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The characteristics and current status of China's construction industry

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The development of China's construction industry is presented by describing its current status and highlighting its achievements, identifying the main constraints preventing the industry from playing a more effective and efficient role in the country's economic development. Fundamental changes occurred in the construction industry after the economic reform, and the industry has been playing a very important role in the national economy, having made impressive progress and been developed at an amazing speed. However, reforms in the construction industry are difficult since this industry is not a single sector. The reform process by its very nature is not systematic. The challenges ahead are serious, and deeper reforms of the economic system are required.

Keywords: China, construction industry, economic reform, business environment

Introduction

The rapid economic expansion in China has resulted many construction activities and has created the largest construction market in the world (Sjoholt,1997). There can be no economic activity without construction. The increase in economic activity has generated, and will continue to do so, a heavy demand for construction within at least the next 10 years. This paper provides a comprehensive study of the development of China's construction industry as a result of the economic reforms by describing the current status of the construction industry in China, highlighting its achievements, and identifying the main constraints preventing the industry from playing a more effective and efficient role in the country's economic development. The sources used in this paper, where not otherwise indicated, are statistics from the publications of the World Bank, *The Economist* Intelligence Unit, the State Statistical Bureau of China and the Ministry of Construction of China (see References).

Construction industry and its role in the national economy

China has been developing at an amazing speed since 1980. Figures 1 and 2 show the growth in gross domestic product (GDP) during 1978–1995, which climbed by an impressive yearly average of 9.4% in real terms during 1980–1991 and 12.8% during 1992–1994. The gross value of industrial output grew by an average annual rate of 17% during 1980–1991, and about 27% during 1992–1993, with a share of 57% in GDP in 1991. The average annual growth rate of agricultural output was 6% during 1980–1990 and 4% during 1991–1993, with a share of 27% of GDP in 1991. The share of services in GDP grew from 23% in 1980 to 27% in 1993. Fixed investment grew at an average annual rate of 13% during 1980–1991 and 23.3% during 1992–1994, with a share in GDP of 32% in 1992. National income grew at an average annual rate of 8% during 1980–1991 and around 12% during 1992–1994. The total value of exports and imports in

1994 were US$121 billion and US$115.9 billion, respectively, with a trade surplus of US$5.1 billion. Foreign direct investment inflows reached US$42.2 billion by the end of 1994, with an average annual increase of 28.1% from 1986 to 1994.

Figures 1–8 present the economic indicators of the construction industry in China and are interpreted in the text that follows (data abstracted from the *China Statistical Year Books* for various years).

Growth of the construction industry

China's construction industry is huge and widespread. Currently the annual output of the construction industry is about US$93 billion. It employs around 24 million people, more than 5% of the total labour force in the country. It accounts for more than 6% of the GDP and has been growing at an average annual rate of about 10% since 1978. The high growth rate of the construction industry is attributable to extreme shortage of infrastructure and building space. This growth rate is likely to remain high in the foreseeable future. The contribution of the construction industry to the national economy, measured by the percentage of construction value-added to the GDP, has been increasing from 3.8% in 1978 to 6.5% in 1994. There was some decline in the construction industry in the early 1990s, due mainly to the 'austerity program' introduced by the government at that time. However, the share of China's construction industry in the GDP is still low compared with developed countries. This implies a strong potential for further growth in China's construction industry.

The majority of construction activities were concentrated in Guangdong province and along the east coastal areas in the field of civil engineering and construction installation work during 1978 to 1994. There is a trend that increasing numbers of infrastructure and energy exploration projects are taking place in the inland provinces. In fact, construction activities have spread all over the country.

Construction output indicators

The gross output value of the construction industry, which was RMB13.9 billion in 1978, had reached RMB382 billion in 1994. The major construction output for this period could be broken down into the

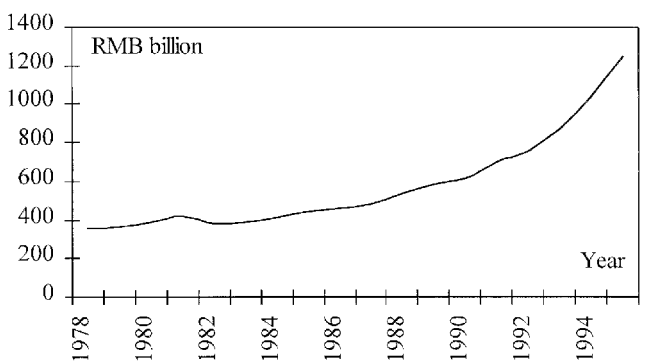

Figure 1 GDP 1978–1995 (RMB bn; constant price; 1978 = 100)

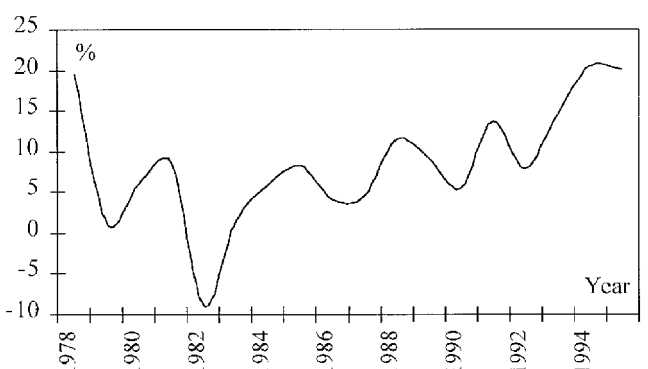

Figure 2 Change in GDP (real terms) 1978–1995

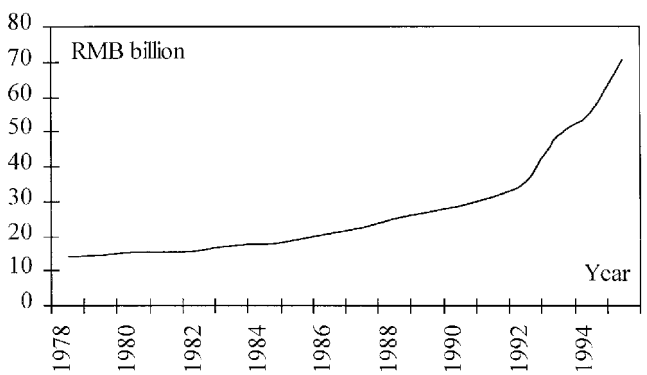

Figure 3 Gross construction output 1978–1995 (RMB bn; constant price; 1978 = 100)

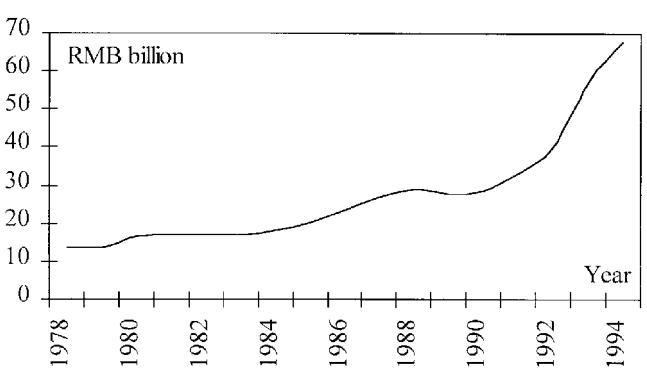

Figure 4 Construction value added 1978–1994 (RMB bn; constant price; 1978 = 100)

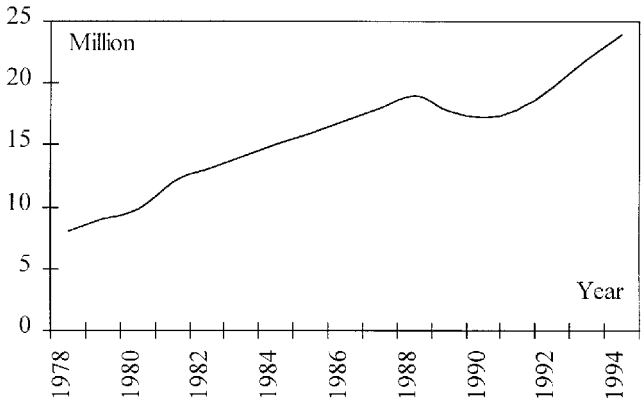

Figure 5 Construction employment 1978–1994 (millions)

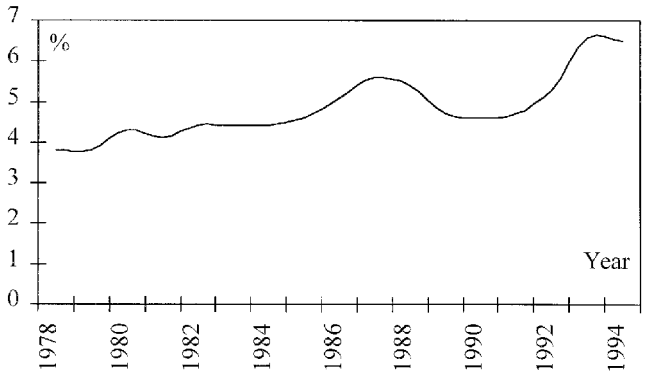

Figure 6 Construction value added as a proportion of GDP 1978–1994 (%)

following: 110 000 megawatts of new electrical generating capacity; 117 million tons of cement production; 7484 km of new railway lines; 41 300 km of new highways; 340 million tons of additional harbour cargo-handling capacity; more than 10 new major railway stations in big cities; over 2 billion m^2 of new residential housing; 9.3 billion m^2 of rural housing; and a large number of public facilities. This was complemented by some 25.4 million tons of additional steel production, 312 million tons of additional coal production and 183 million barrels of additional petroleum recovery.

Construction enterprises and labour force

There are three major types of construction force, acting as contractors, in China: state-owned enterprises (SOEs), urban and rural collectives (URCs), and rural construction teams (RCTs). In 1994 there were more than 94 000 construction enterprises in China. These were composed of about 7250 SOEs with 8.18 million employees, 16 980 URCs with 6.36 million employees and 69 840 RCTs with 9.7 million employees. The rapid growth in construction since 1978 has expanded the construction labour force, which increased from about 8 million in 1978 to over 24 million in 1994.

Linkages of the construction industry to the national economy

Construction typically contributes 5–9% to the GDP in developing countries and provides critical backward and forward linkages to the rest of the economy. In the case of China, the backward linkages are quite significant, and marked by over 10 200 design institutes with 750 000 employees, 1380 supervision agencies with 71 000 employees and very large construction material and service industries. A rough estimate of the employment ratio between construction enterprises and direct and indirect employment in the material and service industries is 2:1. The construction industry also generates large forward linkages to the economic activities which use the constructed facilities. Construction in China is a labour-intensive industry, but wages are low and therefore the value added by the construction industry itself is rather low (6.5% to GDP in 1994) compared with other industries (e.g. 40.9% of manufacturing industry value added to GDP in 1994). However, if the value added by the construction industry included all other backward and forward linkages, it would be large.

Overseas contracting business

The Chinese construction enterprises are increasingly becoming involved in international contracts for engineering projects and manpower services. Since 1979, about 219 900 workers have been sent abroad and the cumulative amount of overseas contracts was US$38.3 billion by the end of 1994, of which the 1994 figure alone was US$6 billion. Most of these contracts were for civil works in developing countries. This has helped the development of the construction industry at home as well. Licences for construction enterprises abroad are issued by the Ministry of Foreign Economic Relations and Trade (MOFERT), mainly to SOEs. Every year, several Chinese corporations have appeared in the list of the top 250 international contractors, published by the *Engineering News Record* (*ENR*). Nine Chinese corporations were included in the 1995 *ENR* list, China being sixth in the international construction market with a share of about 6%. This is a big improvement compared with its 2–3% market share in 1990. Despite these achievements, Chinese contractors

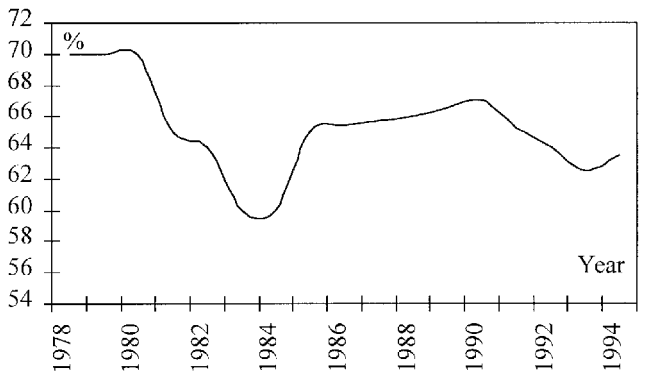

Figure 7 Capital construction investment as a proportion of gross fixed capital investment 1978–1994 (%)

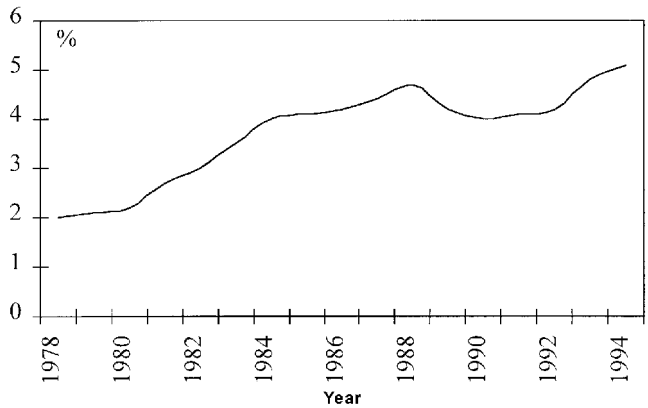

Figure 8 Construction employment as a proportion of the Country's total employment 1978–1994 (%)

face many management and quality problems abroad, due mainly to an alien business environment. In this regard, Chinese contractors could benefit significantly by introducing foreign contractors operating within China.

Construction demand

The demand on the construction industry is closely related to the national fixed capital construction investment scale, which has been increasing rapidly along with the country's economic growth. China's fixed capital investment in 1991 was RMB551 billion, 65.2% of which was in the field of construction and installation. In 1994, the total fixed capital investment reached RMB1637 billion with 63.5% used in construction and installation. The construction industry is very sensitive to the national economy. This was evidenced during the recent austerity program period when the government put tight controls on the state fixed investment through a slowdown in approval of new projects and a credit squeeze. However, since early 1995, construction activities have picked up again all over the country and the short-term prospects look good. The recently formulated Ninth Five-Year Plan (1996–2000) calls for RMB13 000 billion worth of national fixed capital investment over the plan period with about 60% for construction and installation. During the Eighth Five-Year Plan, the total national fixed capital investment reached RMB6219 billion, of which RMB3947 billion were related to the construction industry. The Ninth Five-Year Plan, therefore, is projecting a major boost in the construction industry with an average annual construction volume reaching US$187 billion per year during the plan period. Residential housing and infrastructure will be two key elements of this large construction activity.

Structure of the construction industry

Historic perspective

Prior to the economic reform, China's construction industry had the following features.

- All construction enterprises were owned by the state and its agencies; they lacked horizontal mobility and the experience of other sectors.
- The enterprises had little autonomy with regard to choice of jobs, which were assigned by the government and achieved through administration means.
- Staff were assigned to enterprises which were responsible for meeting the life long social needs of them.
- The international concept of employer, engineer and contractor was highly diffused; they were effectively all in the same agency.
- The supply of materials, equipment, credit and other services were provided by the government through the quota system.

The whole industry thus could be viewed as a single large enterprise with a centralized hierarchical organization in which resources, products and services were allocated almost exclusively by administrative means. While China made impressive progress under this system, it still lagged behind developed as well as many developing countries in construction technology and management.

The construction industry started to change in the early 1980s with the introduction of economic reforms and the opening up process. At the central level, the government started to introduce regulations to set the basic ground rules. At the enterprise level, the entities were gradually given flexibility to operate as 'commercial entities'. Competitive bidding and inter-

national contractors have been introduced. Most construction enterprises, though state-owned, are operating as separate entities competing across sectors and regional boundaries. China's strategies and policies for the construction industry call for competitive bidding, management efficiency, training, increased labour productivity, quality control, advanced technology and greater autonomy and accountability to the enterprises. However, the journey ahead towards a 'socialist market' system is still long and arduous.

Types of construction enterprises

The construction enterprises in China include contractors, design institutes, supervision and engineering consultants.

Indigenous contractors

The contractor is always a key entity in any construction activity, and there are three major types of indigenous contractor in China, namely, state-owned enterprises (SOEs), urban and rural collectives (URCs) and rural construction teams (RCTs). Table 1 summarizes the relative role of the three types of construction enterprises.

It can be seen from the Table 1 that the SOEs did most of the construction work in the past. However, their relative share is now decreasing. The ratio of labour force to number of entities of SOEs is much higher than the other two types of enterprise. This indicates that the SOEs usually have much larger scale in terms of production and employment than the others. The SOEs, which comprise both local units authorized by municipal governments and central ministry-affiliated enterprises, have done most of the construction work of China's infrastructure projects. For some years, notable progress has been achieved in reforming these enterprises in terms of commercial behaviour, operational autonomy and competitive bidding. However, the SOEs still face many unsolved problems, i.e., poor management, old technology and excessive labour force. Compounded by the transitory nature of the reform process, many SOEs are confronted with decreasing work and profits, resulting in losses and closures. The URCs and RCTs, on the other hand, have been developing fast. They now account for over 60% of the construction output value and labour force and are different from the SOEs in that: (a) they are market-oriented and need not rely on assignment of projects, but can more easily look for work in the marketplace; (b) their management has more flexibility with respect to size and workers' benefits of the unit; and (c) they are motivated largely by self-interest because the team's profit is linked firmly to staff income and benefit. The output quality of URCs and RCTs, however, is relatively poor, and their professional and managerial levels are lower than those of the SOEs. They need modern construction technology, better equipment, proper credit and better educated personnel to improve their quality of work. The RCTs, which previously were the main source of labour, are increasingly taking on more construction works.

Foreign contractors

Foreign contractors, in general, have restricted entry to the Chinese market. Most of the foreign entries are in the form of joint ventures. Foreign general contractors in China are allowed to work only on certain kinds of project, such as a foreign joint venture project, a World Bank project, a foreign aid project or a specialist trade project where advanced technology is required and technology transfer to China is a feature of the project. If a Chinese construction company is capable of providing the same end product, foreign contractors may be prevented from taking part. Up to now 118 foreign contractors have been given licences to work in China, and have implemented about 140 construction projects.

Design institutes and supervision and engineering consultants

China has a well-established system of design institutes. In 1994, nearly 10 250 design institutes employed 752 000 employees, double that of 1990. About 44% of the employment in this field is under the administration of line ministries, the rest is managed by municipal governments. In the planned system, these institutes were assigned projects by their respective line ministries or municipal governments. Currently, in most cases, they have to search for the jobs themselves.

Table 1 Construction enterprises in China by type[a]

	Total		SOEs (%)		URCs (%)		RCTs (%)	
	1980	1994	1980	1994	1980	1994	1980	1994
Number of enterprises	57 404	94 942	3.5	7.6	8.0	17.9	88.5	73.6
Labour force (1000)	9785	240 000	49.2	33.8	16.6	26.2	34.2	40.0
Construction volume (RMB million)	347.0	7684.4	63.7	40.0	19.0	21.1	17.3	38.9

[a]Source: *China Statistical Year Books*.

The need to develop construction supervision capacity was felt once contracts started to be awarded to foreign contractors. In the early 1990s, about 400 supervision companies were established which employed about 7000 engineers. In 1994, the supervision agencies numbered 1383 and employed 71 000 staff. Engineering consulting is a new and fast growing field in China. Although design institutes had done some consulting work in the past, they were not called consultants. In general, the technical qualifications of Chinese engineers are very good; however, engineering training is limited to specific sectors.

The Government bodies

The Ministry of Construction

The Ministry of Construction (MC) takes the lead role in implementing the new strategies for developing the construction industry. Its comprehensive responsibilities include formulating policies, preparing development programs, monitoring implementation, training personnel, improving construction technology and managing standards, surveys, design and construction institutions. The central organization of the Ministry is mirrored in the Construction Commissions of the provinces and the independent cities. The line ministries at the centre also have their mirror image structures in the provinces. The bureaux of the line ministries and the local construction commissions are in charge of the majority of construction work in China.

The core agencies

The State Planning Commission (SPC), which is responsible for preparing long term investment plans, has the key role of approving all major projects of the line ministries and municipal governments. Under the current system, the government investment projects are divided into three categories: large size, medium size and small size. Large size investments which are projects of national scope are becoming increasingly rare. Currently, about 7% of the total investment falls into this category managed by the SPC. Medium size investments make up the largest percentage of total investment and are controlled by the line ministries and municipal governments. SPC approval, however, is required at the beginning stage for those projects. Small size projects, defined differently according to sectors and provinces, are handled by local governments and enterprises and need not require central government approval. The State Administration for the Building Materials Industry (SABMI), a separate agency under the State Council, is responsible for all building materials. The SABMI mainly administers the manufacture and mining of the building materials. The State Reform Commission (SRC), which has overall responsibility for macro-economic reforms, has been coordinating with the MC, the SPC and other line ministries to facilitate the reforms in the construction industry. The People's Construction Bank mainly provides construction credit inside the country. It is responsible for issuing loans to construction projects according to the credit quota issued by the People's Bank of China, and reviewing the construction projects at various stages. The Ministry of Foreign Economic Relations and Trade (MOFERT) is responsible for overseas contract business, giving approval for the enterprises to work overseas and taking general administration roles for the Chinese construction enterprises abroad.

The line ministries

The various line ministries have the lead role for their respective sectors. Currently, China has 28 ministry level government agencies. Each line ministry has its own network of design and research institutes, and construction bureaux. Most line ministries issue their own sector specification and, in some cases, construction regulations.

Construction equipment

Construction equipment is considered generally to be a weak link in the construction industry in China. Most enterprises own their equipment. Leasing or rental facilities are rare. In general, the available equipment is old and outdated; much of which is not fully utilized and at times places a heavy burden on the enterprises. Although about 30% of construction equipment is currently deemed old and out-of-date, it is still used because the enterprises lack money to buy new equipment. In addition, the allowed depreciation periods for construction equipment usually are too long, and the used equipment prices are determined by a quota system.

Construction material

Construction material generally accounts for 60% of total construction costs. Every year, China's construction industry consumes 20–30% of the country's total steel production, 70% of cement, 40% of timber, 70% of glass, 50% of paint and 25% of plastic products. Even though the state plan of building materials production and supply through the quota system has shrunk significantly in the last decade, about 50% of building materials are still produced and supplied through the State Plan system for most large projects.

Currently, cement and plate glass are the two main building materials restricted heavily under the quota system. Building material prices, previously controlled

by the state, mostly have been liberalized. However, given the transitory nature of the price reforms, a rationale price structure is yet to develop. Building materials are consuming a huge amount of raw material resources. China is an intensive user of raw materials and transport systems. The main problems with the building material in China are: (I) productivity in building materials is lower compared with other industries; (ii) profitability of building material is low; (iii) a quota system is still being used for estimating construction costs including those of materials. Because it is fixed annually or semi-annually and the material prices are flexible, construction cost estimates cannot be accurate.

Business environment and problems existing

Legal and regulatory frameworks

China has not had any unified construction law in the past, but such law is in preparation and expected to be issued soon. Presently, the industry is governed by a number of regulations issued by the MC and other line ministries. These regulations are available from the China Construction Regulations Compilation published by the MC every two years. The MC has the right to approve the qualification levels of contractors and design institutes. Each project, depending upon its nature, will require a contractor qualified to a certain level to work on it. Design and construction specifications are usually prepared and issued by the line ministries for their respective sectors. The responsibility for assuring the quality of the works also rests with respective ministries or local agencies. Each municipality now has a quality control office to monitor the quality of work in accordance with the specifications. There is an elaborate system for establishing unit prices and inflation factors. There are offices called 'quota stations' in most cities, and the line ministries to revise the quotas periodically, usually half yearly or annually. The construction cost for any job is calculated according to the applicable quota; even the contractor's profit is specified in the quota, depending on the type of project and quality of the company.

The existing legislative and regulatory frameworks are incomplete and often a high level government official has the last word. The legitimate interests of the enterprises cannot be protected properly. The insufficiency of the legal system and the complex of administration procedures are the hurdles for the reform of the construction price mechanism. The contradiction between 'stagnant norms' and the 'dynamic actual costs' of the construction projects has led to many problems regarding tendering, payment, contract management and performance. It is hoped that the proposed 'Construction Law' will provide a rational framework of construction policies and regulations to unify existing regulations issued from different sources.

Pricing mechanism in the construction industry

At the present, most of the construction price adjustment factors and profit margins are still affected and determined through the quota system. The costs of construction projects are calculated from quantities of work and norms; the latter are yardsticks for labour, material and plant consumption. These norms are worked out by the local authorities in a unified manner and are controlled by the central government. Such criteria are still used in pricing building and installation work for domestic projects even after the tendering procedure has been adopted.

For instance, under the unified cost estimation system, the profit from any building or installation work was specified as a fixed value; that is 2.5% of the bid value during tendering and as 2.5% of the actual final account value after the completion of the work. This profit rate has been revised, amounting to 7% instead of 2.5%. However, 3% is used for reimbursement of the costs for providing constructional plant. Therefore, the net profit rate remains 4%, and thus has been raised by only 1%. Furthermore, the excessive reduction in the contract price imposed by the client upon the contractor during contract negotiation often has made the actual profit rate lower than 3% because of the competition in the contracting market. Meanwhile, the market price of labour, material and equipment have been increasing rapidly. Therefore, many contracting companies have suffered big financial losses. This phenomenon becomes even more severe for 'snazzy' construction projects.

Competitive bidding

Since 1984, China has been pursuing project bidding for contracts. In 1989, nearly 47 650 projects used bidding for contracts, which accounted for about 13% of the total construction projects. In 1990 bidding was used in 62 922 construction projects, or 18% of the total activity, while in 1994 about 50% of contracts were let through bidding. Bidding has been used not only in the field of construction and installation, but also has been introduced into design, equipment purchasing and turnkey projects.

Despite this progress, the system for competitive bidding is not yet fully established and needs to be improved. The main obstacle to competitive bidding is

the centrally planned system where jobs were assigned. Now bidding and assignment are taking place at the same time, in what may be called 'partial bidding'. Negotiation with submitted bidders is still very common. Another constraining factor is the lack of separation in the respective roles of the 'owner', the 'engineer' and the 'contractor', which hampers the development of competitive bidding and effective contract management. Bidding documents, procurement procedures and qualification requirements for construction enterprises and design institutes are not standardized, and are ambiguous in some cases. It is hoped that the proposed 'Bidding Law' will help remove some of the difficulties.

Quality control

Construction quality is recognized as a critical problem in China. Quality of construction work undertaken by the line ministries' construction companies is generally better than that of provincial enterprises, and the quality of construction by SOEs is considered to be much better than that of URCs and RCTs. The quality of work done by RCTs is the weakest, with associated waste of the construction material. The reasons for low quality of construction range from poor designs, materials, weak management, ambitious completion targets and lack of work skills. Improving quality of construction is one of the major challenges facing China's construction industry.

Tax framework

The basic tax obligation of the construction industry is stipulated in the state finance and tax regulations. Varieties of taxes and fees are applicable which are separated into engineering construction and management taxes, together with national and local taxes and fees. The tax rates vary within sectors and location, and could be heavy in some cases. Usually the various taxes and fees for a typical civil contract could add up to 20–30% for an urban public utility fee and 10–20% for taxes and local fees. China's construction industry is a low-profit industry, but has to pay the same level of taxes as the high profit industries.

Construction financing

The lack of construction credit is another major constraint. While a number of established banks provide project financing, this facility generally is available to large national projects only. Short term financing sometimes is available to construction enterprises from local banks, and is expensive. Most enterprises, therefore, operate without access to credit facilities. There are several major issues related to the financial aspects of the construction industry.

- Available working capital for construction is rather low. In 1984, construction working capital accounted for about 18% of construction gross output value. This figure has declined to about 8–10% recently.
- Contractors usually face serious arrears in payments mainly due to shortage of available funds with the project entity, even at an early stage of implementation. At times, when construction enterprises wanted a project badly, they would use their own funds or borrow money from the banking system or other sources on behalf of the owner. Construction triangular debt accounts for a large portion of China's total triangular debt.
- Available investment funds based on initial cost estimates are usually insufficient. About half of construction projects lack adequate financing at the time of budget approval.
- The system of advance payment to the contractor is weak. Usually contractors receive inadequate advance payment or no payment at all. It is important that China improves the financial aspects of contracting by improving the payment system to the contractors and making construction financing more easily available.

Human resource development

The educational and training needs to produce managers, engineers, technicians and workers are massive and are increasing due to growing volume of construction industry and the rapidly changing of business environment.

Construction management is still considered to be a serious problem in China. Part of this is due to the transitory nature of the change process. The introduction of commercial behaviour through the contractual responsibility system requires different approaches and management skill, which will take some time to develop. On the other hand, profit motivation is so strong that most enterprises work with short term goals. The management system under the centrally planned economy still largely affects current construction practices.

Conclusion

This paper has described the impact of the economic reforms upon the construction industry, indicating the

fundamental changes in the construction industry since the economic reform and showing the leading role of the construction industry in the country's economic development. Dramatic progress has been made by the construction industry, and it has developed at an amazing speed. However, reforms in the construction industry are still very difficult since this industry is not a single sector. The reform process by its very nature is not systematic. The challenges ahead are serious, and deeper reforms of the economic system are required.

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