THE COST MANAGEMENT SYSTEM IN CHINA – THE IMPACT OF SOCIAL AND ECONOMIC REFORMS IN THE CONSTRUCTION INDUSTRY

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ABSTRACT
The construction industry in China has undergone significant changes over the past two decades as a result of economic reforms implemented by the Chinese government during this period. Construction projects are now awarded through a competitive tendering process. This replaces the traditional assignment system of construction projects being assigned by government units to state-owned organisations. The changes have important impacts on the traditional standard pricing system of construction projects in the tendering process and have opened up a new avenue for the role of cost engineers. This paper provides an overview of the reforms of the competitive tendering and pricing systems in the construction industry. This paper also presents the results of a questionnaire survey in Tianjin to investigate the impact of the social and economic reforms and the role of cost engineers in the Chinese construction industry.

Keywords: cost engineers, market-driven economic system, planned economic system, tendering system

INTRODUCTION
China is the fourth largest country in the world and accommodates more than 20% of the world's population (CIA, 2006). With tremendous economic growth resulting from economic reforms implemented since 1978, China's GDP has increased more than tenfold (Ho, 2006). The construction industry has contributed a significant portion of the national GDP in China particularly in the past few decades (Shen & Song, 1998). Construction activities have been the fundamental platform to support economic activities and the related economic reforms. The total investment in fixed assets has increased from RMB 91 billion in 1980 to RMB 2,988 billion in 1999 (Zhang & Liu, 2006). With the introduction of open-door policy in the 1980s the planned economic system has gradually been replaced by the market driven system (Wang, 2001). The changes have had important impacts on the construction industry particularly with respect to tendering and pricing systems.

It has been an ongoing situation that the construction industry in China suffers from low productivity, over staffing, budget overruns, prolonged delays and poor quality. The ultimate purpose of the economic reforms in the construction industry is to speed up economic growth through improving the effectiveness and efficiency of

activities. The strategic plans of the government to achieve this goal are to transfer the purely planned economic system into a market-driven economic system within a socialist context (Shen & Song, 1998).

The main purpose of this paper is to report on preliminary research by the authors on the impact of China's economic reforms on the construction industry generally and the tendering and pricing systems for construction projects specifically. The paper also examines the impact of these reforms on the role of cost engineers in the construction industry. The research methodology includes a questionnaire survey of professionals in various Chinese construction firms in Tianjin. This paper presents an overview of the reform systems and the results of the questionnaire survey.

REFORMS IN THE CONSTRUCTION INDUSTRY

Since the People's Republic of China was founded in 1949 the economic system was developed under the influence of the former Soviet Union. The national economy was a planned economic system with a high degree of centralisation dominated by state-owned organisations (Chan et al., 1999; Wang et al., 2006). The construction industry, as one of the five major sectors in the economy, was centrally controlled by the government and used as a means to support the economy (Mayo & Liu, 1995, Luo & Gale, 2000). Under this system most construction projects were financed by the central government and the local government was responsible for allocating the design and construction work to the state-owned design institutes and construction units (Xu et al., 2005a).

There was no competition among contractors and, therefore, no motivation to improve efficiency and productivity. The construction industry in China was known for its low efficiency and effectiveness, overstaffing, financial mismanagement and a lack of potential for future development (Shen & Song, 1998; Xu et al., 2005b). China has the greatest economic potential in the world due to an abundant supply of work forces and natural resources. However the full potential in China was not being fully utilized. The state-owned firms were not properly managed and were unable to compete with overseas firms.

In 1978, the Third Plenary Session of the 11th Central Committee of the Communist Party of China declared China's economic reforms and the open-door policy which had a significant impact on the national economy. Since the open-door policy, the construction industry has slowly been reformed to keep pace with economic development in the West and to improve effectiveness and efficiency in economic activities (Shen & Song, 1998). The policy has rapidly transformed China from a centrally controlled and planned economy to a more vibrant and increasingly market-oriented economy which promotes competition among economic sectors. The free market economy was endorsed by the Fourteenth Chinese Communist Party Congress Convention held in Beijing in October 1992 (Mayo & Liu, 1995, Chan et al., 1999; Luo & Gale, 2000). The free market economy was the main focus of reform systems in China and it has had a significant impact on the construction industry. The Congress also endorsed the establishment of a new market-driven foreign trade system to conform to the "international trade union".

In 1993, at the Chinese Communist Party Congress, the Minister of Construction stated 17 agenda items for the reform of the Chinese construction industry (Mayo &

Liu, 1995). Within the 17 agenda items five were directly related to reforming the tendering and pricing systems. These included implementing new bidding regulations, reforming the pricing system, creating a uniform cost-estimating format, separating direct cost and indirect cost, and establishing an effective method for cost control. It aimed to establish a construction market that enables construction firms to be more competitive with international firms by minimising central control over state-owned enterprises and introducing incentive and bonus schemes to motivate production.

Tendering has been used in Western countries for more than 200 years and yet the tendering system was only introduced in China in the 1980s (Shen & Song, 1998). Prior to this, the construction industry had no competitive tendering system. Construction contracts were awarded to state-owned construction firms based on a standard cost concept (Xu et al., 2005a; Wang et al., 2006). Contractors were reimbursed their overhead and material costs based on the government's fixed standard price indices. As such construction firms had no motivation to improve productivity and management skills (Luo & Gale, 2000). The practice of tendering was re-established on World Bank and Asia Development Bank funded projects which required a public tendering process to be undertaken at an international level. China then started tendering and bidding practices in the construction industry (Chan et al., 1999).

In keeping with the reform towards a market-oriented economy, a new tendering and awarding system was implemented in 1984 to supplement and gradually replace the traditional system of awarding contracts. The construction industry has achieved significant progress developing towards international practice (Shen & Song, 1998). With the implementation of a tendering system, construction firms were forced to pursue ways to build faster and cheaper which resulted in increased efficiency and productivity levels. The tendering system has successfully shortened completion time, improved quality, and lowered the cost of construction works (Wang et al., 1998).

In 1999 the Bidding Law was introduced which sets out tender procedures for construction projects (Chan et al., 1999). It aims to change the project financing arrangement from traditionally government funded to loans from commercial banks. In addition, it has changed the project procurement system from government assignment to competition through a tendering process. It stipulates that a project funded by the state or by international financial institutions are required to undergoing a tendering process in the form of public tender or short-listed tender. Contractors tendering for projects are required to pass the client's qualification process. Construction contracts are to be awarded to the firm gaining the highest score in the tender evaluation. The tender evaluation includes evaluating tender price, construction plan, track record, work experience and project professionals (Wang et al., 2006). Since the introduction of the Bidding Law, state-owned and international funded projects have been awarded through a tendering process. A survey in 2005 undertaken by Wang et al. (2006) has revealed that approximately 95% of government funded projects were awarded through competitive tendering and all private projects were awarded by competitive tendering.

Since competitive tendering has become the common practice in the construction industry, the pricing system has also undergone significant changes. Under the traditional planned economic system all construction projects were priced according to national uniform standards of pricing prepared and issued by the government. There was a time lap between the preparation and publication of the price books and therefore the price books did not truly reflect the market values of construction projects. The influence of this “controlled prices” system caused serious and ongoing problems in the industry. This system was promulgated by the relevant governmental agencies to exert effective administration and control of the construction industry in China.

Reformation of the pricing system began in the 1990s as the government began the process of moving away from fixed pricing to a competitive market based system more akin to that found in western democracies. This reform process was extremely complicated and time consuming with the reforms not effectively taking effect until 2003 (Yin & Yan, 2003). The result was the formal establishment of a system whereby prices for all aspects of construction are determined by market mechanisms. The construction industry has therefore moved from a very controlled structure to a largely open system comprising self-formation, self-fluctuation and self-regulation. Whilst this system is common place in western democracies, these changes have tremendous social and economic implications in China as the industry has had to quickly come to terms with a system that is very foreign to their traditional *modus operandi*.

The cost management system has undergone three stages of development. At the first stage (1950-1980) all construction works were assigned to design and construction units by the local government. All construction prices were fixed centrally by the government through the publication of a price book for each region in the country. The standard price book was used to price all construction projects. The standard price book provides quantities for labour hours, materials and equipment involved in each work item, unit prices of labour, plant and materials, and the rates for the calculation of costs and profits (Luo & Gale, 2000; Yin & Yan, 2003; Xu et al., 2005b).

The open door policy has marked the second stage of the development (1980-1990). During this stage construction prices were gradually directed by the government under a tendering system. The state and the enterprise units were the double decisional entities. On one hand construction projects were awarded based on competitive tendering and on the other the tenders were evaluated based on a tender-base price which was prepared on the basis of a quota and relevant charges standard prescribed by the price book published by the government. This stage featured planned control, state guidance and competition (Yin & Yan, 2003; Xu et al., 2005b).

The third stage began after 1990. During this stage, construction project factors have gradually been determined by market mechanisms (Yin & Yan, 2003). Pricing is based on a free-market economy determined by supply and demand in the construction market. Prices are determined by market prices for labour and materials. With the reform in the pricing system, the government now encourages the standard price book to be used as a guide only, instead of a mandate, in project pricing.

Research undertaken by Wang et al (2006) reveals that project prices in the construction industry are now derived under a dual system. Tendering prices are based on both a standard approach and the market system. Standard quantity rates, market prices and competitive rates are common pricing strategies used by construction firms. Wang et al. (2006) also reveal that approximately 80% of projects from the state-owned enterprises have been priced using a combination of standard and market prices and only approximately 3% and 12% respectively were prepared based on the standard price book and market prices respectively.

ASSESSING THE IMPACT OF REFORMS IN THE TENDERING AND PRICING SYSTEMS

Research method

A research team led by the authors conducted a questionnaire survey among construction organisations in Tianjin in November 2006. The survey respondents included developers, contractors, architects, engineers, project managers, cost engineers and others in the construction industry. The survey was distributed through the School of Management at the Tianjin University of Technology. The questionnaire was distributed to state-owned, collective-owned as well as private organisations in Tianjin. A total of 150 questionnaires were distributed and 88 completed surveys were received at the end of 2006 – a response rate of 59%,.

The questionnaire was designed into four sections. The first and second sections were designed to collect data on the personal and company profile of the respondents. The third section consisted of questions designed to examine the changes in the Chinese construction cost management system and the associated problems. The questions were designed as a standard Likert scale where respondents were asked to rate each question from strongly disagree to strongly agree. The fourth section set out to investigate the role of cost engineers in the construction industry and the aspects of training/educational requirements that cost engineers may require to cope with the growing demand under the reformed system. This section was also designed in the same format as section three.

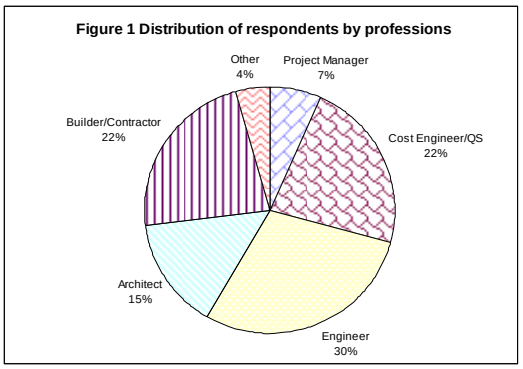
Analysis and discussions

Table 1 summarises the personal profile of respondents. 58% of respondents were male and 42% female. The majority of the participants, approximately 64%, were aged between 25 to 44 years old. Approximately 61% have over 10 years working experience in the construction industry.

Table 1 – Summary of personal profile of respondents

Gender (%)		**Age Distribution (%)**					**Years of experience (%)**				
Male	Female	<25	25-34	35-44	45-54	>55	1-5	6-10	11-20	21-30	30+
58	42	10	30	34	13	13	29	10	30	17	14

Figure 1 presents the distribution of respondents by profession. Cost engineers, engineers and contractors made up 22%, 29% and 22% respectively of total respondents whilst the remaining 27% were distributed amongst project managers, architects and others. Figure 2 shows that the majority of the respondents, approximately 70%, come from large organisations with over 50 people (including directors) in the company.



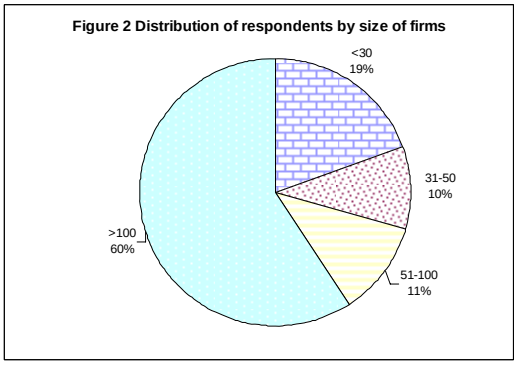
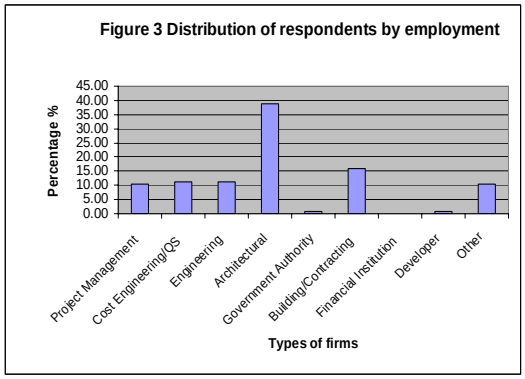
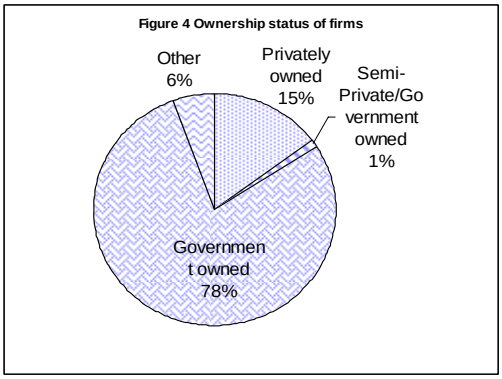


Figure 3 shows that the respondents were employed in a variety of firms with 39% from architectural firms and the remaining 61% spread out relatively evenly from cost engineering, project management, engineering, contracting and development companies. With regards to ownership status of the firms, 78% are state-owned organisations whilst 15% and 7% respectively are privately and collectively-owned organisations (Figure 4).





Section three of the questionnaire examined the impact of changes from a fixed quota based tendering system to a free market system. Respondents were asked to rate eight questions from a scale of strongly disagree through to strongly agree. Table 2 summarise the survey results on the impact of the changes. The survey reveals that the majority of the participants, approximately 83%, agree that the move from an assignment based system of construction projects to a free market tendering system is important for the construction industry. However, only approximately 37% believe that the free market tendering system has been successfully implemented by the government. 43% believe that both systems will co-exist over the next ten years in the construction industry.

With regards to tendering system reforms, 74% believe that the free market approach will eventually replace the fixed market quota system and 75% agree that the free market approach has provided construction companies with more opportunities to obtain jobs in the construction industry and 66% believe that under the new system tendering has been undertaken in a fairer and more transparent manner. Even though the competitive tendering system is still new in the Chinese construction industry, approximately 90% agree that construction companies have the necessary resources, skills and expertise to effectively secure projects through

the tendering process. With respect to international projects, approximately 86% believe that the free market system has improved their competitiveness to tender on jobs overseas.

Table 2 – Impact of changes in the tendering system

Impact of changes in the tendering system	Responses (%)				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
The changes in the tendering system is important for the industry	1	0	16	67	16
The changes is successfully implemented by the government	2	21	40	34	3
Free market tendering system and fixed market quota tendering systems will co-exist over the long term (10 years plus)	3	5	49	39	4
Free market tendering system will eventually replace the fixed market quota system	1	1	24	51	23
Free market system will provide more opportunities for construction companies	1	5	20	67	8
Free market system will result in a fairer and more transparent tendering system	2	8	24	60	6
Construction companies have the resources to effectively tender for jobs	1	0	9	75	15
There is a need for education and training in tendering under the free market system	1	0	9	58	32

The role of cost engineers

The free market tendering system has opened up a massive new market for cost engineers. Although the professions of quantity surveying and cost engineering have been in existence for over 200 years in many parts of the world, it is a relative new profession in China (Yin, 2001). The discipline of cost engineer was not formally established until 1996. The free market tendering system now requires all tenders to be prepared and priced based on current market prices to reflect current market conditions. The role of the cost engineer is fundamental to this process. Subsequently, along with the rapid development of the Chinese economy, the demand for cost engineers has escalated at a remarkable rate since the turn of the century. Table 3 summarises the role of cost engineers in the construction industry under the new tendering system.

Table 3 – Impact of changes in the tendering system

Role of cost engineers in the new tendering system	Responses (%)				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Lack of experienced/qualified cost engineers in the industry	1	15	25	46	13
The role of cost engineers is well recognised in the industry	1	4	40	52	3
Free market system has improved the professional status of cost engineers	0	1	16	73	10
Cost engineers have a crucial role	1	9	24	59	7
Free market system has increased the demand for cost engineers	0	3	11	75	12
Current tertiary education is adequate	8	19	43	24	6
Current post-graduate education is adequate	8	17	40	30	5
Current certification program is adequate	8	21	36	32	3

With an increase in the demand for competitive tendering for projects, 59% of respondents believe that there is a lack of experienced/qualified cost engineers to cope with the workload in the free market system. However, only about 55% believe

that the role of cost engineers is well recognised in the construction industry. Nevertheless, 83% agree that the reforms have improved the professional status and importance of cost engineers.

The survey also reveals that 66% believe that cost engineers have a crucial role in ensuring that the free market tendering system is successful. 87% of the participants agree that the demand for cost engineers will continue to increase. Currently there are 30 universities in China providing undergraduate degree courses in cost engineering and 150 universities offer undergraduate degree courses in engineering management. Within these degrees only about 20% of the current curricula focuses on cost management. However, there is now a strong upwards trend in the extent of cost management coverage in these types of courses. With regards to training/education, only 30% and 35% of the participants respectively agree that current levels of tertiary and post-graduate training are sufficient for cost engineers in the construction industry. In respect to the current certification program for cost engineers, only 35% agree that the current program is relevant and sufficient.

Table 4 summarises the areas that the respondents believe cost engineers require further training. Over 75% agree that cost engineers will require further training and educational development in cost planning, measurement, pricing and tendering skills at the pre-contract stage. 83% and 90% respectively believe that cost engineers will require further training in contract administration and post-contract cost control and 87% in construction law knowledge.

Table 4 – Summary training/education requirements of cost engineers

Training/Education requirements	Responses (%)				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Bills of quantity preparation	0	7	18	62	13
Measurement skills	0	8	17	56	19
Estimating/pricing skills	0	8	13	62	17
Cost planning skills	0	0	16	68	16
Tender evaluation	0	6	18	57	19
Contract administration	0	0	17	64	19
Cost control (post-contract)	0	1	9	74	16
Construction law knowledge	0	0	13	69	18

Problems associated with tendering and pricing reforms

The survey also examined the difficulties that the free market tendering system has encountered since its introduction. Chan et al. (1999) found that the main hindrance for the reforms is the fact that the construction industry has been developed over a very long period under a planned economic system. Any effort to change its basic structure requires substantial changes to established practices, systems and perceptions in the industry.

Table 5 – Summary of problems of the new tendering system

Problems	Responses (%)				
	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Not widely accepted by professionals	6	40	30	22	2
Not widely accepted by contractors	2	46	31	19	2
Not widely accepted by clients	3	44	32	20	1
Fixed quota system is too established	3	16	23	53	5
Lack of experience/expertise	2	23	26	43	6

Table 5 summaries the problems associated with the changes in the tendering system in the construction industry. The survey reveals that approximately 46%, 48% and 47% of the participants believe that the free market approach is well accepted by professionals, contractors and clients respectively in the construction industry. However, approximately 58% believe that the fixed price system is too established in the industry for successful transition to the free market system.

Chan et al. (1999) found that higher education has a significant role to play in the success of the reform movement. The shortage of cost engineers and the lack of technical competence in tendering and pricing of construction projects have restrained the further development of the construction industry in China. In the survey nearly 50% of respondents agreed that the lack of experience/expertise in tendering and pricing in the industry is the major hurdle for the implementation of a free market system.

CONCLUSIONS

This paper investigated the impact of China's economic reforms on the construction industry with a focus on cost management systems. The results of the questionnaire survey provided a local industry viewpoint on the implementation of market-oriented tendering and pricing systems and the increasing demand for cost engineers in competitive tendering. The study suggests that the traditional planned economic system is too established to be successfully transformed into a market-oriented system over the short term. However the tendering and pricing system reforms have made great progress. It has been shown that the local industry believes that improved training, education and certification courses will enable the cost engineering profession to improve the quality of professional services required. It is clear that cost engineers have played a significant role in the success development of the market-oriented system in tendering and pricing and will continue to do so. However, as the development of the profession continues at a rapid pace, the demands on ensuring appropriate levels of professional expertise and service provides perhaps the greatest challenge to the profession.

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