle board. China's Ministry of Construction and the former Forestry Administration of China have formulated standards related to wood construction according to their situation, such as GB 5005-2017 Design Code for Wooden Structures. It is a series of standards being progressively improved. The introduction of national standards is significant in regulating the market order and promoting the development of China's wood structure industry.

3.4.4 Threat

The construction industry still lacks professional organizations and human resources to explore the technology and application of wood structures. The speculation on the probability of green building and low carbon emissions creates an over-optimistic outlook for the construction industry. The wood structure construction is only limited to the bottom floor of the house in China. There is no complete understanding of the relevant technologies of wood structure construction and the prospect of applying wood structure construction.

Wood structure wood processing technology is a complex technology. This is because domestic-related technology is not well developed and promoted. The wood is imported in the form of large logs every year. In 1997, 4,471,000 m^2 of logs were imported. In 2017, it increased to 55,398,300 m^3. The cost of wood structure construction is high due to imports. It harms the development of China's wood structure construction industry.

Due to the development of modern wood construction technology, the performance of various new materials is better than that of traditional wood. The traditional industry culture and the slow acceptance of innovative technologies will be an obstacle to developing and promoting modern wood construction technology in China.

4. Development Strategy of Wooden Structure Building

Wood-frame buildings have great development potential as a typical representative of green and low-carbon buildings. The government should set the reduction in building energy consumption and carbon emissions as the goal and find a modern wood structure system suitable for China's building needs. Relevant departments and wood-frame building enterprises need to do more work in technical research, specification revision, demonstration project construction, education, and training.

4.1 SO Strategy

In China, systematic research projects are lacking to support the development of wood frame construction. Therefore, governments at all levels can formulate corresponding policies, such as establishing a national knowledge competition on wood frame construction, holding a national wood frame architectural design competition, setting up a special official management organization, and funding related projects. It encourages academic and technical exchanges between enterprises, colleges, universities, and practical construction competitions and knowledge lectures (Huang, 2015).

It is necessary to grasp the country ' s policy direction accurately, accurately determine its market position, and lead the overall wood structure construction industry to upgrade and achieve higher quality development. This improves the management and technical level of the enterprises. The number of enterprises engaged in modern wood structure technology and product services is not dominant. However, they have created more industrial value by continuously improving their technical level and capability.

4.2 WO Strategies

Carry out more optimization of planted forest resources, reduce dependence on imported timber, increase technical research on the use of planted forest timber for wood-frame construction, conform to regional conditions in regions with more abundant bamboo resources, adopt local materials, and develop bamboo building materials and bamboo construction (Huang, 2012).

Increase policy support to encourage the development of green, energy-saving, assembled, medium, and high-rise wood-frame buildings. Consideration can be given to allowing the development and use of wood-frame buildings to enjoy the corresponding preferential policies on energy conservation, emission reduction, and industrialization of construction. The land tax qualification, fire prevention, and fire protection of wood-frame buildings should be improved and refined to accelerate the commercialization and marketization of wood-frame buildings.

4.3 ST Strategy

Carry out publicity and promotion of modern wood construction. Organize publicity and promotion activities such as seminars, exhibitions, and on-site visits to demonstration projects for relevant government departments and ordinary consumers. This will help more people understand the application and advantages of wood construction. China has 50 million hectares of plantation/forests, ranking first globally. Increasing the use of wood in construction can promote the sustainable development of China's forest resources. The timber resources for developing wood frame construction in China can be well guaranteed. The relevant organizations must explain the current misunderstandings about China's lack of forest resources. This makes it unsuitable for the development of timber frame construction, and the development of timber frame construction will cause damage to the environment.

Create a new business model combining wood construction, forestry, ecology, tourism, real estate, and new rural areas. Use project management to promote simple product operation and avoid the harsh environment of cheap competition in the wood construction products market. Thus achieve a win-win situation for wood construction enterprises and developers.

4.4 WT Strategy

Further, improve the standard wood structure system and establish a wood structure product certification system to ensure product quality and regulate market business behavior. Research institutes and units can conduct demonstration projects to apply wood structure building technology, study modern wood structure technology

with Chinese characteristics, and provide practical reference cases for improving specifications.

Strengthen the investment in education, science, and technology. Provide professional technical training on development, design, and construction for supervision personnel of wood structure projects. Also, provide technical guidance for the construction process to ensure the smooth progress of the construction and carry out staged long-term training in major cities. Some colleges and universities offer relevant professional courses to strengthen the training of production, design, construction, supervision, and acceptance personnel related to wooden structures. This enhances/improves technical reserve and improves technical innovation ability.

5. Conclusion

This study used questionnaires and literature to analyze the situation of wood frame construction in China. It discussed the advantages and disadvantages of promoting modern wood frame construction in China. The development of modern wood-frame buildings reduces carbon emissions. It promotes related green industries development, increases related employment opportunities, and promotes related technological progress and innovation.

This study also analyzed the factors hindering the development of modern high-rise wood-framed buildings in China. It summarizes and analyses the current wood-framed building industry using SWOT analysis, formulating targeted strategies. It provides reference opinions for decision-makers, making them understand how wood-frame building technology can be used to reflect its value in the low-carbon sustainable strategic policy. In conclusion, where practical conditions and relevant regulations allow, wood frame buildings have better thermal performance, lower environmental impact, and have a wide range of application prospects and promotion value.

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