Expectation in Chance and Challenge of Technological Development in Building Industry in China

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[Abstract] The Chance and challenge faced by building industry of China at present have been analyzed, with the emphasis on the explanation of development trends in five high-tech fields.
[Key words] construction course; high technology

Introduction

It goes without saying that the building industry has experienced the development at unprecedented speed, which greatly upgrades the integrated level of high technologies applied in building industry in China.

Having entered the new century, China is going to get a ride into a new stage of better-off society and modernization. With the implementation of the first five-year planning of the new century and west-development strategy and the opportunity of hosting the Olympic 2008, it is predicted that in the coming five years the building industry in China will enter a golden period of growth at high speed.

1. Building industry in China is at the critical moment of rare development chance coexisting with fierce challenge

1.1 Rare development chances

(1) Chance one – Construction of infrastructures in the period of the 10^{th} five-year planning

In this period, the fixed assess investment in China will increase by about 8 % annually for infrastructures, based on 3500 billion Yuan per year. They are:

- 800 billion Yuan investment in rail transportation facilities in urban areas, among which 200 billion Yuan for subway. 20 of 34 cities with the population over million will build subway;
- 200000 km of highway, 10000 km of expressway, 7000 km railway and 4000 km double line rail;
- 140 deep water berths and 40 airports;
- power stations with the capacity of 77 million kilowatt, power transmission lines of 60000 km long, and 130000 km electricity network for villages;
- 9.5 million tons of crude oil and 37 billion m^3 of natural gas, and 4 million tons of ethylene;
- additional 290 million households using telephone sets, 80 million households using internet and 1.25 million km of optical fiber cables installed, etc.

(2) Chance two –Development of western part of China

The state government has called on developing the western part of China, aiming at balancing the developed eastern part and developing western one. According to the

statistics, the land area in the 12 western provinces/municipalities/autonomous regions amounts to 70 % of the total and the population 28 %. The GDP in the year 2000 is 1660 billion Yuan, 4560 Yuan per capita. It is 50 % lower than the eastern part where the GDP per capita is 6780 Yuan, and much lower than the eastern coastal areas where the GDP per capita is more than 10000 Yuan. It is politically and socially significant to develop the western part. The primary thing to do is to build the infrastructures there. In the year 2000, the state government invested 70 billion Yuan in the western part for infrastructures, 100 billion Yuan in key projects, which drove the GDP up 8.5%. In the year 2001, the investment in infrastructures increased by 18%, about 80 billion Yuan. Meanwhile the investment in the key projects reached 300 billion Yuan. In the coming years, the investment by the state government will be more than before.

(3) Chance three – Development of housing industry

Over the past years, about 1.7 – 1.8 billion m^2 of new house buildings were completed each year and the cost of housing industry per year reached 300 – 400 billion Yuan, which directly raised the GDP about 2%. The urbanization, digitalization and globalization are the primary characteristics of construction in cities taking housing industry as main business.

The objective of urbanization is to reduce the difference between cities and countryside. By statistics, the average GDP per capita in cities is 12,280 Yuan while that in countryside, only 2,844 Yuan, over 3.3 times of difference between. In China the population in cities is about 37% of the total, while in advanced countries, 75%. To speed up the urbanization and decrease the difference between cities and countryside will promote the sustainable development.

Digitalization and globalization display the era characters of information revolution and global economical integrity. With the coming of information ear, many big cities set up their development objectives and strategies of building digital cities to upgrade their competitiveness (“Digital Beijing” is an example). After entering the WTO, how to develop it and cope with the international rule, and how to emerge itself into the global economy are the new tasks faced by Chinese people. The process of urbanization, digitalization and globalization contains many business chances. For example, the digital Olympic is the most important part of the construction of digital Beijing. It has been reported that Beijing will invest additional US$ 400 million in the construction of information systems for the Games, besides the 30 billion Yuan which has been promised by Beijing Municipal Government to invest in the construction of digital Beijing, aiming at shaping Beijing as an international metropolis.

(4) Chance four – Heat reform technology dissemination, a part of sustainable development in urban construction

The heating area of 3 regions (the north, the northeast and the northwest) of China amounts to 70 % of the total area; population, 50%; and building blocks, 50%. Now there are 36 billion m^2 of existing buildings in China, and each year about 1.7 – 1.8 million m^2 of new buildings are completed. However, China is short of energy resources. The percentage of average per-capita amount of reserves is as follows:

- Coal 50%
- Crude oil 12%
- Natural gas 6%

Paradoxically, China is a huge energy consumption country. The energy consumed by buildings amounts to 27.6% of total energy consumption and the average unit energy consumed by heating building space in China is twice higher than that in the world. There is a long way to go in the energy efficiency for buildings. The dissemination of the heat reform technology will have great effects upon the sustainable development of urban construction and drive the following industries:

- HVAC system and equipment
- Control system matched with heating system
- Radiation
- Pipe network
- Heat sources
- Thermal insulation of building envelop, etc.

It is predicted that over the coming 5-10 years, the production value of above-mentioned industries will reach 80-100 billion Yuan.

(5) Chance five – Construction of Olympic Games stadium facilities and infrastructures

The information provided by Beijing Municipal Government says that 37 stadiums will be built or expanded for the 2008 Olympic Games, in which the Central Government, Beijing Municipal Government and non-governmental organizations will invest more than 300 billion Yuan in the construction of Olympic facilities and infrastructures. It is deduced that from the year 2002 to 2008, Beijing will increase 40 billion Yuan of investment in capital construction each year, which will drive the nation's GDP up 0.3 – 0.4 %, and Beijing's GDP up 5%.

2.2 To view correctly the chance and challenge faced by building industry after entering the WTO

After 15-year hard negotiation, China finally entered the WTO in the year 2001. How to view correctly the chance and challenge and how to work out the counter-measures to meet the international competition are urgent tasks faced by the Chinese people. Actually chance is coexisted with challenge. Following the WTO agreement, the Chinese market of building industry including the following fields must be more open to overseas competitors:

- Construction
- Geotechnical exploration, design and consulting
- Real estate development
- Urban planning
- Municipal utilities
- Engineering services: norms and construction budget

Meanwhile, the overseas construction market is also more open to China and the Chinese companies have more chances to undertake the projects in other countries and to work with foreign companies. In a word, chance and challenge coexist simultaneously.

However, the competition within Chinese building industry is very fierce. When the foreign-invested ventures in these areas are allowed to enter China, the competition will become fiercer.

At present, in China there are 90000 enterprises with 28 million employees working in building industry. The foreign enterprises will be treated in the same way as the Chinese ones within 3 years after entering the WTO;

There are 12000 design institutes with 800000 employees working for the projects with

engineering value of 1500 billion Yuan, and income of 30 billion Yuan. The foreigners can set up design firms in China within 5 years;
There are 27000 real estate development companies with 1 million employees and annual investment of 360 – 400 billion Yuan. All above markets will be open except some projects related to luxury hotels, apartments and office buildings.
We are facing the challenge of multi-corporation with strong financial foundation, advanced technologies and management experiences. The critical challenge is the competition of the talent human resources, of which the key point is the competition of the management mechanism of human resources. The local Chinese enterprises should adopt practical and workable counter-measures to seek survival in the fierce competition by taking advantage of superiority and staying out of inferiority.
In terms of building industry the following points should be taken into consideration:

- To fully assess the new situation and encountered problems and to study the challenge faced by high –technologies;
- To pay great attention to human resources development and to master the game rules of WTO so as to protect the national industries;
- To promote the engineerization and industrialization of research findings;
- To back up the technological innovation in design and construction;
- To keep the national features in the technical regulations.

To grasp the chance and to meet the challenge, the most important issue is to improve the qualification the local enterprise itself and to upgrade its competition. It is only through the innovation in concept, mechanism and technology that the local enterprises can win the competition either in China or in the world.

2. Analysis of high technology development in building industry

The high technology in building industry is the applied technology serving for the traditional industry. The development of high technology and that of traditional industry are complementary to each other. The dissemination of high/new technology can improve the traditional industry and the latter is the support base of high technology development. In the coming five years, the building industry in China will face a historical development chance and the high technology will play a vital role in it.

2.1 Information technology and CIMS technology

Over the past 20 years, information technology was widely applied in the geotechnical exploration and design, and the management of residential quarters and urban areas. The R&D of building CAD, the building intelligent system and the urban e-management system has promoted the application of new/high technologies in traditional industry. The CIMS technology (computer integrated manufacture system) has been initially applied in housing industry, from job description, design, construction, purchasing to property management. It is helpful to raise the production efficiency and technology level through the co-operation between different companies. It is predicted that in the coming ten years, the information technology and CIMS technology will be applied more widely in urban construction and engineering, becoming the main force to improve the traditional industry.

2.2 Technologies of structure safety system

The technologies of structure safety system includes those of:

- super-high structures and steel structures;
- pre-stressing technology and large-span spatial structures;
- earthquake resistance, disaster prevention and structure strengthening;
- underground space and foundation engineering;
- new building materials and additives;
- building fire prevention, etc.

The application of these technologies plays an important role in protecting people's life and property and promoting the industry progress. Nanometer materials will be widely used in building engineering besides sanitary ceramics because of its advantages of cost-effective, weather resistance, keeping color, spot endurance, water-proof, washable and anti-bacteria. The building fire disaster actually comes from the secondary disaster: toxic substance. It is believed the research of materials will make progress in the coming five years. In addition, it is urgent to develop the technologies to assess and inspect the safety of structures. The emphasis of underground space technology will be put on the systematic technologies including planning, design, structure safety, leakage, air-conditioning, fire prevention and lighting, so as to make progress in the application of underground space, which is one of the indexes of international metropolis.

2.3 Energy efficiency technology and air-cleaning technology

Energy efficiency technologies include those of:

- blocks
- frame lightweight building walling system
- thermal insulation of exterior walls
- energy efficiency window/doors and sealing materials
- energy efficiency heating and refrigeration.

Air cleaning technology has been widely used in the electronic products, biology pharmacy and cleaning rooms in hospitals.

Energy efficiency and friendly environment are closely associated with sustainable development. The application of energy efficiency and friendly environment technologies can produce remarkable economical effect, and far-reaching social effect as well. The heat meter technology for high efficiency heating and refrigerating system, constant-temperature control technology, steel radiators, heat sources (ice storage, ground heat and solar energy) and heat transmission technology will be improved in coming days.

The research on the technologies of ecological residential buildings (including the built environment in living quarters, energy and environment, indoor air quality, water, materials and resources), esp. on the technologies of testing and inspection, will make progress.

2.4 Research on the construction of Olympic projects

The objectives of the construction of Olympics are to build green and high-tech stadiums and facilities. Thus the emphasis of research should be put on the following topics:

- The application of green and high technology in the construction of stadiums and facilities
- Acoustics & lighting technology and Olympic stadiums and facilities

- Large-span space technology for Olympic stadiums and facilities
- Earthquake resistance and disaster mitigation technology for Olympic stadiums and facilities
- Quality inspection and evaluation for Olympic stadiums and facilities
- Fire safety planning and evaluation for Olympic stadiums and facilities
- Quality control of materials for Olympic stadiums and facilities

The research projects “Analysis of workability of Chinese building engineering standards and codes to Olympic stadiums and facilities” and “Structural analysis of stadiums with moveable roof” should be completed in the short period.

It is fitting that we should hold the young in awe. How do we know that the generations to come will not be the equal of the present? Undoubtedly, the 2008 Olympic stadiums and facilities will be built into the green and high-tech ones at the world top level.

2.5 Building and construction machinery and equipment

It is believed that the machinery and equipment with local brands of reinforcing, prestressing anchoring equipment, façade cleaning machine and lift-distributor tower crane will dominate the Chinese market and their quality will improve continuously. The remote control technology monitoring the performance of elevators will be more applied in coming days.

3. Conclusion

In a word the rapid development of building and construction industry in the 10^{th} 5-year planning period in China has brought about the rare development chances. However, to face the chance and challenge from entering the WTO, it is urgently needed to accelerate the technical innovation in the industry. We are full of confidence in the research and application of the technologies of information, structure safety system, building energy efficiency, air cleaning, construction machinery and equipment, and the standards and codes in the coming 5 years. And we are full of hope that high technology will upgrade the level of traditional industry and push the industry forward in high gear.

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