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Labor Supply Business

Tingyu An

A dissertation submitted to
Kochi University of Technology
In partial fulfillment of the requirements
for the degree of

Doctor of Philosophy

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Abstract

As is known, the construction industry plays a significant role in absorbing labor force as an effective employment countermeasure in most countries. Thus, it is highly dependent on its laborers and ought to seek for their benefits. Since the Reform and Opening-up Policy was adopted in 1978 in China, along with the institutional changes from the traditional planned economy to the market economy, the construction labor market has also undergone profound changes, largely due to the state-owned enterprises restructuring and implementation of Rural Land Contract System. Although the Chinese construction industry has provided enormous employment for labor force, especially for those surplus rural laborers called ‘migrant laborers’ in China, however, it has recently been in a dilemma with an increasing labor outsourcing practice for construction production, and relevant potential of labor exploitation. The latter does take place in China regarding those widespread labor right infringements such as ignorance of occupational health and safety (OHS), payment default, long working hours, few social welfares, etc. This study is aiming at seeking for the balanced and sustainable development strategies for the Chinese construction labor market combing economic with social views.

Literature reviews combing with the descriptive and explanatory problem formulation on the three aspects of construction labor market in China argue that the dilemma of current Chinese construction with poor labor conditions is supposed to be rooted in the current subcontracting systems. It is empirically verified by a case study of China Railway 12th Bureau Group Co., Ltd (CRGC-12), through which two major management approaches concerning the practice of labor subcontracting are interpreted, compared, and analyzed in depth. Under the current existing systems, eliminating the ‘informal’ labor subcontracting team (*baogongtou* in Chinese) is not applicable in practice, while promoting the new ‘formal’ labor subcontracting enterprises is not

adaptive and failed to match the expectations in terms of development. The deeper roots lie in the current overall subcontracting systems with excessively restrictions on the number of subcontracting layers and the scope of subcontracting business. Both of above block the specialization of construction subcontracting market with an ignorance of better ongoing development of subcontractors, who suffer from the uncertain and futureless business environment. Under that condition, it is difficult for subcontractors to achieve the improvement of labor employment. Situation becomes even worse in view of adversarial relationships up and down the construction supply chain. The current scheme is proved to be a failure in improving labor situations, in turn having negative side effects, such as the current irrational industrial structure, underdeveloped and incompetent professional subcontractors, etc. In a word, it is essential to facilitate subcontractors' development in order to achieve the sustainable and fundamental change of construction laborers' poor situations.

New thinking is drawn from the Japanese construction, in view of its success in facilitating the development of subcontractors. Through the case study of *Kajima* in Japan, the rational relationship under Affiliated Companies mode between general contractor and subcontractors are found to be a valuable initiative to the achievement of a regular subcontracting practice, further the specialization of construction subcontracting market, and consequently a sustainable construction labor market. Further analysis in depth shows that the predominant role of general contractor, the principle of organizational market, and the 'assurance systems' for public procurement are the three interrelated and interacted contributors to the success in establishing and maintaining the long term relationships in the past Japan. Regarding the practical situation of subcontracting market in China, the significance of combining cooperation with competition should be deeply understood up and down the construction supply chain.

The deregulation of current subcontracting systems with a release of subcontracting layers

and subcontracting scope is proposed in this study. As a support, the long term relationship between general contractor and subcontractors is suggested to be promoted. Moreover, for their mutual understanding in the achievement of integrative construction supply chain management, a tentative effort on the economic incentives for general contractor and subcontractors is made through mathematical modeling.

This study may serve as a start point to regularize the subcontracting market aiming at the achievement of sustainable construction labor market in China.

Key Words:

Sustainable Construction, Migrant Labor, Subcontracting systems, Production Uncertainty, Work Relationships

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1 Introduction

1.1 Research background

The rapid pace of development in the construction industry worldwide presents new and urgent challenges that must be acknowledged and accepted. It includes balancing the social and environmental needs, creating more productive, healthy, and safe ways for working, conserving and sustaining natural resources, and reducing vulnerability to natural hazards, and so on. It calls for innovative thinking on the construction industrial development, among which the sustainable development of construction industry has been drawing more and more attentions globally in recent years.

1.1.1 Involvement of labor force in the sustainable construction

(1) Sustainable construction

Recent studies ^{[1] [2] [3] [4]} have attached an increasing significance to the idea of sustainable construction. The meaning of the term ‘sustainability’ is various. One of the most often quoted definitions is¹: ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ by the World Mission on Environment and Development (1987). The definition by the International Organization for Standardization (2002) is ‘the maintenance of ecosystem components and functions for future generations’. As can be seen, long-term perspective is highlighted in both definitions with a consideration on future generations. One common acknowledgement is that sustainability has three pillars as economic sustainability, environmental sustainability, and social sustainability ^[5]. The former two have now broadly been understood and aroused much attention in recent years in the academic fields, industrial trades, and administrative sectors. However, the concept of social sustainability seems to be much more difficult to understand and master, particularly in practice. Generally speaking, the social sustainability could be interpreted as the sense of social responsibility to a certain extent. Although there has been an increasing tendency of adopting the principles of Corporate Social Responsibility (CSR) by more and more construction enterprises all over the world, however, its implications on the economic activities of construction enterprises remains to be ambiguous, weak, and far from practicality and effectiveness during the fulfillment process, especially in current China.

¹This widely accepted definition of Sustainability comes from the Brundtland Commission in a 1987 report for the Organization for Economic Co-operation and Development (OECD), specifically referring to economic development.

Although recent researches in China have shown the increasing significance of social responsibility to the sustainable development of enterprises ^[6], however, the initiative of social responsibility has not been understood in depth in practice. According to the 2009 blue book on Chinese enterprises' CSR ^[7], although the index of CSR of the state-owned enterprises (referred to as SOE) is far ahead than other private and foreign enterprises in China according to the analysis based on the 'quaternary model' including four aspects as enterprise accountability management, market performance, social performance, and environmental responsibility, however, the initiative of their participation in CSR has been doubted, which is assumed to be largely due to the rigid interventions by the Chinese government ^[8] rather than in spontaneity. It may indicate that in general the essences of social responsibility, especially its implications on the economic activities in the long run have not yet been aware and grasped by those Chinese enterprises. In other words, it remains to be a great gap in promoting or spurring effective approaches in practice to transform the factor of social responsibility into the key enterprise competitiveness from perspective of sustainable development, compared with other developed countries that have already the integrated and sound systems in fulfillment their social responsibility along with the economic activities (see Table 1-1).

For example, in Japan it is commonly believed by most construction general contractors that implementing schemes to fulfill social responsibility has already become an important part of a sustainable development plan and a way in which successful and sustainable community development can be achieved, in accordance with their CSR guidelines. As a result, they are making much effort on working in close partnership with all involved stakeholders at every stage of a project, including local communities, which eventually show the advantages over the enterprise competitiveness in the long run (see Figure 1-1).

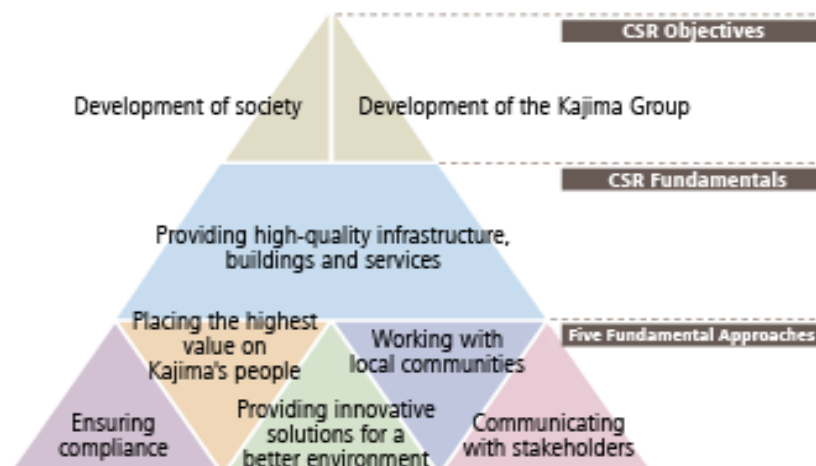


Figure 1-1 *Kajima's* corporation social responsibility framework

Source: http://www.kajima.co.jp/english/csr/csr_outline/index.html

Table 1-1 Examples of construction enterprises from different countries concerning CSR

Corporation name	CSR fundamentals/visions	Relevant approaches
<i>Kajima</i> ^[9] (Japan)	<ul style="list-style-type: none"> ① Meeting the demands of society ② A commitment for our planet's future ③ Placing biodiversity conservation at the core of business activities ④ Practicing strong corporate ethics ⑤ Ensuring safety and dependability ⑥ Achieving harmony with the earth 	<ul style="list-style-type: none"> ① Ensuring compliance ② Placing the highest value on <i>Kajima's</i> people ③ Providing innovative solutions for a better environment ④ Working with local communities ⑤ Communicating with stakeholders
Bechtel ^[10] (The United States)	<ul style="list-style-type: none"> ① Customers and partners will see us as integral to their success. We will anticipate their needs and deliver on every commitment we make. ② People will be proud to work at Bechtel. We will create opportunities to achieve the extraordinary, and we will reward success. ③ Communities will regard us as responsible—and responsive. We will integrate global and local perspectives, promote sound management of resources, and contribute to a better quality of life. 	<ul style="list-style-type: none"> ④ Ethics. Uncompromising integrity, honesty, and fairness are at the heart of our company. ⑤ Excellence. We set high standards. We apply advanced technology, and we continually innovate and improve. We thrive on challenge and accomplishment. ⑥ Fair Return. We earn a return that fairly rewards the value we deliver. ⑦ Mutual Respect. We work by our Bechtel Covenants, which encourage openness, teamwork, and trust. We value an inclusive culture based on diverse backgrounds, experience, and views. ⑧ Safety. Zero accident is our unwavering goal—people's lives depend on it. ⑨ Sustainability. We plan and act for the future—for the long-term good of our company, our customers, and our world.

Bouygues Construction ^[11] (France)	<p>① Balanced development to serve our clients better</p> <p>② Commitment of social responsibility at work and in society (OHS, training, etc.)</p> <p>③ Innovation to protect the environment</p>	<p>① Foster a trusting relationship with our customers</p> <p>② Incorporate risk into the day to day management of the company</p> <p>③ Lead our business sectors in occupational healthy and safety</p> <p>④ Develop our employees' skills</p> <p>⑤ Establish balanced, long term relationships with our stakeholders</p> <p>⑥ Respect the environment</p> <p>⑦ Participate in economic and social life</p>
China Railway Construction Corporation Limited ^[12] (China)	<p>The trust and support of the interested parties are the basis for the company to survive and develop. While the company develops steadily and rapidly, it actively performs the social responsibility, and feeds back to the interested parties with the progress of the company development, pursue to the maximization of the common interests of the company and all the interested parties, realizing the harmonious mutual trust and share the value.</p>	<p>① Tax and national construction</p> <p>② Great contribution to labor employment</p> <p>③ Emergency rescue and disaster relief</p> <p>④ Poverty alleviation contribution</p>

(2) Essence of social responsibility

According to Wells (2003), the social responsibility is about minimizing the negative effects and maximizing the positive effects of economic activities on people and society, involving the following three levels broadly. First is the impact on those involved in the activity itself, notably its labor force or employees. Second is the impact on the local community where the activity takes place. Third, there may also be social implications for the wider global community. The relative significance of those impacts varies with the sort of activities.

Concerning the construction industry, its functioning generally consists of two aspects in most countries. Those are not only its contribution to the development of national economy and people's standard living, but also its role in absorbing labor force as an effective employment measure^[13]. Its social impacts from the three levels mentioned above have features below.

- The global social impact is relatively minimal in construction sector (although can not be entirely neglected in view of the fact that there are international businesses in this sector, involving international migration of labor force and so on).
- The impact on local communities can be quite a significant component (see Table 1-1). However, what should be pointed out here is that, the biggest share of this impact stems from the investment decisions that are usually made from the up-stream of the construction industry itself. Unfortunately, the local responses or voices are neglected in many cases. With rare exceptions, the construction industry still performs in the way to respond to the demands that are placed on it by the investors, rather than play a major role in the decision making process of investment itself. Although recently the significance of local communities' participation in the building process has begun to draw some attentions in some countries like Japan, how to be truly involved in the process is still proved to be extremely difficult.
- The major social impact is undoubtedly on the labor force those are involved in the construction activity itself, along with the rise and fall of the construction industry. Experiences of many countries show that construction industry has great influences on the labor market in view of the fact that it provides much needed employment for a large number of the poorer and less well educated laborers of the society, afterwards becomes highly dependent on their work^[14]. It functions as a good indicator of the general labor market situation².

In a word, a big component of social responsibility in construction sector consists in its labor force, indicating the significant role of the development of the construction labor market in the realization of its social responsibility.

²<http://www.nav.no/NAV+EURES+work+and+recruit+in+Norway/Selected+professions+and+industries/Selected+professions+and+industries/1073746429.cms>

(3) Basic issues of construction labor market

Regarding construction labor market, there are basically three involved issues as the source of labor, the basis on which it is employed and the way it is treated. It is commonly acknowledged that on the one hand, those issues related to labor in the construction industry have profound implications for project quality, productivity, skill development and so on, which are usually to be the immediate and great concern of the involved parties with regard to the relevant economic benefits ^{[15] [16]}. On the other hand, such issues as the number of jobs, the systems under which construction workers are employed and managed, as well as their working and living conditions can affect the achievement of social objectives such as the alleviation of poverty and promotion of social stability and harmony ^{[17] [18] [19]}. Particularly, for most developing countries that have a surplus rural labor, the construction work often has more significant meaning for them since it frequently acts as the only alternative for rural laborers who are not much or well educated. Therefore, the development of construction labor market should be of high priority from both economic and social perspectives.

(4) Negative image of current construction

Unfortunately, referring to many countries' experiences amid the development of construction industry, its social responsibility is prone to being neglected or even sacrificed when confronting with economic benefits. It can be seen from the universal existence of exploitations on labor force associated with the construction work ^[20], such as the low wage, long work hours, poor conditions of occupational health and safety (OHS), insecure of jobs, and low rate of social insurances, and so on, which becomes particularly severe in recent China. Thus, the industry is known worldwide to be notorious as a dangerous place to work with 3Ds (Dirty, Dangerous, Difficult or Demeaning; 3Ks in Japanese as *Kiken*, *Kitanai*, *Kitsui*). Particularly with regard to safety, the data from a number of developed countries show that between 20% and 40% of all occupational fatalities occur in the construction sector. Although it is not available to get the exact data in most developing countries, however, the rate is undoubtedly much higher in view of their exposure to unnecessary dangers due to insufficient protective measures. Moreover, in most developing countries, the construction laborers are prone to exploitations, since the majority of them are recruited through intermediaries or labor contractors on a temporary (often daily) basis, and dismissed when they are no longer required. As known, the construction production in most developing countries is still to be labor-intensive with a low level of mechanization, insufficient capabilities of construction management, not yet established safety culture, and so on. It not only exerts negative effects on current construction laborers, but places a big obstacle for the retention and recruitment of future construction labor force. Until now, few adaptable measures have been applied to the development of construction labor market combining the economic views with social views from a long term perspective.

Since the social sustainability is much more difficult to grasp in practice as mentioned before, the study concerning what constitutes a sustainable development of construction labor market and how to foster it in practice should be considered more carefully. It is regarded that a socially responsible construction industry might be defined as one that enhances the positive aspects of employment in the industry and protects its labor force from negative ones. It is that feature of social responsibility with which this study is concerned.

This study has more significance for developing countries, since most of their construction production is still to be labor-intensive, with a relatively low level of mechanization and industrialization. Similar experience occurs in recent China that has a surplus rural labor force. Contrary to the rapid economic development in the construction sector, its labor force has been suffering severely from poor working and living conditions.

1.1.2 Macroscopic outlook on general employment policy in China

Researchers have already view the employment as an imperative issue for future Chinese economy growth ^[21]. It has already pointed out that the promotion of employment by economic growth and investment growth in China is increasingly weakened, and the reform on macroeconomic policy and employment policy is also insufficient to relieve the unemployment pressure. Now to solve the unemployment problem and create more jobs for the massive labor force has already become the foremost economic development goal for the Chinese government. One of the keys to solve the unemployment problem relies on the changes in the economic growth model from economic growth priority towards employment growth priority, telling that it is time to correctly handle of the relations between labor-incentive industries and capital-incentive industries (labor benefits and capital profits), and the proper coordination between expanding domestic demand and creating employment opportunities.

Actually, the central government of People's Republic of China (PRC) is beginning to pay close attention to the employment situation in recently years and to raise the issue as a vital element in economic development. This can be seen from the five points that were pointed out in a national working meeting organized by the Central Committee of the CPC and the State Council in Beijing in September 2002 with an aim at improving the overall employment situation, including the handling of:

- the relationship between the development of the economy and the creation of more jobs
- the relationship between the adjustment of the economic structure and the creation of more jobs
- the relationship between further reform and the creation of more jobs

- the relationship between joint economic development in cities and rural areas and the creation of more job opportunities
- the relationship between an improvement in the social security system and the creation of more jobs

Since then, to solve the unemployment problem and create more jobs for the massive labor force has been recognized to be the foremost economic development aim for the Chinese government. It has already been highlighted in its inclusion as a target in the 16th National Congress of CPC, particularly with a focus on rural labor force (see Table 1-2).

Table 1-2 Shifts of economic development goals by Chinese government

The 15 th National Congress of CPC (1997)	The 16 th National Congress of CPC (2002)
• Keep GDP increasing by 8%	• Employment is the foundation of the people's livelihood
• Accelerate the reform of state-owned enterprises, and form the market competitive mechanism	• Widen the employment approaches, and develop the labor-incentive employment positively • Encourage enterprises to provide more employment, and reemployment to unemployed laborers through policy support
	• Firstly put forward to providing more employment opportunities for rural labor force

Regarding the construction industry, it must be acknowledged firstly that it is one of the key sectors in supporting economic development in China. Secondly, the construction sector is one of the most important sectors providing employment, since it absorbs a huge number of laborers, especially rural laborers among all sectors in China. Thus, it could be inferred that the construction sector is supposed to play a significant role in not only the adjustment of the economic structure in China, but the improvement of labor employment as well. It tells that the Chinese government should place considerable importance on the development of the healthy and sustainable construction labor market to fulfill its missions.

However, during last three decades in China, contrary to the expansion of construction that has already been a leading contributor to the Chinese economic, it accompanies with a serious deterioration of construction foundations, both the business environment for construction enterprises and its labor force. The economic aspects are supposed not to be neglected, since an adaptable construction labor market should not only assist in sustaining high levels of employment, but help create the conditions for construction business success in China as well. Regarding construction business environment, it is generally known that construction remains to

be a challenging business to turn a profit. Even worse, an adversarial and non-trust working relationships up and down the construction supply chain can be seen everywhere. For example, big construction general contractors generally believe that there is an impending increase of subcontractor defaults when production problems are happening, and thus have a deep prejudice against subcontractors when doing business with them. It should be acknowledged that current Chinese construction is still a labor-intensive industry where different kinds of enterprises co-exist. Many construction enterprises are small and medium-sized enterprises (SMEs), and the larger-scale enterprises tend to be state-owned enterprises (SOEs). Without creating a favorable business environment for most of them, the labor employment seems difficult to improve. However, the task to reform these enterprises is enormously challenging, especially with an integrating of economic and social objectives.

1.1.3 Contributions of the construction industry in China

(1) Pillar for national economy

The Chinese construction industry has so far enjoyed a good opportunity for development, and has already been a leading contributor to the Chinese national economy. It covers 12 sectors in China, including commercial and residential buildings, roads, railways, port facilities, water and irrigation, electric power generation, mining, smelting, chemical and petrochemical plants, transportation, mechanical installations and urban public utilities. The construction industry in China has developed rapidly during the last three decades with a number of glorious productions such as Three Gorges Project, High-Speed Railways, Urban Mass Transit, and so on. It has generally acknowledged as a pillar for national economy in China.

The Chinese construction industry is a key supplier of infrastructure and investment to the economy, with the construction and installation accounting for 13.9 trillion Yuan, more than 60% of Total Investment in Fixed Assets (FAI) in 2009. Since the construction sector is largely dependent on fixed asset investment and the growth in China's economy has being largely driven by investment, activities in the construction sector closely correlates the development of the national economy. Therefore the efficiency of the construction industry is a key determinant of the competitiveness of the supply of infrastructure and investment goods into Chinese economy. The construction industry has maintained a strong level of development in China in recent years, with the Gross Output Value (GOV) increased by more than 5 times in the last decade, demonstrating a slightly faster growth than that of its Gross Domestic Product (GDP) (see Figure 1-2). In 2009, Value-added by the construction (VAC) accounts for 6.6 percent of China's GDP (see Figure 1-3).

The building construction industry in China has recorded a consistent strong year-by-year

growth during the period from 2006 to 2010, and is expected to continue to grow during the period from 2011 to 2015. Supported by robust economic growth and government spending, Emerging Market Intelligence expects a broad base growth in building construction across all key sectors, including residential, commercial, industrial, and institutional sectors ^[22].

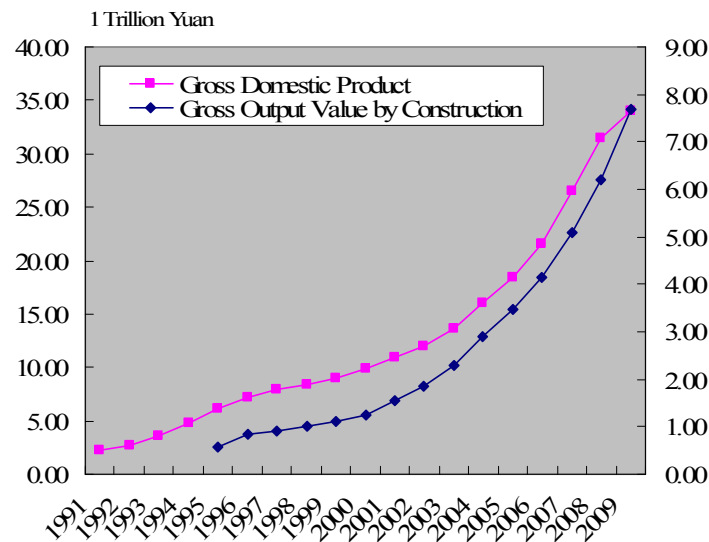


Figure 1-2 Gross Output Value of Construction, and Gross Domestic Product in China (1991-2009)

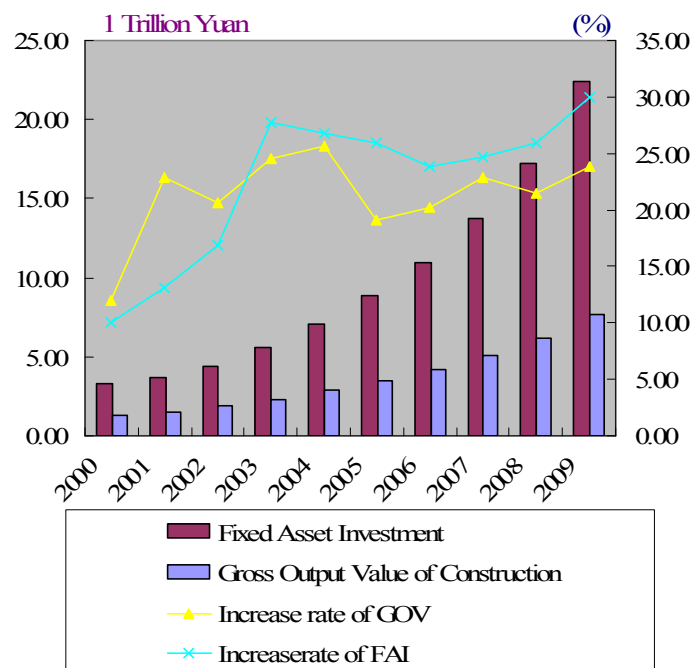


Figure 1-3 Fixed Asset Investment, Construction Gross Output Value, and increasing rates (2000-2009)

(2) Ability to absorb labor force

As the third largest sector in employment according to China Statistical Yearbook, the construction industry has been making an increasing contribution to employment in China. Along with the increase of FAI, the number of construction laborers also increased (see Figure 1-4 and Figure 1-5) with the exception of a small decrease in 1998. It is estimated that total employment in construction increased more than 3 times between 1980 and 2009. By the end of 2009, the number of Construction Enterprises reached 70,817, employing 36.73 million people and generating 7.68 trillion Yuan in GOV and 1.56 trillion Yuan in VAC. Profits totaled 271.88 billion Yuan in the year, with taxes at 265.37 billion Yuan.

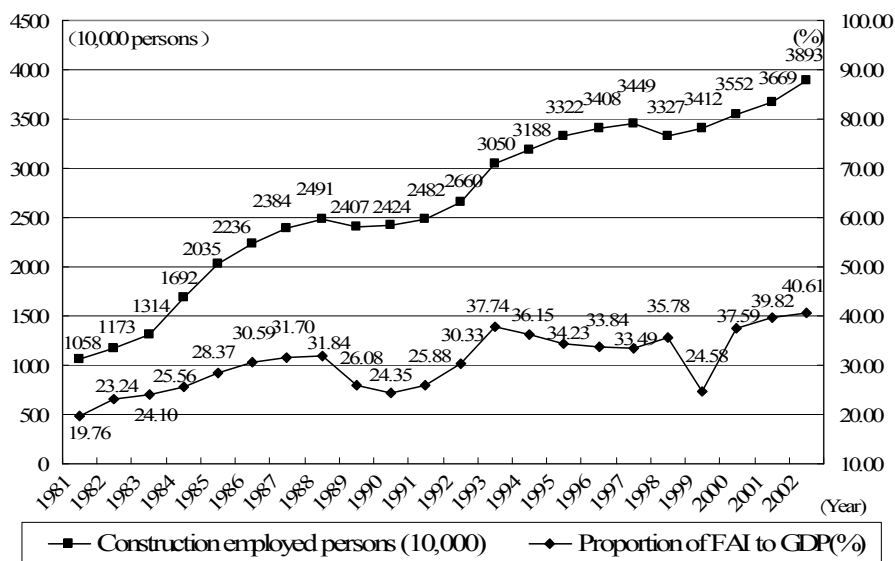


Figure 1-4 Status of construction employment in China (a)

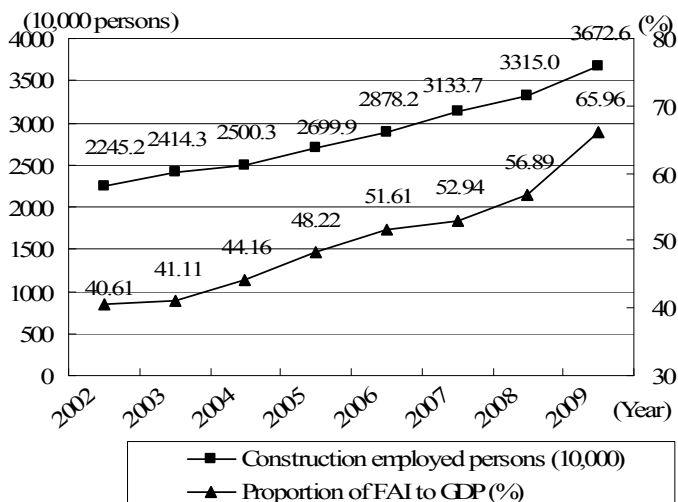


Figure 1-5 Status of construction employment in China (b)

From 1981 to 2002 (Figure 1-4), construction employed persons refer to all people who are engaged in social labor related to construction and get corresponding remuneration or business income. From 2002 to 2008 (Figure 1-5), construction employed persons refer to people employed by construction enterprises that are with licenses of either general contracting or professional contracting (referred to as ‘GCEs’ or ‘PCEs’ hereafter) according to the new Construction License System established in 2001. Therefore, the data since 2002 is not comparable with that of previous years. What needs to be highlighted here is that, the number of construction laborers is much bigger than that of statistics. In China, the expansion of construction has brought a boom in the number of construction laborers, of whom more than 80% come from rural areas, named ‘migrant laborers’. Migrant laborers in China particularly refer to as those rural surplus laborers who come to urban areas to make a living rather than farming in the countryside. The rough data shows that there are at least 40 million migrant laborers associated with construction works in China. And most labor issues are associated with this particular group.

1.2 Problem statement

1.2.1 Dilemma confronted by the Chinese construction industry

(1) Not yet sufficient role in employment

According to the data from China Statistical Yearbook 2009 and the Second National Economic Census of China, the proportions of Construction Value-Added to GDP (6.6%, in 2009) and construction employment to total employment (5.0%, in 2009) remains much lower than other developed countries or regions in Asia ^[23](see Table 1-3). It indicates that Chinese construction industry still has an enormous potential to develop aiming at more contributions to national economy and employment.

Table 1-3 Significance of construction to national economy in different Regions

Country or Region	Proportion of Construction Value-Added to GDP (%)	Proportion of Construction Employment in Total (%)
Japan (2000)	7.3	10.1
Korea (2000)	7.6	7.2
Singapore(2000)	7.0	5.9
Hong Kong (2000)	7.1	9.0
China (2009)	6.6	5.0

(2) Stagnant employment growth in the construction sector

Recently, although the construction sector has continued to expand recent years, the potential of construction abilities in absorbing labor force sees a tendency to be faltered or slowed down, even with a decline in the rate of employment in some year. In other words, the stagnation of employment growth in construction has been gradually revealed. It has already been observed by researchers from China, and the reasons for stagnation of employment growth in construction sector could be explained as following ^[24]:

- Stagnant growth of urban employees employed in the construction sector.

From policy review, the stagnant employment growth of urban employment in the construction sector is largely due to reforms and restructuring of the SOEs and the employment relation change from permanent to temporary.

- Sluggish growth in the number of rural laborers employed in the construction sector.

Literatures and regression analyses show that increasing mechanization and industrialization has eased the growth in rural employment. It seems to be a dilemma between reform objective of labor productivity up and a heavy price paid in terms of employment opportunities. With regard to the third reason labor productivity in the construction sector, it is argued that while the greater efficiency and improved labor productivity were the objectives of reform and greater development, a heavy price was paid in terms of employment opportunities in China.

Another important reason that should be pointed out lies in the negative image of construction, which results in the difficulties in recruitment and retention of construction laborers, especially among the growing new generation of migrant laborers in recent China. Construction industry employers seem to lag behind other industries in how they conduct their people practices. This gap must be closed; otherwise recruitment and retention of employees will become chronic problems in the near future. Those explanations argue that the future construction development in China calls for more labor-oriented strategies. The government should place considerable importance on maintaining a competitive and flexible construction labor market. Meanwhile it could be noticed that informal employment is supposed to play a significance role in the rural labor employment, although it seems to provide the hotbed for the exploitation of the construction laborers to happen easier.

(3) Poor working and living conditions of migrant laborers

In China, the expansion of construction has already been a leading contributor to the Chinese national economy, and brought a boom in the number of construction laborers, of whom more than 80% come from rural areas, named ‘migrant laborers’. In China, migrant laborers particularly refer to as those rural surplus laborers who come to urban areas to make a living rather than farming in the countryside. Contrary to the glorious achievements in the

construction sector, the working and living conditions of its labor force are extremely miserable (see Figure 1-6).

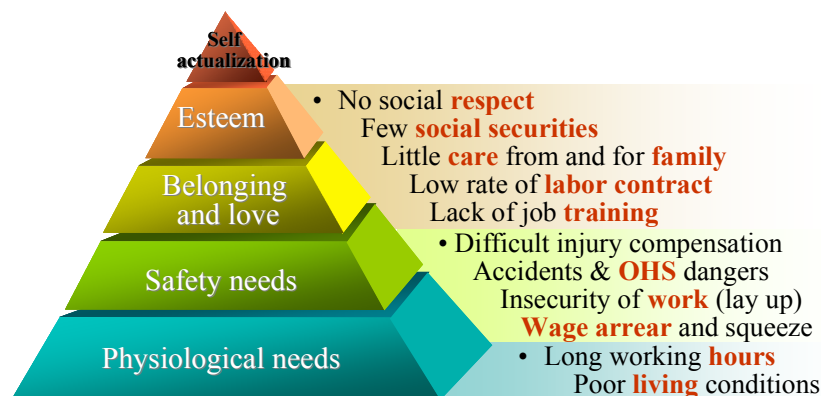


Figure 1-6 Poor Construction Migrant Laborers in China

Source: Investigation in China Railway 12th Bureau Group Co., Ltd (CRGC-12), 2009

<http://sacom.hk/category/campaigns/new-world-development-construction-workers>

In general, those severe treatments for laborers are largely stemmed from the universal discrimination and no human respect for the rural laborers, no matter from employers or the whole society. It can be disclosed from the Chinese saying by ‘*nongmingong*’, sometimes by ‘*minggong*’ in short. This kind of discrimination can be felt everywhere in China. It reveals the emergence of a racially divided work systems in construction sector even the overall Chinese society. The details will be shown in next chapter with more interpretation and exploration of the root causes. Figure 1-6 shows that the future construction development in China calls for more labor-oriented strategies urgently.

1.2.2 Necessity of more labor-oriented strategies for industrial development

With regard to the industrial policies in the Chinese construction, up until now, those policies have mainly been oriented from the perspective of the industrial development³, focusing on such issues as enhancing technical aspects of the industry, improving labor productivity, and increasing enterprises’ efficiency, and so on. This can be seen in: the reform and restructure of management in construction enterprises, as well as the introduction of the market mechanism into recruitment practices in the 1980s; the reform of state-owned enterprises (SOEs) and

³<http://www.lawinfochina.com/NetLaw/display.aspx?db=law&sen=rLdDdW4drhdDdWfdrLdFdWdd9ddvdWnd9DdGdWfdrddGdWud/Ld5dWEd9hdDdWud/ddTdWud9Dd+&Id=4604&>

adjustments to the qualification requirements adopted in the late 1990s; and the promotion of mechanization and industrialization these years. It is true to say that many good experiences have been accumulated with regard to the rapid development of construction industry. However, the negative effects on the potential on the job growth and employment situations have being occurred. This can be noticed from the increasing difficulties in retention and recruitment of the construction labor force in recent China, with a major reason that most construction laborers have being suffering from the poor working and living conditions, such as low wage, long work hours, uncertainty of employment, less social securities, and so forth (Figure 1-6). It reveals that a labor-based development strategy may need to be taken into consideration as soon as possible for current and future of Chinese construction. However, until now, far from enough attention has been aroused to the significance of the labor-based development strategies in construction sector. It is not exaggerated to say that the construction industry employers lag far behind other industries in how they conduct and inspire their laborers practices. This gap must be closed; otherwise recruitment and retention of employees will become chronic problems for Chinese construction in the near future. In other words, it is urgent for Chinese construction not only to pay close attention to improve current employment situation, but to raise the issue that how to foster a sustainable construction labor market as a vital element in its future development. It is certain to be a complicated and systematic task to be tackled carefully, since any frequently changeable or short-sighted regulations or interventions would not only not solve the existing problems efficiently and fundamentally, but bring new fatal problems and aggravate the tension between the construction industry and its labor force eventually. Examples of China will be given and analyzed to show how the negative effects happened.

1.3 Research objective

The challenge to economists, policy-makers, and construction employers in China is not only to find remedies that will cure the deteriorated construction labor market but meanwhile aim at building future construction labor force as well. The focus of this study is to identify and analyze the practices in the areas related to the construction labor market amid the development of construction industry, based on which to seek for balanced and sustainable strategies to develop Chinese construction labor market integrating economic and social views. The negative side-effects of recent approaches to develop construction labor market in China are specially called for careful examination in order to learn lessons.

In short, at least the following objectives will be achieved in this study with the support from the cases of China Railway 12th Bureau Group Corporation (referred to as CRGC-12), and *Kajima* Corporation of Japan (referred to as *Kajima*).

-
- 1) Explore the construction labor problems amid the development of construction industry in China;
 - 2) Analyze the unsatisfactory progress of recent scheme for regularizing the construction labor market in China, of which the side-effects are specially examined in order to identify the root causes;
 - 3) Seek for promising practices for building the future construction labor force, integrating the economic views on industrial development;
 - 4) Put forward appropriate strategies for sustainable development of Chinese construction labor market combining the practical situation; and
 - 5) Conduct an analysis on the potential economic incentives to support the proposals through mathematic models.

1.4 Structure of the dissertation

The thesis is organized into the following 7 chapters (see Figure 1-7). Chapter 1 describes the research background, problem statement, and research objectives. The process and reasons of the deterioration of construction employment situation in China will be described and explained in details in Chapter 2, keeping an eye on its interconnections with the construction production problems as well. Followed with that is the problems to be focused to solve in this research. Chapter 3 provides literatures review on several practices and theories around the issues related to the construction labor market development, such as flexibility of labor market, labor outsourcing practice, differentiation and integration in the construction management particularly regarding labor organizing process, transaction cost theory and so on. Based on the above, lessons will be drawn to give the detailed directions for this research. Chapter 4 puts forward the research questions that are narrowed down, and describes the conceptual model to be argued in form of the hypothesis tree, addressing the development of appropriate strategies and approached for the research. Followed is the analysis methodology used to test those hypotheses and the reasons for the cases or samples selection. Chapter 5 provides the development process and determinant factors of cases in China and Japan, attempting to explore the theoretical and practical illuminations from their failure and success. Based on that, a new approach on labor procurement combining competition and cooperation among the Chinese construction enterprises is put forward in Chapter 6, and the theoretical analysis on its incentive mechanisms will be conducted through a tentative mathematical modeling. The thesis concludes by summarizing the major findings of this research and pointing to some directions for future study in Chapter 7.

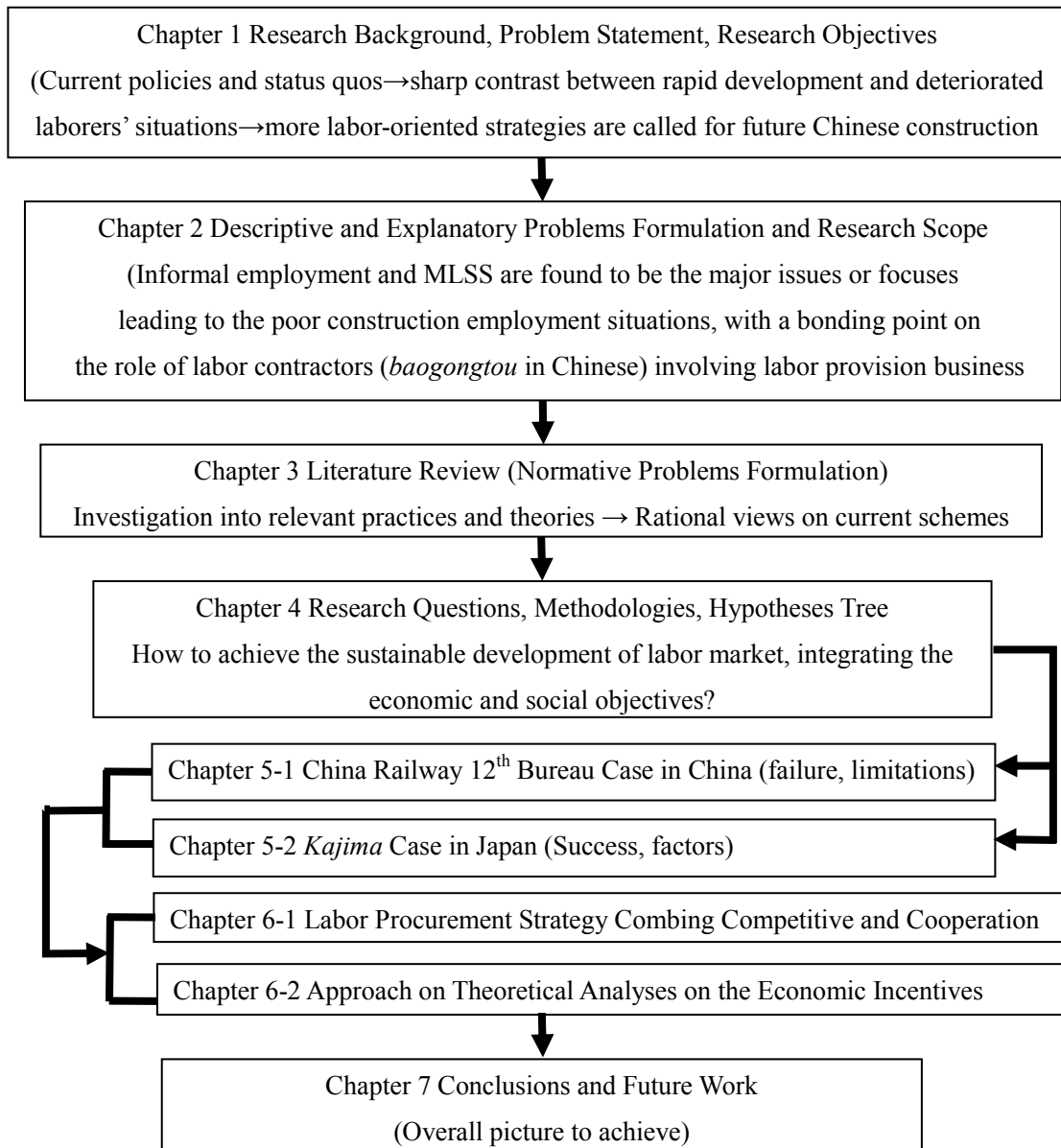


Figure 1-7 Structure of the Dissertation

2 Problem Formulation

Any useful prescription and effective implantation depend on the accurate diagnosis, which indicates the significance of the detailed exploration of current status quos of Chinese construction labor market in terms of descriptive and explanatory problems formulation.

During the last three decades, Chinese construction industry has developed rapidly which has already become one of the largest construction markets in the world. It has brought a great volume of construction activities and a boom in the number of construction laborers. This part is trying to capture a general image of Chinese construction labor market, basically involving the source of labor (migrant laborers), the basis on which it is employed (employment system and construction production systems) and the way it is treated (exploitations and no respects).

2.1 Institutional changes associated with the labor employed basis

Since the Reform and Opening-up Policy in 1978, Chinese construction labor market has undergone some changes along with the institutional reform. Over the last three decades the industry has undergone major changes in its industrial and the workforce structure. This part examines shifts in the industry and workforce structure of the Chinese construction industry over the last three decades.

2.1.1 Reform and restructuring of construction enterprises with changes in employment systems

Most large and medium-sized construction enterprises in China had been state-owned establishments under the traditional planned economy system. One important goal of economic reform in China was to allow those state-owned enterprises to be more market driven. Along with the state-owned enterprise restructuring, permanent employment under Centralized Placement System was gradually substituted by optional employment under Labor Contract System. As a result, a number of construction laborers were gradually dismissed from most state-owned construction enterprises into optional employment labor market, while technical and management staff members were maintained. It subsequently led to the separation between technical and management layer and labor-service layer regarding construction management.

In other words, on the one hand, a number of construction laborers possessing construction experiences were released to construction labor market, which meant that they had to strive for their living in other ways. Some of them continue construction works mainly involved in labor-service business under new mode (interpreted in Chapter 5). On the other hand, as most

large and medium sized construction enterprises have gradually focused on techniques and management issues, it then becomes necessary for them to find capable and trustful collaborators who can provide with good laborer-service and take charge of concrete construction work on site.

2.1.2 Readjustment in the overall construction industrial structure with a newborn labor service business

From above, it could be noticed that construction labor-service has gradually been separated from previous construction businesses, and formed as a new business. Along with the overall construction industrial structure readjustment in China, the status of this newly developed business has been clarified and confirmed in the whole construction market.

(1) New Construction License System

Since institutional reform in the construction industry started in the 1980s, China has gradually introduced Tenders and Bids System into construction projects. Under this system, a general contractor usually estimates the total cost for building a project and places a bid or estimate on the entire project. In turn, construction subcontractors offer bids for their services and are hired by the general contractor based on those bids and their professional reputation. This system is universally adopted in most construction projects in China now, in which a number of laborers, artisans and professionals are supposed to complete the specific tasks that they specialize in as subcontractors. As a result, relationship between general contractor and subcontractor tends to become a crucial element to assure a smooth process of construction projects. Concerning subcontracting business scope, there are two categories of subcontractors according to current Construction License System. One is professional contractor (PC), and the other is labor-only contractor (LC). A brief explanation of those three categories of contractors involved in the construction production is introduced as below.

General Contractor (GC): General contracting in China previously was only regarding business of construction. Nowadays, in order to be consistent with the global market, large and middle sized construction enterprises are being encouraged to develop their integrated competencies for Engineering, Procurement and Construction (EPC) contract. Correspondingly, super-level license of general contracting was added to Chinese Construction License System in 2007.

Professional contractor (PC): A construction professional contractor is only permitted to subcontract with general contractor or client to finish the permitted professional engineering work within a construction project. According to new Construction License System, there are 60

kinds of professional engineering work. The general contractor and professional contractor ought to have a joint and several responsibilities on the subcontract project.

Labor-only contractor (LC): It has not been put forward formally until new Construction License System was established in 2001. According to current Construction Law of the People's Republic of China and related regulations, a labor-service subcontractor can only make a contract with general contractor or professional contractor regarding labor provision business rather than other engineering works.

Figure 2-1 shows the overall picture of the institutional changes that have great impacts on the employed basis for laborers.

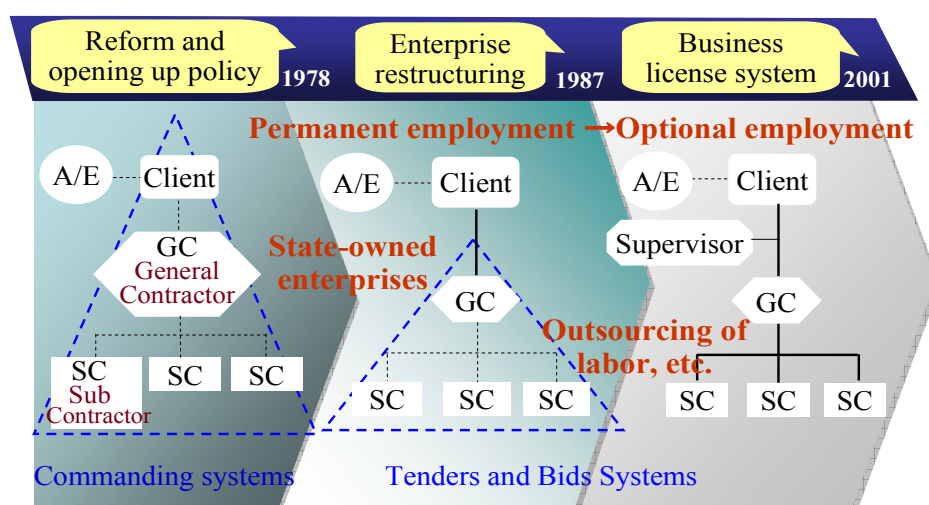


Figure 2-1 Institutional changes in the Chinese construction industry

(2) Contracting relations in principle and in practice

In China, subcontract of engineering works again is strictly forbidden according to current laws on Tenders and Bids. Two points are highlighted here. One point is that in China, subcontract of engineering works again is strictly forbidden according to current regulations. The legal contracting relations under Tenders and Bids systems should be as shown in Figure 2-2 in principle; however, the practice of multi-layer subcontracting exists on construction sites widespread with insufficient site supervision, vague responsibilities for involved parties. Another point is that as shown in Figure 2-2, labor-only subcontracting positions at the most fundamental layer. As a newly separated business as labor provision from those conventional construction businesses in China, labor service market is far from well developed yet with undisciplined trades, mostly done by small and unqualified informal labor service groups or teams. Numerous problems closely related to this business arise in practice due to insufficient competencies of labor subcontractors, such as frequent construction accidents due to insufficient

capabilities of labor subcontractors, jerry building leading to poor quality of projects, infringement of migrant laborers' rights under illegal acts of labor-service business, and so on. Considering its indispensable and fundamental function on the implementation of construction site management, labor-service subcontracting management need to be stressed and regulated regarding project objectives.

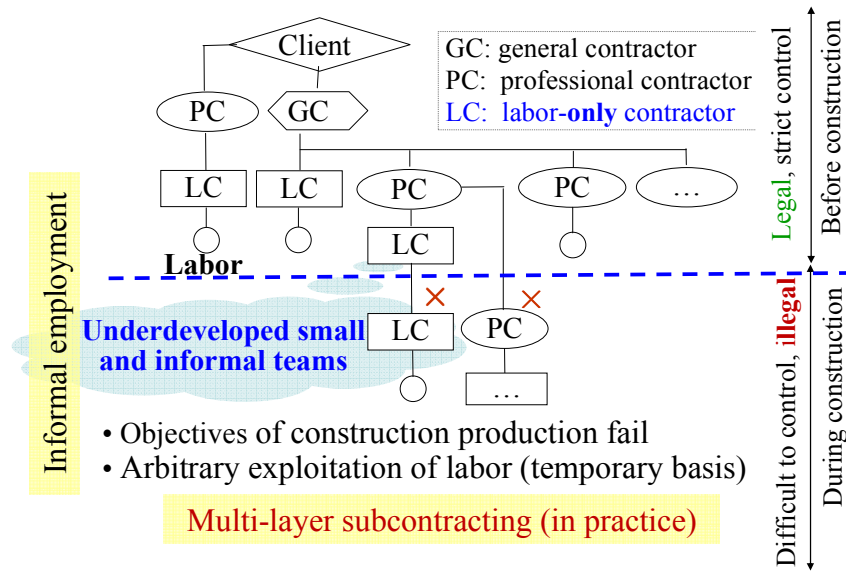


Figure 2-2 Contracting relations in principle and in practice

2.2 Boom of construction migrant laborers

During the period of economic and social transformation, many peasants began to be liberated from traditional cultivation and farming works, who then rushed into urban areas and were largely absorbed by the construction industry. They generated a particular phenomenon in China called 'migrant laborers'. Migrant laborers in China refer to those who have a rural household identification according to current Household Registration System with strict urban and rural divisions, but the main income is from other sources rather than farming.

2.2.1 Characteristics of construction labor force and impacts on construction work

The phenomenon of the boom of construction migrant laborers is mainly due to the following two institutional changes. One is the change from previous collective production and equal distribution under rural collective communes to autonomy of agricultural production by families or individuals under new Rural Land Contract System. It increased the rural labor productivity to a large extent, and then generated a surplus rural labor force. The other lies in the

cancelling of some unreasonable restrictions on peasants' rights to enter the urban labor market involved in construction works.

In a word, migrant laborers have become an indispensable part of construction labor force (see Figure 2-3) and made a great contribution to the rapid development of Chinese construction industry^[25]. Seen from another aspect, the construction industry has played a significant role in absorbing surplus rural labor force in China, in view of the fact that approximately a quarter of total migrant laborers throughout the whole country are involved in construction works nowadays^[26].

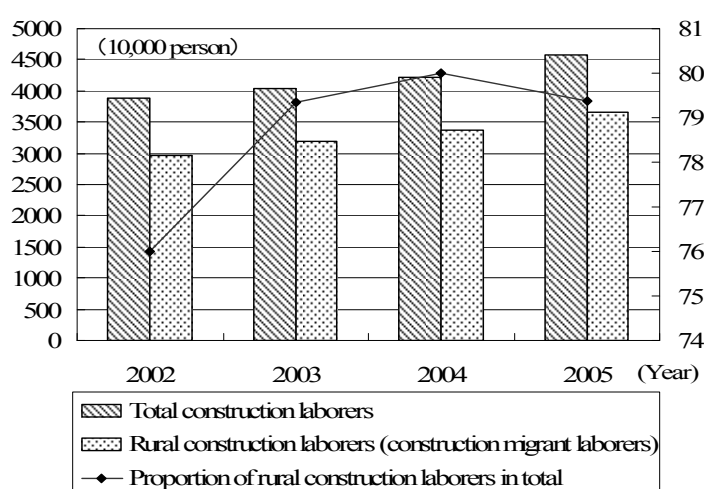


Figure 2-3 Contribution of rural labor force to the construction industry in China

Among those construction migrant laborers, only a few of them are employed by formal construction enterprises, while the majority of them worked on urban construction sites under informal employment by rural construction teams. Chinese construction migrant laborers are mainly categorized as follows:

Type A: Employees from town and village labor-service enterprises or other urban construction enterprises. Most of them are relatively-fixed skilled workers, which accounts for only 4%~5% among all migrant laborers in Chinese construction industry.

Type B: Rural construction team, as most widely existing form. These migrant laborers are usually recruited by so-called 'labor contractor' (see Chapter 5), and then exported to construction fields by teams. There is no guarantee for construction migrant laborers in any legal form.

Type C: A few scattered laborers who try to find jobs individually.

The following features make labor-service management of construction projects more difficult.

- **Large number**

There is usually a quite huge requirement for laborers on construction site especially in the infrastructure projects. For example, in bidding sector 2 and sector 3 of civil engineering works of Beijing-Shanghai high-speed railway project, the numbers of construction laborers on site once reached a peak of approximately 18,000 and 29,000, respectively. And nearly 80% of them were migrant laborers. Managing such a large number of laborers is a big challenge itself.

- **High disparity**

Generally speaking, as laborers recruited in construction project usually come from different parts of China, they have significant differences in customs and living habits. It can easily result in communication difficulties and even conflicts, which are inconsistent with the concentrated construction management. During the investigation of one project conducted by China Railway 12th Bureau Group Co., Ltd, a staff member from the company said that as construction laborers on site were usually from various provinces (16 provinces in this case), the distinctive dialects made it difficult to convey instructions and get feedback clearly. What is even worse is that sometimes laborers had conflicts with each other due to localism. Thus most staff members from the company were unwilling to communicate with the field laborers, and even discriminated them.

- **Seasonality**

Over a long period in the traditional agricultural society in China, most peasants possessed nothing except bound to farmlands, so they had a strong feeling on farmlands. Even when Chinese peasants strived to move to urban areas pursuing for a higher-quality life, they could not cut down the relationship with their farmlands. In addition, as the urban areas have not yet fully opened to the peasants (largely due to Household Registration System), admission of them in urban areas is extremely difficult. What mentioned above results in the phenomenon of migrant laborers returning to rural hometown, especially in the harvest season and traditional festivals, regardless of how long, crowded, and expensive it will take them to back home. It is likely to lead to high risk of labor shortage and project delay during construction process.

- **Low quality of service**

Most construction migrant laborers are poorly educated. Even worse, most of them just left their hoes for entering the construction sites without any vocational training or construction experiences. They could not meet the skill requirements of large-scale construction. In 2002, the number of construction migrant laborers was around 29.59 million, of whom only 2.5% have been formally trained and certified. Even including those who have received short-term training, the percentage would not be more than 8%. It makes it extremely difficult to conduct labor-service management in practice. In addition, lack of skilled laborers has been found as a key factor affecting construction safety on sites ^[27]. As a result, it seems necessary to speed up

skill training among migrant laborers so as to be adapted to scaled and centralized construction.

- **Lack of the conception of overall project performance**

There exists a so-called small-peasant-mentality among most migrant laborers, with the main characteristics as distinctive individualism and the only concern of income. Lack of consciousness of overall project performance especially regarding quality and safety makes it extremely difficult to implement management among them.

In recent years, construction migrant laborers have become a grave concern for the society as many problems arose. Take construction accidents for example, their low-level performance had been severely blamed as one of the main reasons for safety and quality problems on construction sites. However, it should be considered more seriously that it is usually them who suffer most from construction accidents. Their living conditions had also been extremely poor for a long time, with widespread payment delay or default, and extremely excessively long working hours ^[28].

2.2.2 Construction migrant laborers' poor situations and 'plausible' causes

Figure 2-4 outlines the experiences of migrant workers in the construction industry and the influences migrant workers are having during the reorganization process of construction industry laborers. For the causes behind those problems, it usually focuses on the 'illegal' practice of multi-layer subcontracting that has universally existed during the construction process, and the practice of informal employment after the reform on the employment systems. The universal views on negative effects of those two schemes on migrant workers and the ways in which they are related to the construction production in China are outlined in Figure 2-4.

Whilst there are various views concerning the labor organizing process and subcontracting ^[29], Figure 2-4 depicts the far-reaching influences of migrant workers. Take wage arrears for example. The problem of wage arrears in the construction industry has been long regarded as a difficult problem. In the end of 2003, the Premier of the State Council of China, Wen Jia-bao, helped a Chongqing migrant worker to get an arrear wage and shed tears for the hardship of workers. Despite the several years administrative efforts, the labor conditions in the construction industry seem not improve much. Another grave example lies in the aspects of social securities. The rate of participation of social securities is almost the lowest among all sectors in China⁴ (see Table 2-1).

In view of those miserable situations for construction migrant laborers ^{[30] [31]}, several countermeasures have been taken with resort to compulsion by administration, however with unsatisfactory effects or progress.

⁴2009 investigation on migrant laborers in China

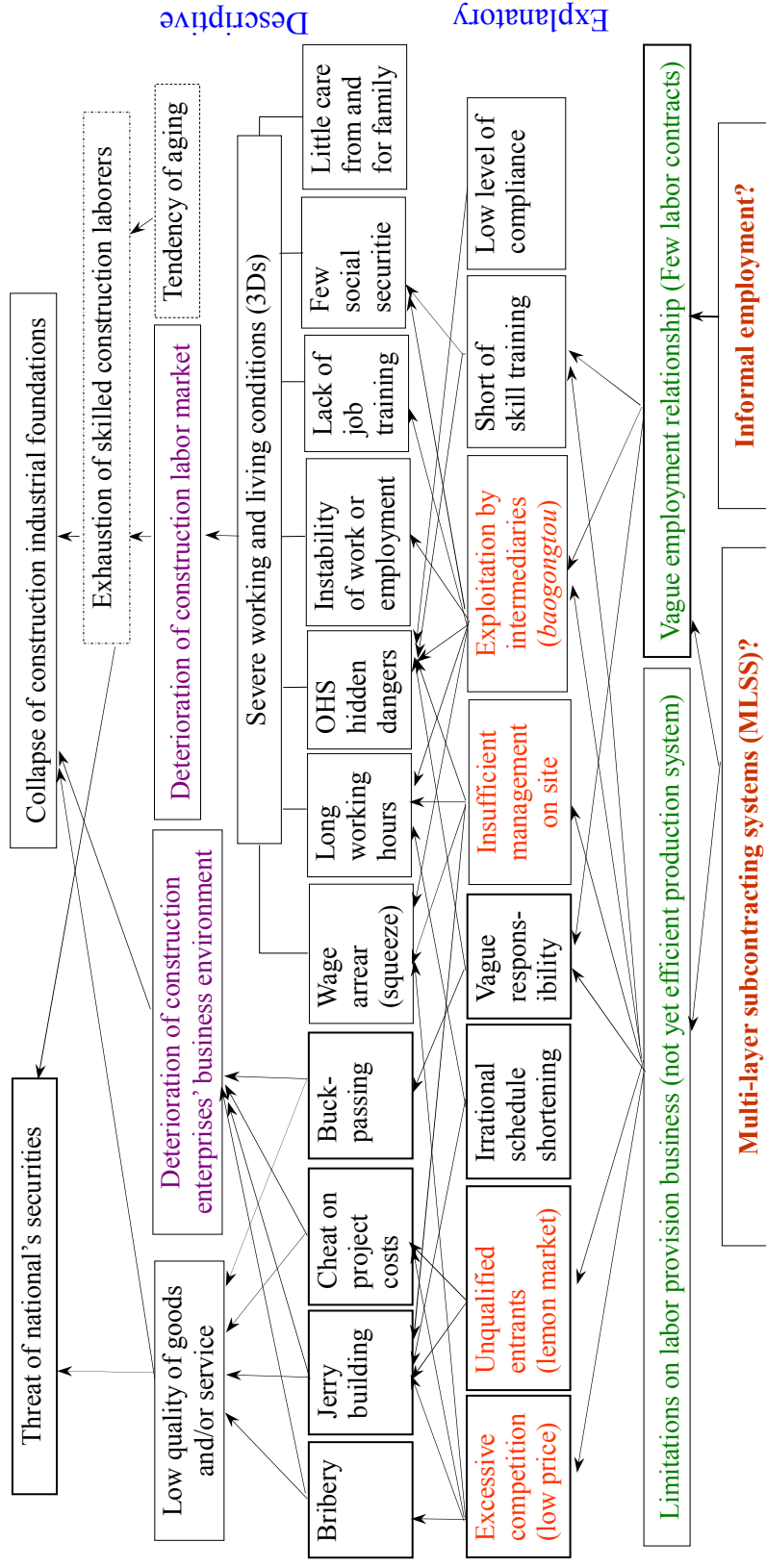


Figure 2-4 Descriptive and explanatory problems formulation

Table 2-1 Participation rates of social insurances among migrant laborers in China (%)

Sector	Pension insurance	Occupational injury insurance	Medical insurance	Unemployment insurance	Maternity insurance
Manufacture	8.8	27.5	14.7	4.2	2.4
Construction	1.8	15.6	4.4	1.0	0.6
Transportation & post	10.7	27.2	15.4	6.1	3.5
Retail	6.1	11.6	8.3	3.1	1.8
Accommodation & Restaurants	3.6	11.7	7.1	1.7	0.8
Service	4.8	14.2	9.4	2.7	1.6

2.2.3 Notorious ‘*baogongtou*’ and its unpromising alternative

In 2001, labor supply enterprises became a new category under the licenses system in order to regularize and develop the construction industry labor market. Recent studies in China described the central role of labor contractor, known locally as ‘*baogongtou*’, who is the head of the working team with laborers usually coming from the same rural area. *Baogongtou* exerts profound influences on the labor provision business and the lives of construction workers. Through joining an informal team led by a *baogongtou*, the laborer is provided with an opportunity to obtain work and acquire skills, which can lead to higher income to some extent. However, this opportunity is mostly denied to those without family and social connections with *baogongtou* that are needed to join the team. Thus, it is regarded to post a barrier to training and innovation. Even worse, frequent construction accidents and labor payment default have been universally reported with an indiscriminate blame on *baogongtou*. As a result, *baogongtou* is generally considered to have negative connotations in China, which precipitated the Chinese government to prohibit the informal *baogongtou* and promote the formal labor service enterprise (LSE) as an alternative in 2005. However, due to the excessively high barriers and stiff criteria of the establishment of LSE, labor subcontracting enterprises have not matched expectations in terms of development (see Figure 2-5). Many such enterprises seek a higher level license and there is a huge imbalance in the number of general contractors compared with labor supply subcontractors. This is unlike normal business practice in the construction industry and so policies and regulations may need to be reassessed and adjusted accordingly by policy makers. A more detailed analysis on the root causes behind will be given in Chapter 5 through the case study of CRCG-12.

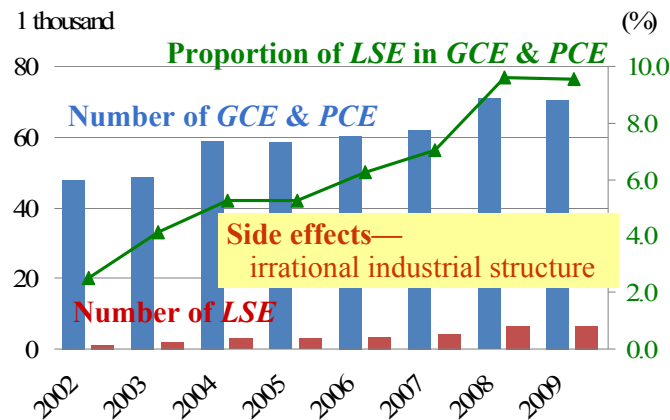


Figure 2-5 Unsatisfactory development of LSEs

Fresh thinking may be needed, not only focusing on external and forcing changes in labor contracting organizations. In a summary, rigid interventions by government have not achieved a sustainable and effective solution, in turn may have negative side effects. A more rational response may argue that the scheme itself is inappropriate only when it does not fit the reality. Actually, informal employment and MLSS have rationality of existence for current Chinese construction. Schemes in countries like Egypt, India, and Korea, illustrate that the policy direction should be based on the acknowledgement of laborers' temporary or casual employment status instead a fundamental change in the way they are recruited and employed. And MLSS in Japan even performed very well during developing period.

From a long-term view, perhaps it may be more valuable to regulate employment behaviors of labor-service traders, with regard to construction management from organizational level in order to ensure migrant laborers' legal rights more effectively. In other words, the role of labor contractors need be examined carefully, in view of its direct relationships with most construction laborers on site in order to find a fundamental and sustainable way to solve those labor problems.

The focus could be how to promote construction management from organizational level, in this case, how to encourage the development of LCs, even PCs to be better integrated into the construction production systems with good performance. That is to say, may how to encourage proper development of subcontractors including LCs even SCs (mostly small and medium-sized enterprises) with a focus on labor-based technologies under the overall production systems become the crucial issue for both industrial structure adjustment and employment improvement, which may bring a possible soft landing for future construction.

3 Literature Review

This chapter is mainly aiming at a better understanding the practice of subcontracting and its implications on the construction production and labor market development from the institutional view and organizational view (at a firm level).

3.1 Understanding the development of construction labor market

As mentioned before, an adaptable construction labor market should not only assist in sustaining high levels of employment situation, but help create the conditions for construction business success as well. Thus, a deep understanding of the development of construction labor market from an economic view is necessary.

3.1.1 The characteristics of construction production

Distinguished from other sectors, construction has several particular characteristics, which exert great impacts on its production systems and labor market development.

- 1) The execution and completion of construction production takes place on temporary and mobile worksites.
- 2) The projects are normally unique with a relatively non-standardized immobile final product.
- 3) The industry is exposed to weather variations and seasonal cycles.
- 4) Construction is very materials-intensive and location-dependent.
- 5) The end price is demand-driven, and the costs are supply driven.
- 6) Market orientation can be local, rural, regional, national and global.
- 7) The construction sector is characterized by a widespread variety of small and medium-sized enterprises and a limited, but dominant group of large general contractors. It has following two implications, especially crucial in this study.
 - Competencies are not equally distributed over the production chain and the organization of skills is divided and fragmented.
 - The negotiation power of construction enterprises, especially those small and medium-size enterprises, is very weak compared to their clients, general contractors, and large materials suppliers.

Thus, the production system for construction is very heterogeneous. It generally demands cooperation under the various circumstances in one-off and complex construction project. A

great number of subcontractors with various specialties and competencies are involved throughout the project life cycle that is from conception to execution and completion.

Furthermore, the production process generally takes the form of a fragmented multiple chain of production that has lengthened and broadened ^[32]. This chain constitutes a logistical chain (both horizontal and vertical), as well as a value chain of an economic and productive nature from conception to completion. Works with specialties or other common tasks are often outsourced to small enterprises, teams, or self-employed workers. In view of this process of subcontracting or outsourcing, which results in the thinning of direct labor force and the demand of various suppliers or subcontractors, existing enterprises become size-down and new enterprises emerge. Cremers (2009) argues that subcontracting or outsourcing to those independent enterprises does not lead to the true-sense independence. Companies at a lower level in the value chain, with the exception of high-tech specialty subcontractors or other proprietary activities, are not on an equal footing to act compared with general contractor or its upper contractor. Thus labor force is prone to being treated as a buffer to their disadvantageous business positions.

3.1.2 The flexibility of construction labor market

With regard to labor market development, some researchers use the flexibility as a measurement for institutional deficiencies. According to a research report on labor market development research from UK ^[33], it is worthwhile elaborating on the deficiencies of the institution-based measures during the development of the construction labor market mainly with a regard at flexibility. Commonly, it is assumed that flexibility increases each time the regulation on labor market occurs, and conversely the flexibility decreases when some deregulation occurs. However, many researches have pointed that flexibility should be influenced and determined by numerous factors, including employment regulations, labor market, institutions, etc. ^{[34] [35]}. As a result, a comprehensive understanding of the flexibility of labor market is needed before any improvement approach is done to achieve its sustainable development.

(1) Definitions of construction labor market flexibility

The report on an ‘index of labor market flexibility’ (ILMF) by BERR⁵ summarizes some comprehensive definitions of construction labor market flexibility. One possible definition at a broad level might be the degree to which the ‘forces’ of demand and supply determine labor market outcomes without being impinged on by the other factors, such as institutional, cultural

⁵Adopted from the report by Department for Business Enterprise & Regulatory Reform (BERR) of UK

and political impediment. A more narrow definition might be the extent and duration that unemployment deviated from its natural rate in response to shocks. Most definitions are likely to be ultimately related at a conceptual level, though the implications for how flexibility may best be measured are likely to vary.

There are three domains involving most key drivers to influence the labor market flexibility. Figure 3-1 captures those main three domains of construction labor market flexibility and their component sub-domains. Of course, it does not include all domains that are likely to influence the labor market flexibility, but it is believed to include the key drivers. What is to be stressed here is that the flexibility of production function consists of the employment status, which is not necessary to be permanent. It may also include casual or temporary employment, including fixed-term work, part-time work, subcontracting, and other forms. The various employment forms could make firm more flexible with its business or production process to some extent.

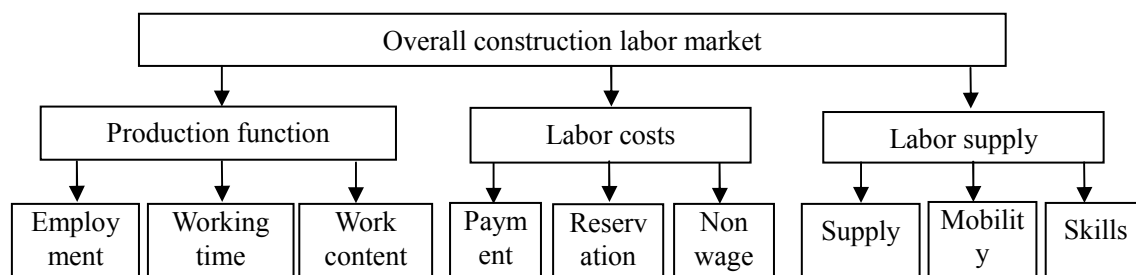


Figure 3-1 Identified components/domains of flexibility

Note: In labor economics, the reservation wage is the lowest wage rate at which a worker would be willing to accept a particular type of job.

(2) *Interactions between institution and labor market*

According to those definitions in the previous section, one key point that should be stressed on is that the flexibility is actually an outcome of numerous factors interacting in the labor market, rather than just being dominated by one or two. Figure 3-2 illustrates the dynamic interaction between labor market outcomes, regulation, and flexibility, which is derived from Monastiriotis's model ^[36].

It shows that there exist dynamic interactions between labor market outcomes, regulation, and flexibility. Monastiriotis regards that regulation can be thought of a set of conditions those are outside the labor market but have impacts on it. Labor market outcomes (the level of employment, real wages, etc.) can be a function of these regulatory conditions and other conditions (the skill-mix and geographical dispersion, etc.), and also the degree of flexibility in

the labor market. In turn, labor market outcomes will have feedbacks onto the regulation, other conditions (which may move with some inertia) and the level of flexibility. In this sense, flexibility itself can be regarded as an endogenous outcome, from a complex set of interrelationships. Furthermore, labor market flexibility can increase or decrease for reasons completely unrelated to regulations or institutions.

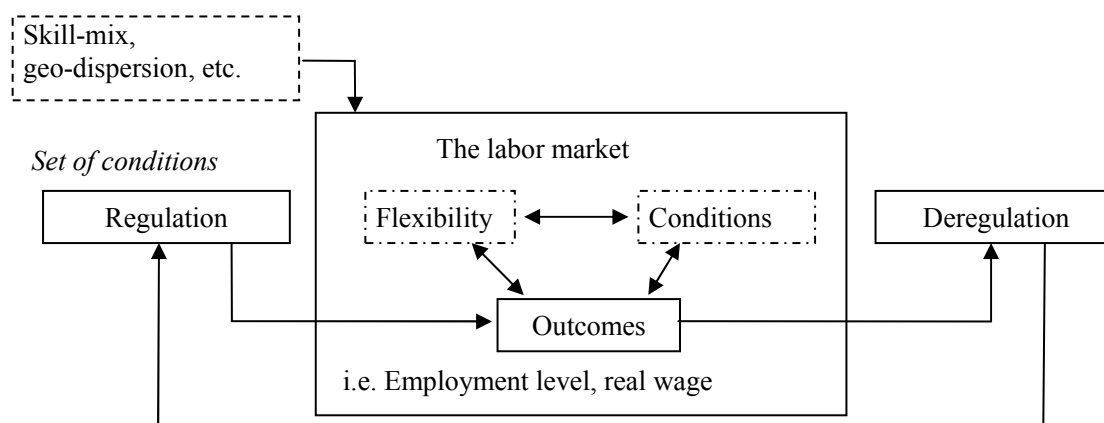


Figure 3-2 Interactions between institution and labor market

Source: derived from Monastiriotis's model

Unfortunately, governmental or institutional regulations are frequent to be blinding or insensitive to those interactions existing in the labor market and economic conditions, at least in a short term. It in turns follows with adverse or negative side-effects on the labor market adjustments or flexibility to a certain extent. Case in China depicts a clear governmental failure with purely rigid institutional interventions. However, it may then generate an obvious area of reform to improve the functioning of labor market and increase the economic efficiency, in terms of deregulation. It indicates that we need a more rational or dialectic opinions on the current existing schemes, which is supposed not to just follow others' experiences, but should combine the practical situations. Rowlinson⁶ points out that the change could be done from the institutional level, normative level, and the cultural level, with an increasing difficulties but more effectiveness. The three levels ought to support each other in a homocentric way. In view of China's experience, the normative change without corresponding institutional change can not be sustainable and eventually lead to culture change.

Through this realization of process to achieve the construction labor market flexibility, we could see labor market deregulation usually assumes a central position in academic and policy

⁶Professor Steve Rowlinson, from Department of Real Estate and Construction, the University of Hong Kong, in a seminar on the 30th July, 2011.

debates. It could also be seen from the experience the Japanese construction industry regarding the construction employment improvement movement (see Table 3-1). Policies to remove rigidities from the labor market include a range of arrangements but naturally concentrated on those aspects of employment protection, minimum wages, unionism, unemployment benefits and so on. Regarding wage and income distribution system, In China, the government also formulates minimum wage standards according to law and makes timely adjustments to them, standardizes wage payment methods, and regularly issues information regarding wage guidelines, guidance wage levels for the labor market, and labor costs. It encourages enterprises to trial-implement the system of collective wage negotiation and guides them to adopt diverse wage systems and distribution forms. While safeguarding enterprises' right to independent decision-making in the matter of wage distribution, the government also guarantees workers' right to receive the remuneration for their work according to law⁷. However, the deficiency lies in how to conduct the behaviors or norms of construction enterprise business, which is not an easy task in practice in view of their profit-pursuing essence.

Table 3-1 Construction Employment Improvement Movement in Japan

Labor subcontracting Business	Labor protection	Relationship between GC & SC
1947-Vocation Stability Law (illegal)	<i>Employment</i>	<i>Bilateral contract</i>
1952-Amendment of Construction Law (legal)	1947-Vocation Stability Law (direct)	1952-Act on guaranty service related to advance payment of public works
1970-Basic plan on construction labor countermeasures (<i>Nikenrei</i>)	1951-New Construction Labor Employment Law	1962-Act on prevention of payment delay for subcontractors
2005-Construction Labor Law (Promotion of construction labor employment)	1976-Labor Employment Improvement Law	1968-Notification on the Rationalization of Sub-Contract
	<i>OSH</i>	1977-Amendment on subcontract items
	1972-The industrial Safety and Health Law	1978-Guideline for rational relationship between GC & SC
	<i>Training</i>	
	1958-Vocational Training Law	
	<i>Insurance</i>	
	1947-Labor Injury Compensation Law	1992-Wage model for PC

⁷<http://baike.baidu.com/view/949874.htm>

3.2 Organizational approaches for flexibility

3.2.1 Regarding the use of human resource

From the perspective of companies that do concrete business, various approaches to achieve the flexibility are used as a management technique for organizing the workplace to optimize the use of human resources at the intra-company and inter-companies levels.

(1) Various employment schemes with regard to the skills characteristics

- Flexibility firm model with regard to functioning

Flexibility firm model⁸ was originally proposed by Jon Atkinson from the Institute of Manpower Studies in 1986, which is based on the principle of segmenting the workplace into core and peripheral groups. According to the flexible firm model (Figure 3-3), the ‘core’ group is composed of employees that are vital to the organization, functionally flexible, and difficult to be replaced (one key reason is their skills, knowledge, or experience). The ‘peripheral’ group is composed of employees who are numerically flexible since their skills are in plentiful supply in the labor market, so they can be easily replaced, or they are only needed to complete particular tasks (irrespective of the scarcity or otherwise of their skills), or else they are only needed at peak times across the working day or week ^[37]. Thus it could be inferred that various employment schemes will be adopted.

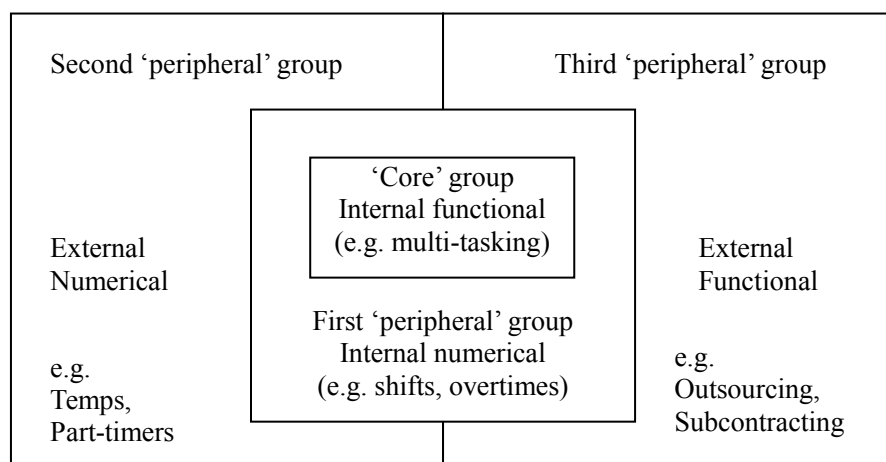


Figure 3-3 A model of the flexible firm

Source: adapted from Errington and Gasson ^[38]

⁸<http://www.jrank.org/business/pages/601/flexible-firm-model.html>

From the employee perspective, of course it is better to be part of the core group than the periphery group since the former usually enjoys better working conditions, such as greater job security, better remuneration, and so on. What is to be stressed here is that the importance of external workers is clarified in this flexible firm model. In particular, they are subtracted workers who typically undertake non-core activities however with an importance for the running of business.

In a word, from a start point of degree of various skills needed for conducting construction production, this model supports the rationality of the emergency of labor force division, and advent of various employment schemes, especially with regard to the practice of subcontracting with regard to flexibility. It implicates that the casual or informal employment has its rationality of existence for the Chinese construction. It could be further supported by the following section.

- Human resource architecture

A similar approach is a concept of human resource architecture, developed by David Lepak and Scott Snell for ‘studying alternative employment relationships used by firms in allocating work’^[39]. Compared with the previous model, they clearly put forward the interrelations between employment status and skill characteristics. Those are essentially four types of employment relationships, based on the degree to which workforce skills are of high or low value, and firm-specific or generally available, shown in Figure 3-4.

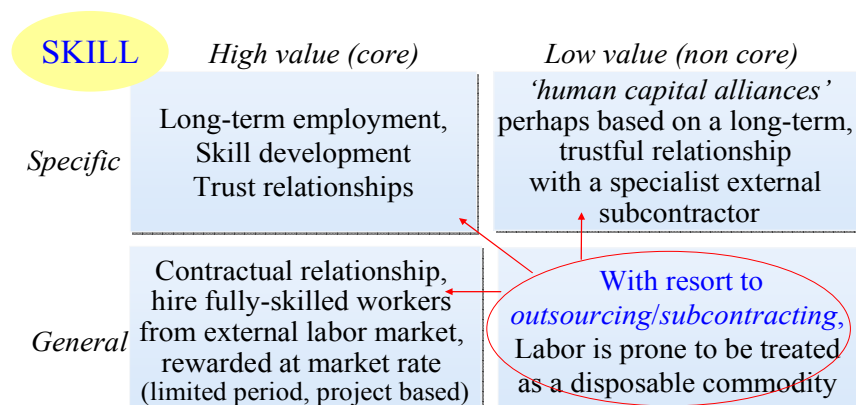


Figure 3-4 Interrelations between employment status and skill characteristics

Lepak and Snell represent a deeper exploration of the make-or-buy decision in human resource management. They clearly state that firms will develop different forms of employment schemes with particular segments of the workforce, depending on the nature of the work they perform and the skills they bring to their employment. Again, it verifies that informal employment in the construction subcontracting market has its rationality to exist. Further, it tells that in order to change employment status, the skill development is supposed to be firstly done.

That could partly explain the irrationality of promoting formal employment among current LSEs, since their skill levels are still not to be sufficiently with high value or specific.

(2) Temporary employment as a buffer to business fluctuation

In view of the fluctuation of construction business, temporary employment can fulfill the needs of employers due to an increase or decrease in the business or work load on a project basis. It is beneficial for increasing staffing during some busy seasons, or decreasing staffing when it is not needed. Due to the characteristics of construction production mentioned before, many tasks on construction sites actually could be efficiently performed by temporary employees. Under this occasion of using temporary employees, it is a common practice to pay the temporary agencies or intermediaries or labor contractors at a flat rate, and they are responsible for paying its employees in principle. Through that way, the responsibility for payroll costs, such as taxes and social benefits are avoided. In order to change that employment behavior, a stable and continuous work relationship might act. More analyses will be given later.

(3) 'Independent' contractor as a partner

For the execution of construction projects, by analyzing the tasks that are required for work force, the jobs that would be best fulfilled by independent contractors can be determined. 'Independent' contractors are able to conform to any kind of schedule that may be needed, and what should be dictated is the schedule before signing an agreement with an independent contractor, in term of subcontracting. The requirements of scheduling could be based on total hours worked for a pre-determined period, or on a set schedule that is needed to make available by the contractor. Thus the reliability of this schedule is certain to exert great influence on the subcontractors. More details concerning the practice subcontracting with an inter-companies work relationship will be focused on in the following section.

3.2.2 Regarding the advent of subcontracting in construction production

(1) Spurs to the advent of subcontracting in modern construction

Subcontracting is an age-old practice, with forms as followings in modern construction^[40]. One form of subcontracting is the prefabrication of some construction components due to the sophistication and specialization of trades. This kind of subcontracting trades usually demands long-term investment of capital in production facilities and equipment, referred to as specialist contractors or professional contractors. Another form of subcontracting has also been developed in trades that demand little or no capital investment, referred to as labor contractors. There are two main reasons for this^[41].

From the macroeconomic level, the fluctuation regional and local demands for the services of general contractors require flexibility in order to adjust their capacities. A large workforce

on payroll is undoubtedly a burden for any company that can not rely on long-term market demand.

From production management level, instability and unreliability of work on site, as one of the inherent uncertainties for production, becomes greater with a relevant result is the waste of workers waiting or lay up. That is a spur to the advent of labor contractors or other categories of subcontractors. However, it should be kept in mind that the uncertainty of work is not eliminated, but just transfer to subcontractors. Thus, there exists a potential variance between the economic motivations of project manager by general contractor and subcontractors in most projects. If it is not recognized and well dealt with, it can lead to a cycle of reduced trust and instability in production control. The high degree of waste common in most construction projects ^{[42] [43] [44]} suggests that both parties function at the state of lose-lose equilibrium. The notion that waste is present, and that instability and variability in production systems is one of its root causes, is central to lean thinking ^[45].

(2) The increasing practice of labor outsourcing

The practice of employing labor through intermediaries or labor contractors (referred to as labor outsourcing) has been a widespread practice in the construction industry particularly in most developing countries ^[46]. It has also developed rapidly in recent China following the institutional reform in 1984 entitled Separation of Management from Field Operations ^[47]. Through it, on the one hand, most operational workers who had previously been employed directly and permanently by the state-owned enterprises have been laid off and reemployed through subcontractors under casual employment. On the other hand, a huge number of surplus rural laborers have rushed into urban areas and then largely been absorbed on construction sites due to its low threshold, generally through intermediaries or labor contractors ^[48]. In addition to developing countries, labor outsourcing and the decline in direct employment of laborers in construction industry has also been on going in the majority of developed countries. For example, the nominal self employment in UK's construction keeps increasing, most of which are supplied by labor agencies or subcontractors. It may be concluded that most construction labor today is recruited through intermediaries on a world wide scale.

The function of intermediaries or labor contractors who recruit and control the labor in most countries is essentially the same. They build the bridge between the laborers seeking for jobs and contractors or subcontractors who can offer jobs, through bringing labor to construction site when required and taking it away when no longer needed. Recent researches concerning the benefits from labor outsourcing suggests the practice of labor outsourcing is unlikely to disappear. Wells (2003) ^[49] summarizes the main merits from contractor's view point that are the flexibility in labor recruitment, the opportunity to reduce labor costs by evading the overhead costs associated with the employment of labor and on-costs associated with legal employment,

and risk transfer through delegating the responsibility of labor force supervision. Assaad (1993)^[50] points that it could bring some security to laborers who are prone to unstable working environment through offering jobs, sometime a kind of belonging to working team and even a social bond. Contrarily, the demerits of labor outsourcing turn to be tough and severe. However, the disadvantages turn to be tough and severe. From the industrial perspective, the practice has been criticized since it poses an obstacle to training and innovation^[51], which is liable to low productivity and skilled labor shortage^[52]. From the perspective of labor force, since labor outsourcing is prone to decreasing the degree of general contractor's control on labor force, it has a great potential for exploitation, which does take place in recent China with widespread labor right infringements^[53] such as ignorance of occupational health and safety, payment default, no social welfare, etc. And hence it is regarded as a social problem in China generally ascribed to the government. Consequently, the Chinese government has taken several rigid interventions in the protection of construction labor such as prohibition on informal labor contracting, restriction on the subcontracting layers, etc. However, whether those interventions are rational and applicable for current and future development is argued by researchers and practitioners. Take the practice of multi-layer subcontracting for example which is illegal in China. It is frequently blamed for the higher risks of multi-layer exploitation and responsibility evading in most cases^{[54] [55]}. However, a more rational response may argue that the scheme itself is inappropriate only when it does not fit the reality. Actually, multi-layer subcontracting systems (MLSS) are considered as a great contributor to the success in the Japanese construction industry in that MLSS facilitate the highly specialization of subcontracting market with abundant small and medium-sized specialist subcontractors, who make continuous efforts on technical and engineering issues and pose ways to pass down those skills to their craftsmen through mentoring^[56].

3.3 Construction management views at a firm level

From the perspective of management, we could see that many researches on construction management are focused on projects, rather than on the enterprise that executes project construction. Generally speaking, the aim of effective management of construction projects is commonly to be the central interest to all parties involved, while it also depends on the effective management of the enterprise who conducts that project. It should be noticed that the project is a temporary organization, while the enterprise is a continuing capacity to create the built environment^[57]. This section provides some theoretical views on the construction management at a firm level. Organizational behavior perspectives will be shown firstly from how they were originally developed to analyze intra-firm organization, and then inter-firm.

3.3.1 Intra-firm theoretical views

(1) Social-technical systems (STS)

The conception of a production process as a ‘socio-technical system’ (STS) was first developed in the context of labor studies after the Second World War by researchers at the Tavistock Institute of Human Relations in England⁹, which is devoted to the effective blending of both the technical and social systems of an organization. STS in organizational development is regarded as an approach to complex organizational work design that recognizes the interaction between people and technology in workplaces. Trist (1981)^[58] describes the genesis of the concept, and its subsequent development. It grew from a critique of both ‘human relations’ analysis associated with the work of Mayo, and the scientific management movement linked with the inspiration of Taylor. Its central tenet is that production organizations are both technical systems consisting of machinery and techniques, and social system of personal and group interaction. These two are seen as independent variables whose features need to be jointly optimized to ensure efficient production. The overall perspective played a role in the development of the ‘contingency theory’ of organization design. The organizational imperatives of professionalism can also undermine communication in the construction process.

Brown (1967) points that the major weakness of this approach lies in the inability to handle conflict within organizations, since it was developed for handling relationships within single organizations, thus all the managers under investigation were within a single hierarchy; moreover, the perspective was psychologically oriented, and so has difficulty in grasping a context in which the parties have different economic interest^[59]. When applied to the construction industry, where the project is made up of a multiplicity of organizations, all of which have different economic interest, then it has only limited analytical use.

(2) Organization- environment perspective

The central of the ‘organization and environment’ perspective are the concepts of ‘differentiation’ and ‘integration’, which were firstly developed by Lawrence and Lorsch^[60]. This framework was favored and deployed by many researchers in construction management^[61]^[62]. According to Lawrence and Lorsch, differentiation is the extent of the division of the organization into distinctive subsystems due to differing environmental contingencies, and integration is the extent of co-ordination of the various subsystems to achieve common tasks. Pointed by Morris^[63], a dilemma faced by construction industry is that ‘the building process is heavily differentiated and is likely to become even more so, as technology becomes more sophisticated, yet at the same time there is an increasing need for it to become more integrated’.

⁹http://en.wikipedia.org/wiki/Sociotechnical_systems

Later Reuschmeyer^[64] emphasizes that these two concepts are not dichotomous. He considers that two different dimensions that differentiation is a feature of structure, while integration is an element of process. To achieve integration, further differentiation may be required. This is exactly what has happened in the construction industry with the emergence of project management jobs and management contracting firms. Thus it argues the necessity of the achievement of further specialization, based on which an integrative management could be achieved. Regarding the restrictions of subcontracting market in current China, the level of specialization is still to be low. It again argues that some deregulations are needed.

The weakness of this approach is similar as the socio-technical systems approach that this perspective was developed for the examination of relationships within organizations, and it cannot be transferred to be adapted to construction projects. In particular, Lawrence and Lorsch use the framework to analyze the responses of organizations to environmental (i.e. market) uncertainty. However, it could be noticed that the uncertainties within the construction process usually cause most problems for construction project management, while the environmental uncertainty may not be a significant uncertainty that construction firms face to great extent. Furthermore, the main element of differentiation in the construction project is between firms, not within them. Another point of issue is that integration in construction projects means the integration of firms, not departments or functions, and that this implies integrating across market relationships.

(3) Project management

The notion of project management as a distinctive managerial process, requiring specialist or professional skills and distinctive organizational design is central to the literature on construction management. The main advantage of project management as opposed to functional management is that it can provide a 'unifying agent' across the various functions of the organization in the face of uncertainties and complexity^[65].

There are also some limitations, one of which is that their discussion is restricted to the single organization situation. In other words, the question they pose themselves is how a defense contractor organizes itself to meet its contractual commitment with the Department of Defense. This is a qualitatively different questions from that of how do these firms organize themselves to meet the client's requirements, for it does not include the issue of transaction between firms.

According to Walker and Hughes' research^[66] using linear responsibility analysis, it could be noticed that most cases of differentiation between tasks and within tasks include differentiation due to the actors being part of different companies. The implications of the transactions between these firms being governed by contract rather than administration for that differentiation, and the requisite process of integration could not yet been discussed.

The fragmented nature of the construction industry means that functional differentiation

tends to take the form of differentiation between firms. This implies that the market relations between these firms introduce a qualitatively new element into the process of integration. Quite simply, the theory and practice of project management were not originally designed to handle differences between firms, only differences between functional departments within organizations.

3.3.2 Inter-organization views

It will then argue that the tendency in construction management research has been to apply them uncritically to the construction project, which is an inter-firm organization, with the effect that one of the most important characteristics of inter-firm relationships, the reliance on contractual rather than administrative governance of transactions, is not addressed. I will then go on to present a perspective derived from the work of Williamson (1975), which allows this feature of project organization to be explicitly addressed.

Williamson (1975) addressed the issue of the division of labor between and among firms and markets in terms of a transaction cost approach. His transaction cost approach makes it possible to examine both intra-firm and inter-firm organization with some common concepts ^[67].

The approach of transaction cost was developed from the institutional economics of Commons, and the analysis of administrative behavior by the Carnegie school. It represents a major attempt to combine economic and sociological perspectives on industrial organization. The key point is that there are also costs of transaction between involved parties except the production costs, as William pointed that ‘a transaction occurs when a good or service is transferred across a technologically separable interface’.

Regarding construction project, it is completed under an inter-firm organization with one of the most important characteristics of relationships in the reliance on contractual rather than administrative governance of transactions.

Derived from the work of Williamson ^[68], this feature will be explicitly addressed.

(1) Bounded rationality

Generally speaking, there are usually two kinds of situations in which the transaction costs tend to rise. One is too complex or uncertain environment for all alternatives to be fully specified, in which the ability to take rational decision is limited or bounded. The other is the market forces are not fully at work, and competition is limited to small number of parties, which is likely to be opportunistic exploitation of the situation. In a word, the two key factors in generating transaction costs are: the bounded rationality in the face of uncertainty and complexity, and the opportunism in the context of generally small number and short-term work relationships. These problems are mostly due to information asymmetry since the parties

involved in the transaction possess different levels of information, and the cost of achieving information parity is high.

Williamson argues that when transaction costs are high, it is cheaper to transact within a hierarchy, rather than rely upon market allocation of resources, while markets may be very poor in economizing upon transaction costs. It should be aware that the Williamson's framework is clearly an analysis of how firms make decisions over resource allocation. The construction project is not an economic entity, which does not make decisions over resource allocation. The firms making up the project coalition together with the client, are the resource allocators, the sources of land, labor, and capital upon which any form of production depends.

Winch (1988) ^[69] argues that neither the economic environment nor the market complex have special impacts on construction, although they are often held to cause uncertainty. Technological change is another potential source of uncertainty, but the rate of technological change in the construction industry is relatively slow, and the impact in construction is also to be weak.

In fact, the opportunistic behavior is greatly facilitated by the project uncertainty, thus it is fundamentally needed to specify the categories and sources of uncertainty facing construction firms, shown in Table 3-2 and Table 3-3 respectively. Task and natural uncertainties indicate that it is impossible to fully specify the work to be done before the letting of contracts, never mind the stage to the agreement of the brief with the client. Organizational uncertainty also generates bounded rationality of a more subtle kind. Other members of the temporary organization are, often as not, unknown quantities, and it therefore becomes more difficult to achieve effective organization design. Efficiencies are sacrificed as a result. A further result is that the quality of workforce in terms of its skills and commitments is unknown, and no continuing framework for the development of those skills and commitment can be provided.

Table 3-2 Major uncertainties within construction project process

Classification	Sources	Function
Natural uncertainty	Weather, geological conditions	f (weather, geological information)
Task uncertainty	Characteristic of small batch production, Learning curve problems	f (expertise, reliability of work plan)
Organizational uncertainty	Temporal organizations (tensions, opportunistic behavior, etc.)	f (project size, reliability of work relations)
Contact uncertainty	Estimated cost and actual cost (Associated with competitive tendering, etc.)	f (level of competition, size of firms, size of projects)

Table 3-3 The main sources of uncertainty in the construction process

Internal	Personal competence Integrity of the involved parties Differing economic interests of the involved parties
External	Labor Suppliers the clients planning authorities environmental (i.e. market) uncertainties

(2) Benefits of hierarchy of management

It is pointed that hierarchy has many advantages in view of the bounded rationality due to uncertainty and complexity. One common approach is the direct control in construction management. Those merits mainly including ^[70]:

- making it ease for the skill or expertise to be transferred from one project to another;
- enhancing a quick feedback on the technical problems;
- reducing response times when natural uncertainties are met;
- decreasing organizational uncertainty since the established project organization could be transferred from one project to another;
- reducing opportunistic behaviors;
- reducing bills of quantities and contracting documents in relations to market transaction;
- reducing significantly the management overhead costs, etc.

(3) Market forces vs. institutional constraints

In spite of all these benefits of hierarchy given above, there has been little or no shift towards hierarchy in view of the experiences of construction industry in most cases. On the contrary, the trend has been towards greater market governance within the emergency of management contractors and the retreat of general contractors from actually doing any site work.

Winch explains the reason as the existence of powerful market forces pushes the industry towards the market governance of transactions in response to contracting uncertainty ^[71]. To be emphasized, the high level of uncertainty which the contracting system generates leads to an emphasis upon flexibility rather than efficiency. Then contractors increasingly subcontract a large proportion of work. It increases their flexibility and minimizes the capital committed to the project; also passed some of the costs of uncertainty on to other parties' shoulders. The emphasis upon flexibility also encourages firms to reduce commitment to fixed capital and

hence stifles technological change, and commitment to human capital, and hence encourages the casual employment of the labor force and a refusal to invest in training.

Regarding direct production and subcontracting, a comparison is given in Table 3-4. It could be understood that a balance is difficult to find, since strategies that improve the performance of construction firms in terms of profit maximization are frequently incompatible with the strategies for effective project management and employment improvement.

Table 3-4 Contracting system in construction production

	Subcontracting / outsourcing Labor organizing process through market	Direct production Labor organizing process through enterprises
Definition	Inter-organization production	Intra-organization production
Major costs: Overhead cost and on-cost	Transaction costs Categories: Search and information costs (for SC), Bargaining costs, Policing and enforcement costs, etc.	Organizational cost (retention of production elements, project management, recruitment of resource, overhead costs etc.)
advantages	No organizational costs; Flexibility in the recruitment of labor; Reduction of labor costs; Simplify the process of tendering and offloads a large part of risk in project management; Delegation of responsibility for Supervising the labor force	Stability of supply; Integrative management; Control of quality
disadvantages	Instability of supply; Low level of integrative management; Difficult control of quality	A burden of cost on labor, management, supervision, etc.
Occasions for utilization	Existence of sufficiently qualified supplier; Less stress on quality; Insufficient punishment on insufficient supervision;	Insufficiently qualified supplier; Severe punishment on poor quality due to insufficient supervision; Severe punishment on subcontracting; existence of measures to release burden of labor cost
Side effects	brokers without integrity (Market of	Loose organization;

under excessive use	lemon); Jerry building under insufficient budget; Vague employment relationship and exploitation of labor; Weakening of labor market foundation	Restriction on specialization due to excessively direct production
Governmental intervention	Introduction of direct management	Subcontracting with responsibility systems

An empirical observation of labor contractors' business characteristics on several construction sites in China reveals those uncertainties do exist universally in practice, resulting in workflow unreliability to a great extent. Regarding the uncertainties of tasks or jobs, it is observed that the contract forms for labor contractors are usually vague, no matter in written, oral or even there is not any. They generally get their jobs through informal information channel based on social relationship, such as work companion, relatives, usually in short term. It is hard to guarantee the next job for most labor contractors, and hence they suffer a high degree insecurity of jobs. Moreover, the contract expiration is frequently unclear, which also exerts negative influence on their future jobs. Consequently, a number of laborers are laid up on construction sites without access to the next jobs. May there be some other better way to deal with those uncertainties to facilitate their development instead of conventional risk transfer through contracting.

(4) Alternative approach regarding uncertainties

As is mentioned before, subcontracting is now accepted widespread as an important aspect of firm activity. Particular interest has centered on flexibility and the technological context behind the increasing subcontracting activity. Some theories have been developed to analysis the motivation behind the decision to subcontract instead of producing in-house. For example, Williamson has highlighted the dangers of opportunistic behaviors and the adverse implications of buying-in inputs for the incentives to invest in transaction specific assets ^[72]. The transaction cost approach allows the differences in the interests between different firms who are the members of the project coalition to be analyzed. That is to say, the dynamics of the contracting system are assessed in terms of contradiction between construction firms' responses to the uncertainties inherent in the project, and those deriving from the contracting system itself.

It becomes a reality as more and more professional partnerships become limited liability companies. Even in the case of partnerships, it is asserted that their economic behavior is largely indistinguishable from that of enterprises strictly conceived for most purposes in construction management research ^[73]. While Barnes (1990) ^[74] provided a useful view that the skills of project managers as integrators of the highly differentiated members of the project coalitions

have a major contribution to make, it is an open question whether these skills are best deployed within the management contracting enterprises, which are an emergency type of enterprises in the construction industry.

The dynamics of the contracting system are assessed in terms of contradiction between construction firms' responses to the uncertainties inherent in the project, and those deriving from the contracting system itself. Risk transfer is a common strategy to counteract by most upstream contractors, however, may not be a good way since those uncertainties actually could not be eliminated, but in most cases just simply transferred through subcontracting system from the upper layer (GC) to the owner layer (SC) in the construction supply chain. In that view, other approaches may perform better, for example, through risk sharing under long term work relationships.

Another view is on the universal objective of improving construction productivity. As is known, pursuing for higher productivity is a persistent objective for construction enterprise, while a crucial aspect in improving construction productivity lies in the ability to substitute capital for labor. Firms may not substitute capital for labor if future workloads are uncertain. Thus for a better ongoing development of subcontractors, a relative stable construction demand seems to be essential.

In current China, the massive public housing and infrastructure investments provide some stability in workloads, similar in the past Japan. What is different is that in Japan, the main contractor further virtually guarantees profit for the subcontractor to ensure his loyalty and the government decides on the percentage of public works that should be carried out by small and medium enterprises ^[75]. It may also point out the direction of introducing long term relationships into the Chinese construction industry from view of improving its productivity, since it is a persistent objective from an economic view.

4 Research Questions, Methodologies, and Hypotheses Tree

4.1 Research questions

As mentioned above, the reality of labor outsourcing in the Chinese construction industry needs empirical exploration. Only through a better understanding of its status and implications to industrial development like how it will change the way of business ultimately, the labor-based strategies for Chinese construction could be formulated and then sustained in the long run. To be more specific, those research objectives are therefore to address the following empirical questions:

Question 1: Whether the current interventions in China that deal with some negative repercussions of ‘informal’ labor contracting have to totally deny the practice?

Question 2: Are current systems rational and effective for the achievement of an adaptable construction labor market in current China?

Question 2-1: Is current subcontracting system incentive to LCs?

Question 2-2: Is it rational to compel formal employment among them?

Question 2-3: what deregulation is called for more rational systems?

Question 3: How does labor outsourcing affect the functional change in those involved parties for an efficient construction production process, particular the changes in GCs?

Question 4: How to facilitate the development of construction subcontractors and cultivating their active roles in the establishment of a sustainable labor market? In other words, what could be incentives for SCs to develop competencies?

Question 4-1: What are the sources of small labor subcontractors’ competitiveness, and what barriers do they encounter in their dealings with their important ‘customers’ as GC?

Question 4-2: What principles should be valued to optimize the flow and management of labor and further achieve the complete integration of general contractor and subcontractors for construction production?

Question 4-3: What efforts could be done in practice for general contractor (GC) and subcontractors (SCs)?

Question 4-4: From institutional level, what kind of deregulations may assist in improving the flexibility of labor market?

4.2 Research methodologies

To answer the above questions and further verify those hypotheses aiming at the achievement of the research goals, some methodologies will be applied in this study, including

literature reading, empirical studies with field investigations and interviews, qualitative analyses using mathematical model and game theory.

An investigation into three construction sites in China is conducted to explore the main issues related to the Chinese construction laborers. With a reference to several countries' experiences through literature reading, reasons for current unsatisfactory progress on developing construction labor market in China are analyzed, among which the significance of stimulating subcontractors' roles in improving laborer' conditions is identified. It calls for good working relationships between GC and SCs. Since the practice of cooperation and team work is very common in Japan, and its benefits are widely acknowledged in practice and literature, a representative Japanese general contractor is chosen for case study concerning the influence of labor outsourcing on its business model and in turn its efforts on cultivating subcontractors.

4.3 Hypotheses tree

The hypothesis tree (Figure 4-1) summaries how this study proceeds with the tentative proposals for solution of those questions associated with the sustainable development of construction labor market, developed on a basis of literatures reading and empirical studies.

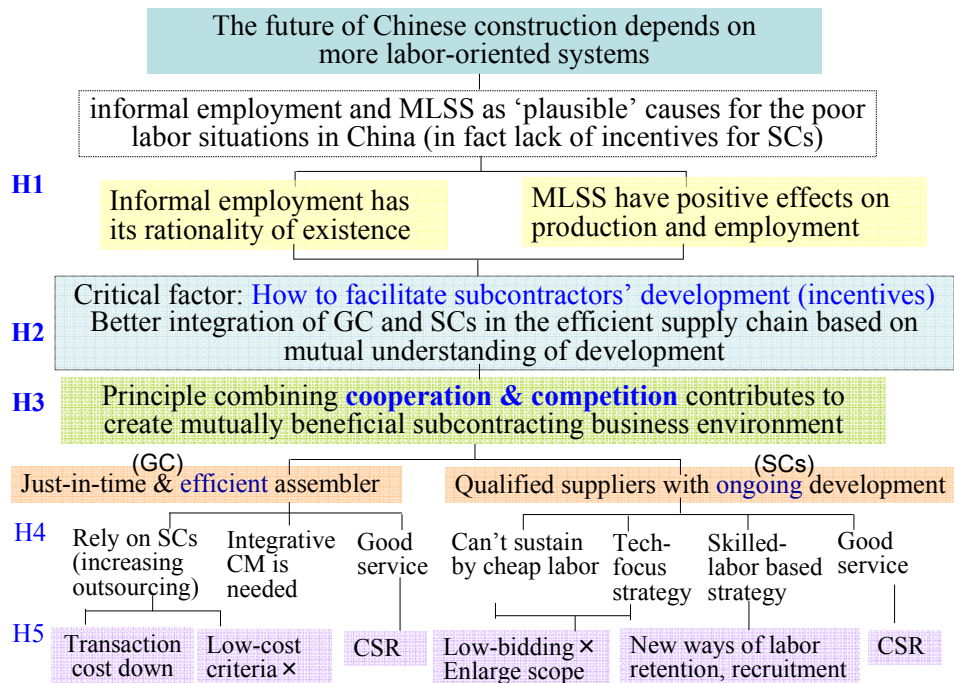


Figure 4-1 Hypothesis tree for a tentative approach to the achievement of the sustainable construction labor market in China

Firstly, it argues that practices of informal employment and multi-layer subcontracting have their rationalities of existence for current and future Chinese construction. Without a rational response to those schemes, any rigid interventions will finally fail to perform well in practice. To overcome some negative repercussions of those schemes, one crucial issue is to facilitate the subcontractors' development based on mutual understanding to create reciprocal business environment for both GC and SC. It has positive meanings for both industrial structure adjustment and sustainable employment improvement. To achieve that, principle combining cooperation and competition is believed to contribute to realize the efficient and effective construction production systems with just-in-time and efficient assembler (GC) and qualified suppliers (SCs) with better ongoing development in future. Guided by those principles, some strategies for GC and SCs could be promoted in practice.

4.4 Research logic frame

The logic frame of this research is shown in Figure 4-2 in general. We argue that for a well development of labor market, three levels from institutional, organizational, and individual should work together and support each other. A common perception is that even if we have good system, but not well implemented, it will eventually turn out to be a failure; vice verse, if the development of practitioners are restricted or limited by systems, their motivations will be suppressed, leading to the worsening of their performance. In the following part, the failure of current schemes (for developing construction labor market) in China will be further examined to identify the missing part for good performance of implementation. Then research questions are developed, with the goal to find approaches to facilitate their development. Manners of this research include literatures reading, empirical studies, and qualitative analysis.

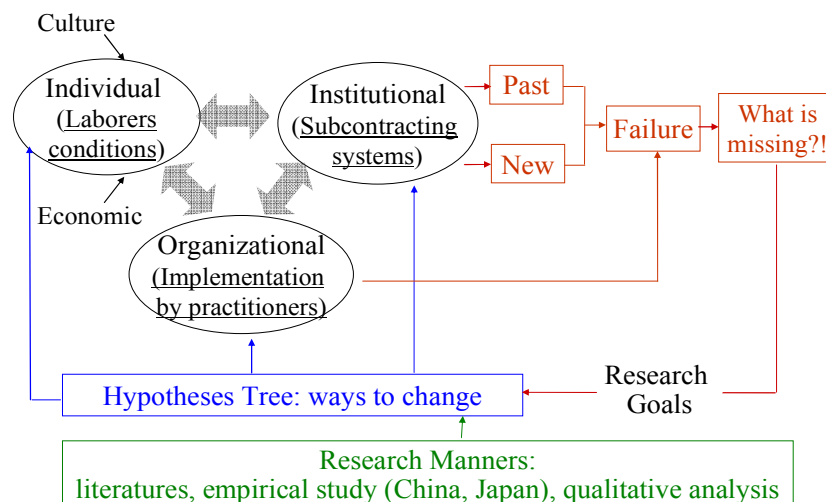


Figure 4-2 Logic frame of the research

5 Case Study

5.1 Case of China Railway 12th Bureau Group Co., Ltd

On a basis of characteristics of construction migrant laborers, two main modes of labor-service subcontracting management and relevant problems will be interpreted and analyzed in this section through this case. It is expected to deeply understand the subcontractors' imperative roles in not only improving construction labor management, but further achieve the efficient production. Some deficiencies of current schemes for improvement will firstly be analyzed on a basis of the investigation results on several projects conducted by this general contractor. One key factor for the failure of current schemes to achieve the improvement of labor market fundamentally is that there is no incentive mechanism for subcontractors to perform well in the contraction supply chain under current subcontracting systems. The business environment is filled with no mutual understanding and non-trust work relationships between GC and SCs. It then points out a possible direction for change.

5.1.1 Basic information

China Railway 12th Bureau Group Co., Ltd (CRGC-12) is one of the 32 wholly-owned subsidiaries administrated by China Railway Construction Corporation Limited (CRCC). Predecessor of CRCC is the Railway Corps of People's Liberation Army (PLA). In 1984, the Railway Corps of PLA were transferred and incorporated into the Ministry of Railways, and renamed Headquarters of China Railway Construction. In July 1989, China Railway Construction Corporation was founded. In September 2000, China Railway Construction Corporation unhooked connections with the Ministry of Railways, and entirely transferred to the Central Enterprise Work Commission. CRCC has been listed in 'Fortune Global 500' for five consecutive years, and 'Top 225 Global Contractors' for ten consecutive years.

As a subsidiary of CRCC, CRGC-12 provides project and construction management services to construction, energy, transportation, and civil utilities sectors. The company was founded in 1998 and is based in Taiyuan Province, China. It is established under approval of the Ministry of Construction as a Special Grade general contracting enterprise for railway projects with comprehensive construction ability. Nowadays the Group administrates 14 wholly-owned subsidiary companies, 4 specialized branch management companies, 1 Overseas Division and 5 regional project headquarters. Several projects in progress include Nanjing-Anqing Railway, Beijing-Shanghai High Speed Railway, Shanghai-Hangzhou High Speed Railway, East-West Expressway in Algeria, and so on. It employs more than 17,000 workers with more than 700

first-grade registered construction engineers. The company has entered upstream of construction industry market. It takes ‘Honesty, Innovation and Superiority’ as its business ideology in providing high quality building products and best service for consumers at home and abroad.

5.1.2 Contradictions between the construction company and labor service group

Labor-service group is the specific operational layer in practice in the railway construction projects. Owing to the particularity of population structure and the status quo of productivity in China, labor-service group in railway construction projects is largely occupied by migrant laborers with main features as mentioned in Chapter 2. Owing to the features of construction migrant laborers and the characteristics of construction production, there universally exist the numerous contradictions referred to as game relations between construction companies (labor users) and labor-service group in practice. As known, game generally refers to the decision in a competition between two parties or more. The ideal situation should be a win-win relationship by mutual cooperation between construction company and labor-service group aiming at a common goal. While in practice, it is extremely hard to achieve such a win-win relation because of various game relations numerous contradictions existing between construction company and labor-service group (see Table 5-1). The difficulties in dealing with those game relations have been revealed obviously according to the experiences of CGRC-12. Several approaches actually have been done to seek for an appropriate solution.

Table 5-1 Contradictions between construction company and labor service group

Main contradictions	Construction company's Interest	Labor service group's interest	Interpretation
wage	reduce wages and lower project cost	increase wages	as part of project cost, labor wage is easy to be cut
productivity	extend working hours and increase labor intensity to increase productivity	reduce working hours and labor intensity without wages deduction	inefficient way to increase productivity and no respect to laborers
quality	build excellent project without increasing cost	just complete workload	workload-based labor wage, neglecting the quality of service
safety	decrease accidents but reluctant to pay for security facilities and safety training	secure working environment	laborers' insufficient awareness of safety
Treatment	only care for company staff	same treatment as company staff	unequal treatment even no basic human respect

5.1.3 Labor-service management mode under labor-service teams (LSTs)

According to Medium and Long Term Railway Network Plan and Railway Eleventh Five-Year Planning, railway construction in China entered a rapid developing period, while the number of construction accidents also increases sharply. One major cause consists in the labor-service management mode under labor service teams (LSTs), not only limited to railway construction projects.

(1) Emergence

Due to the particularities of construction production as regionality and intermittency, most construction enterprises prefer labor-service outsourcing under flexible labor relations to retention of fieldworkers under formal employment. Then with a huge number of construction migrant laborers rushed into urban areas, labor-service team (LST) emerged as required. It developed in a large scale in the late 1980s, and has being occupied the main position involving in the labor provision business and further labor-service management on site.

(2) Features

In this mode, the team leader is called ‘labor contractor’ (*baogongtou* as mentioned before). Only a few of labor contractors worked in construction enterprises before, but separated from the enterprises owing to enterprises restructuring, while most of them have not any construction experiences at all. They usually play an active role in recruiting migrant laborers mainly from relatives, fellow-villagers, or other relevant source, and then take charge of the recruited laborers’ living and working, including payment. For migrant laborers, they can get approach to jobs through LSTs despite high risks of being infringed on their legal rights.

For contract-issuing party, firstly LST can speed up the organizing process of fieldworkers by virtue of existing interpersonal networks; secondly, it can save troubles through limiting demands and reducing dissatisfaction from migrant laborers by virtue of labor contractors’ interpersonal relationship. However, as this kind of mode relies more on relationship than formal contract, the laborers rights can not be guaranteed in any form. Cases of unreasonable delay or deduction of labor payment occurred frequently these years and aroused great concern from the government and society. Moreover, as most of migrant laborers and even labor contractors are short of construction or managing capabilities and sense of responsibilities, project safety and quality could not be assured.

(3) Phenomena

It is indisputable that LST had played a positive role in meeting the urgent requirements of construction laborers and thus made an essential contribution to the boom of Chinese construction industry. However, deficiencies of this mode have gradually been revealed in view

of some universal phenomena recently. Figure 5-1 shows the process of labor service management and the major arising problems. Two phenomena will be highlighted here.

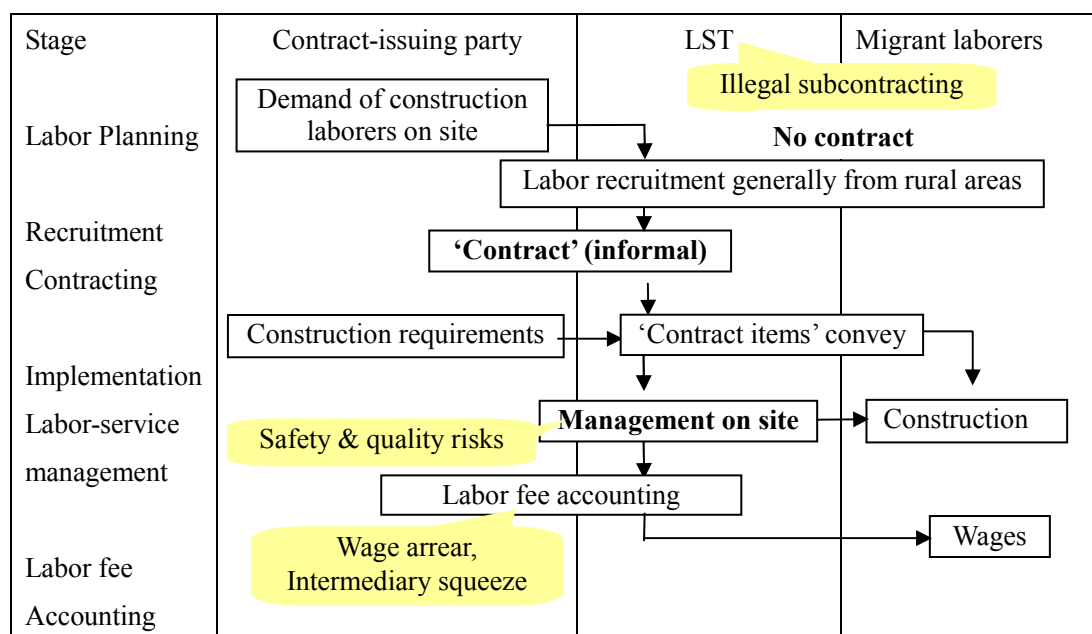


Figure 5-1 Labor service management under LST and major problems

Phenomenon 1: Infringement on legal rights of migrant laborers

Generally speaking, as LST is usually a temporal organization which can be easily influenced by variable factors as project location, project duration, season, etc., the team members do not have any guarantee of jobs or welfares. Moreover, since management of LST relies on social relationship rather than any legal contract, laborers' rights can be easily infringed by arbitrary team leaders. Take labor wage payment for example. Concerning the frequent cases of unreasonable delay or deduction of labor payment recently, which have aroused great concern from the government and society in China; it is labor contractors that have been found as the culprit in most cases. That is one of the triggers for the Chinese government to prohibit LSTs rigidly since 2005.

Phenomenon 2: Safety and quality problems on construction site

As most migrant laborers and even 'labor contractors' do not have sufficient construction experiences, capabilities or competencies, or responsibilities, project safety and quality are commonly under high risks. It has been found to be a main cause of frequent accidents and quality problems recently.

(4) Prohibition

It is urgent to normalize labor-service management in order to assure the construction safety

and quality, and encourage more social resources to participate in railway construction actively. In view of the severe issues related to this mode, the Chinese government tried to put an end of LSTs in three years from 2005 to 2008 ^[76]. Under such background, the new labor-service mode of frame-style construction team has been put forward firstly by CRGC-12, and then spread widely after guideline of this mode was issued by Ministry of Railway in 2008. However, contrast to strict prohibition in principle, this mode continues to exist widely in practice, sometimes with ‘tricks’ to escape from the administrative punishment. The reasons that it is hard to abolish LSTs in practice will be analyzed in next section.

5.1.4 New labor-service management mode under labor-service enterprises (LSEs)

Labor-service subcontracting is a new business separated from conventional construction businesses. Largely owing to LSTs, construction labor-service subcontracting market remains disordered, and not only migrant laborers but construction enterprises suffer a lot as well. In order to ensure the implementation of project quality and safety management, prevent migrant laborers from being defaulted by labor contractors, and furthermore establish a lasting effective mechanism to stimulate construction laborers, labor-service enterprises (LSEs) have been promoted vigorously in China nowadays.

According to Construction Law and Views on establishing labor-service enterprises and improving labor-service subcontracting systems issued by the Ministry of Construction (renamed as the Ministry of Housing and Urban-Rural Development of the People’s Republic of China since 2008), it is required rigidly that all construction enterprises should only invite bids of labor-service from LSEs who have a required license of labor-service subcontracting business since the end of June, 2008. Most construction labor-service enterprises (LSEs) came into being under this background.

(1) Emergence of LSEs

According to Construction Law and *Views on establishing labor-service enterprises and improving labor-service subcontracting systems* issued by the Ministry of Construction (renamed as the Ministry of Housing and Urban-Rural Development of the People’s Republic of China since 2008), it is required rigidly that all construction enterprises should only invite bids of labor-service from LSEs who have a required license of labor-service subcontracting business since the end of June, 2008. Most construction labor-service enterprises came into being under this background.

(2) Features of LSEs

Organizing and managing of LSTs are more like individual behavior constrained by morals rather than laws or regulations, while construction LSEs are legal persons which belong to a

category of labor dispatchment enterprises. It indicates that they must comply with relevant laws or regulations.

For example, LSEs must sign an employment contract with laborers and take charge of personnel recruitment and training, routine management, remuneration payment, and various insurances payment etc. according to current Company Law.

Different from general labor dispatchment enterprises, LSEs should comply with Construction Law simultaneously, with characteristics as follows. First, they must obtain labor-service subcontracting license only from relevant construction department. Second, it is only permitted for them to provide labor-service for construction enterprises, and only in the form of labor-service contracting, with incoming charged from construction GCEs or PCEs in the form of management fee.

(3) Development of LSEs

Since 2001, the numbers of construction LSEs (Table 5-2) and employed persons of LSEs (Figure 5-2) have been gradually increasing in China. However, it also should be noticed that even in 2008, the total number of GCEs or PCEs goes up to 62,074, but the number of LSEs is just 4,357, 6.6% in all; the number of employed persons of LSEs is only 5.7% of that of GCEs or PCEs. It reveals that current development of LSEs is far from enough to meet the practical demand in Chinese construction market. From another perspective, it indicates that most labor-service on construction site, like concrete, steel reinforcement, plastering, etc. have still been in the charge of numerous LSTs. LSTs continue to occupy an overwhelming position in the labor-service subcontracting market in practice, which blocks the development of LSEs to a large extent. The deeper reasons will be analyzed later.

Table 5-2 Development of construction LSEs

Year	GCEs or PCEs	LSEs	Proportion of LSEs to GCEs or PCEs (%)
2002	47852	1193	2.49
2003	48688	2021	4.15
2004	59018	3104	5.26
2005	58750	3101	5.28
2006	60166	3748	6.23
2007	62074	4357	7.02
2008	71095	6837	9.62
2009	70817	6756	9.54

Source: China Statistical Yearbook (2003~2010)

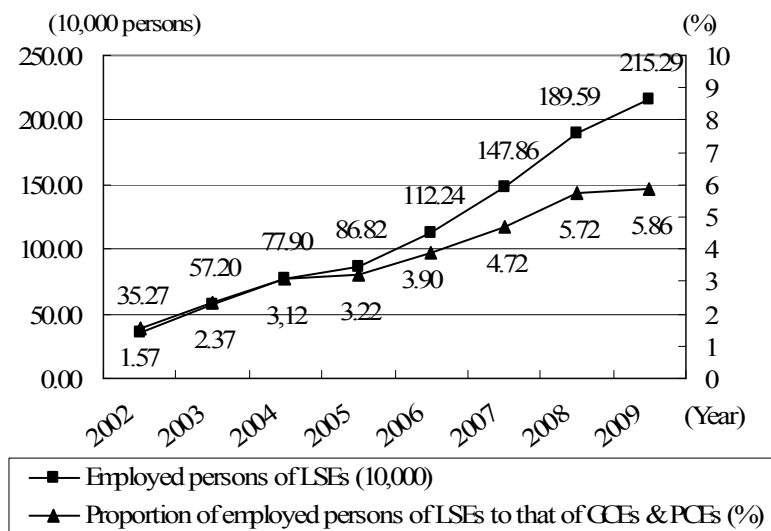


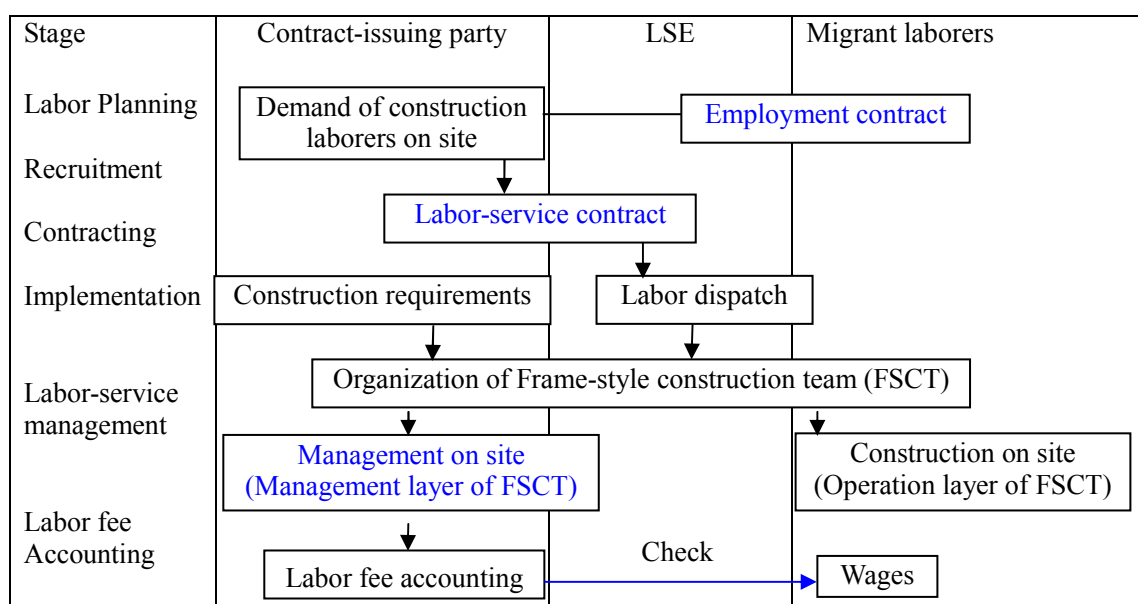
Figure 5-2 Development of employment by construction LSEs

Source: China Statistical Yearbook (2003~2010)

(4) Corresponding Frame Style Construction Team (FSCT) in railway projects

Along with emergence and development of LSEs, a new labor-service management mode called Frame Style Construction Team (FSCT) has recently been promoted ^{[77] [78]}. FSCT is a primary fieldwork construction team, which builds a bridge between contract-issuing enterprise and LSE. The organizing process by contract-issuing enterprise is demonstrated in Table 5-3.

Table 5-3 Labor service management under LSE in principle



The specific organizational structure is shown in Figure 5-3 that is composed of two layers. One layer is fieldwork management and supervision, conducted by managing, technical and operational personnel from contract-issuing enterprise. The other layer is fieldwork operation, conducted by laborers who should be dispatched from LSE, or some special engineering laborers employed by contract-issuing party directly.

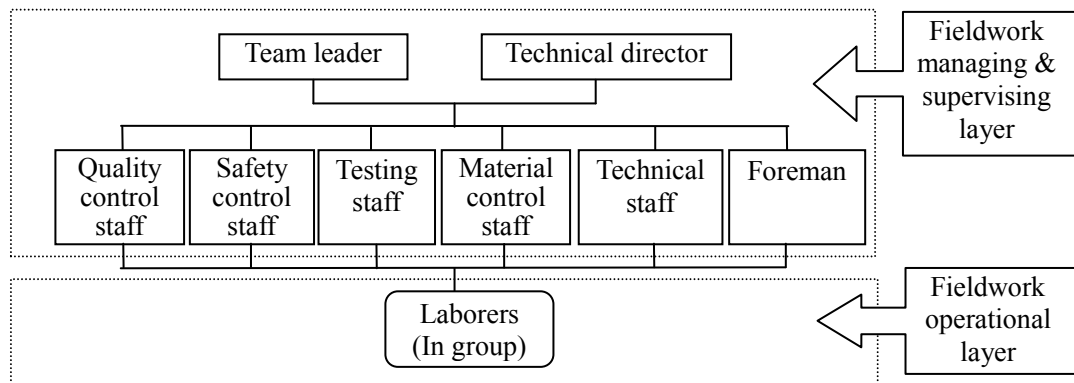


Figure 5-3 Organizational structure of FSCT

This mode spread widely after guideline of this mode was issued by Ministry of Railway in 2008 ^[79] considering the following merits in principle.

For migrant laborers, under the new mode, contract-issuing enterprises must sign a labor-service contract with every migrant laborers dispatched from LSE. According to the contract, migrant laborers' wages should be calculated and paid by contract-issuing party instead by LSE. The new wage system can lower the risk of payment deduction or default which has been frequently done by 'labor contractor' under LST mode for a long period.

For contract-issuing enterprises, they have been bothered with the problem of jerry-building by dishonest 'labor contractor' for a long period. Under the previous LST mode, procurement of materials and labor is usually in the charge of 'labor contractors'. Sometimes they cheat on labor or materials, like defaulting laborers' wages, using inferior materials for building, etc. Contract-issuing enterprises have been seriously blamed because of insufficient management on site especially when safety and quality problems emerge.

Under the new mode of FSCT, GC can assure the implementation of quality and safety management systems on site more concretely through direct intervention on material management and fieldwork supervision (see Figure 5-3). In another word, this new mode can lower the subcontracting risk concerning quality and safety by the integration of management from GC and operation laborers from LSE. Concerning the motivation of promoting this new mode among railway construction projects, it has a significant meaning on protecting the legal rights of migrant laborers and assuring the project objectives such as safety, quality, schedule,

etc. in a more effective way, compared with the conventional mode of LST. That is why it is promoted widely in Chinese railway projects by government currently. However, as LSEs have not yet developed in a large scale to meet the needs of rapid construction development, the implementation of labor-service management mode of FSCT seems constrained and developed far from expectation.

5.1.5 Analysis of restrictions on development of labor-service subcontracting market

Current labor-service subcontracting market in China, which is in the second level of overall construction production systems, remains to be confused and disordered with irregular labor-service organizations. In this section, several restrictions on its development will be identified.

(1) Disadvantages of LSEs in the market-share competition

- Competition with LSTs

As pointed by one staff member from China Railway Corporation (contract-issuing party), in practice they could not or would not like to follow the regulation of selecting LSE instead of LST concerning labor-service management. One reason is that there are not enough and capable LSEs in current subcontracting market as mentioned before (see Table 5-2). Another reason lies in the Cost-Based Selection (CBS) of contractors, which is widely adopted particularly in the subcontracting market. Generally speaking, as labor cost occupies a considerable percentage in total project cost, tenderer with lower labor cost is more favorable in the bidding under CBS. Compared with other irregular labor-service organizations such as LSTs, LSEs should have a higher labor cost in view of related taxes payment, management expenditure, and responsibility risks, while LSTs do not have to consider. It reveals that as there is no sound business evaluation system yet in current subcontracting market, LSEs are usually exposed to a vitally disadvantageous position in the competition of labor-service business. That may explain the dumping that LSEs depress the labor cost to an unreasonable extent just in order to get the job and maintain the basic operation. In return, it is likely to bring about problems concerning project quality, safety, labor issues, etc., and block the development of LSEs in the long run.

In a word, LSEs have no superiority in current market competition over other irregular labor-service organizations. Thus, most LSTs would not like to transform themselves into LSEs. Even LSEs would find a job privately under the status of LST rather than LSE. Moreover, most LSEs are compelled to bid at an unreasonably low price, resulting in an extremely slow development of LSEs, much far from expectation. It is urgent for the government to identify and analyze the root cause behind those phenomena and then establish effective schemes to regulate the labor-service subcontracting market in practice instead of absolute prohibition in principle.

-
- Competition with GCEs with low-grade license and subcontractors ‘anchored’ to GCEs

In addition to LSEs and LSTs, general contractors or professional contractors sometimes also engaged in labor-service business in spite of prohibition. In some regions of China, it is even locally permitted for them to possess the license of labor-service subcontracting business. It is one reason that illegal subcontracting still exists widespread against laws.

The illegal subcontracting in China is mainly in three forms according to current Construction Law and Tenders and bids Law:

1) wholly subcontracting, which refers to the act of subcontracting the whole contracted project or all of dismembered engineering works within the contracted project to another contractors, instead of fulfilling their responsibilities based on contract;

2) partly subcontracting again, which refers to subcontracting any engineering works to uncertified subcontractors, or without permission from client, or subcontracting the main structural engineering works to another contractor; and

3) sub-subcontracting, referring to subcontracting the construction works more than one time.

Firstly, for those low-grade GCEs who are less competitive in bidding the whole project, there is a considerable probability for them to get engineering works illegally from general contractors under the disguise of labor-service subcontracting with a license of labor-service subcontracting business; in return general contractors can gain a considerable profit without any construction work, regardless of the risks of project quality, safety, lawsuits, etc. As a result, numerous low-grade GCEs survive through this way instead of being eliminated in the market selection or competition.

Secondly, there arise a number of unincorporated entities that possess a certain operating fund or trade channels but without required licenses. They sometimes ‘anchor’ themselves to a certain general contractor under the name of labor-service business subcontracting, through which the general contractor appear to be legal to complete the main structural engineering works by those anchored entities, and gain a considerable profit without any effort; in return, those entities can ‘borrow’ the general contractor’s license in order to tender for the contract of other project just submitting a certain fee.

In this situation, the risks of safety, quality, lawsuits, etc, are usually high considering the incompetence of those entities and vague responsibilities of involved parties. Regarding LSEs, compared with low-grade GCEs, they seem less competitive in professional skills or economic strength, while compared with those entities anchored to GCEs, they seem to have less relationship with GCEs which is extremely important to get market share in China. It can be concluded that LSEs almost have no way to survive and develop under the existing conditions. That may explain why it is unrealistic to expect those low-grade GCEs or entities to transform

into LSEs automatically under current market.

- Competition with unqualified LSEs

In order to speed up the development of LSEs, some short-term countermeasures have been taken by administration. Take LSE license requirements for example. In some regions of China, registration limitation on capital has been decreased, and even the skill certification rate of laborers has been loosened to a large extent. Furthermore, examining and approving procedures of LSEs application have been simplified and delegated to lower level of administrative sectors. All above is trying to encourage LSE to develop fast. However, it provides a chance for those incompetent LSEs to enter the market, which can easily result in the quality uncertainty of LSEs (sellers), since the subcontracting market remains to be under asymmetric information for labor-service demanders (buyers). It suggests that establishment of information system and public transaction platform is essential to labor-service subcontracting systems.

(2) Institutional deficiencies on current labor-service subcontracting market development (lack of incentives)

Since labor-service subcontracting business is newly developed business and becomes paralleled with professional subcontracting business in China recently, the existing laws have not yet specific regulations on it. The legal status and future of LSEs seem very vague in current construction systems in China. Situation perhaps is much worse if taking consideration on strict restriction on subcontracting layers according to current Tenders and Bids System. It constrains the specialization of construction industrial structure and the long-term development of middle and small sized construction enterprises to a certain extent.

From the case of Japan, it could be seen that multi-layer subcontracting systems (MLSS) have been adopted widespread, and subcontracting of the labor-service business only is forbidden in Japan. Under MLSS, an interdependent construction market has been developed, composed by a small number of top class general contractors who have overwhelming advantages in technology and management, and multiples of competent professional contractors who have superior operational skills and proprietary construction technology. In 1999, the proportion of professional contractors in Japan was already more than 70% ^[80]. Compared with Japan, China has almost an equal number of general contracting enterprises and professional contracting enterprises, and it seems hard to change (see Table 5-4).

Seen from the development process of construction industry in most developed countries, along with the growth of general contractors who will gradually develop their capabilities for undertaking EPC or DB projects, concrete engineering works are usually subcontracted or sub-subcontracted to professional contractors that are in small-scale but with highly specialized construction skills or technologies ^[81]. Professional contractors then act as a key party in the overall construction production systems. It indicates that LSEs in China nowadays may be a

middle offspring during the transition period that is supposed to be substituted by PCEs. Thus, only when LSEs develop their professional skills then they could sustain in the construction industry in the long run.

However, according to current Construction Law and Tenders and Bids Law of the People's Republic of China, there is a restriction on the number of layers of subcontracting engineering works within the project in consideration of the risks of quality, safety and responsibility prevarication, etc. Although it may be valuable for stressing on the definite responsibilities of general contractor to client, and subcontractor to general contractor, it has in return minimized or constrained the subcontracting market, since the amount of subcontracting work becomes limited. It seems hard for middle and small sized construction enterprises (mostly PCEs and LSEs) to get the job from the market for development.

Table 5-4 Development of professional contracting enterprises

Year	GCEs	PCEs	LSEs	GCEs or PCEs	Proportion of PCEs (%)
2002	33652	30999	1193	47852	63.21
2003	29359	19329	2021	48688	38.12
2004	-	-	3104	59018	-
2005	32389	26361	3101	58750	42.62
2006	33175	26991	3748	60166	42.23
2007	34071	28003	4357	62074	42.15
2008	38212	32883	6837	71095	42.19
2009	38375	32442	6756	70817	41.82

Source: China Statistical Yearbook (2003~2010)

In a word, partly due to the current subcontracting systems, the relevant subcontracting market is lowly specialized, in which PCEs even have not sufficient space to develop, needless to say the newly born LSEs only with labor-service business. The Chinese government has made some efforts by administration forces, such as setting restriction in the Construction License System that general contractors and professional contractors are not allowed to deal with labor-service business as a sideline, while LSEs can not apply for the license of general contracting or professional contracting adversely. One of the motivations is to encourage the development of LSEs and further labor-service subcontracting market. Perhaps it may have some effects on regulating the labor-service subcontracting market temporarily. However, without fundamental changes in the overall subcontracting market, the construction industry can not achieve a sound industrial structure, in which all categories of construction enterprises can

develop well in the long term view. That is to say, the applicability and effectiveness of this enforcement may be reserved for further consideration regarding the unsatisfactory progress with implementation. Most project managers¹⁰ admit that ‘illegal’ *baogongtou* remains to abound on construction sites in disguise since it is preferable to formal LSE in current labor subcontracting market. The immediate cause lies in the principle of Cost-Based Selection (CBS) under current competitive labor contracting market, which makes the informal *baogongtou* with lower labor cost by avoiding the overhead cost and on-cost of formal employment beat the competition. While the deeper reason is supposed to be the institutional deficiencies in current subcontracting systems with excessive restriction on subcontracting layers, since it is liable to the constraints on the further development of small and medium-sized subcontractors and ultimately the highly specialization of construction industrial structure ^[82]. Until now, general contractors complain that the subcontracting market is too disordered and deficient in supplying qualified subcontractors with laborers and specialist skills; meanwhile, *baogongtou* as well as LSE complain that they could not see any promising future under current insecure and non-incentive business environment. Thus, fundamental improvements in laborer’s situation have not been available.

(3) *Insufficient supply with skilled laborers*

The shortage of skilled laborers has already become a bottle neck to the development of LSEs. According to new Construction License System, LSEs are required to have a 100% certification rate of operational workers on post. However, the rate of skill certification among operational laborers remains extremely low, as an effective professional skill training and education system involving migrant laborers has not established yet. It should be considered as soon as possible from a long-term view of the development of subcontracting market ^[83], which demands a cooperation of all involved parties.

5.1.6 Discussions

(1) *Direct control or delegating of labor management on site*

Efforts have been made in many countries to overcome the disadvantages of labor outsourcing. Regarding the loss of control over the labor force and site work, one common practice is that general contractor adopts an arrangement whereby the labor is sourced through a labor contractor but paid and supervised on its own, which has also been promoted by the Ministry of Railways in China since 2005. Through that, even when risk is passed down to the labor contractor with a fixed sum paid for a package of work, the site manager employed by the general contractor can still exercise a considerable degree of control. Bresnan (1985) ^[84] points

¹⁰2009-2010 investigation into construction sites of CRCG-12

that it could be further enhanced through the use of known subcontractors with whom general contractor has a long standing work relationship, or through the employment of specialty subcontractors. However, direct control by general contractor is supposed to be a transitional mode seeing that the long term strategy for most general contractors worldwide tends to be a 'just in time' assembler supplied by specialized, efficient and independent subcontractors. It could then be inferred that subcontractors should be cultivated with more subjective initiatives on developing specialist skills and management capabilities to achieve more efficient construction production. Based on that, situations of construction laborers largely recruited and employed by informal labor subcontractors under current labor subcontracting market could achieve fundamental and sustainable improvements. Schemes for improving laborers' situations including social welfare have also been devised in other countries like Egypt, India, and Korea, based on acknowledging of laborers' temporary or casual employment status. Most of those schemes illustrate that policy direction should be oriented to accommodate the needs of construction laborers without requiring a fundamental change in the way they are recruited and employed. It reveals that the prohibition of *baogongtou* and restriction of subcontracting systems may be one-sided with ignorance on its further development like becoming a specialty contractor or even general contractor, and ignorance on its functioning of building a social bond to some extent. Although the latter argument should not be carried too far, it is acknowledged that *baogongtou* has potentials to foster close relationships among groups of laborers.

(2) Contractual or non-contractual relationship

Recent Chinese government thinks that one of the most important solutions of labor issues is labor contract, revealed from the promotion of LSE which is ought to sign a contract with laborers. It is believed that if there is labor contract, the conditions of labor force would be much improved. Of course, contract has legislated constraints by law enforcement in labor users regarding formal payment and welfare systems; however, it should be on the premise of necessary accountability, which is far from sufficient in current China. Furthermore, many cases in other countries indicate that there is usually a large gap between regulations in principal and action in practice, suggesting that contract could not solve the problems fundamentally. An alternative solution is non-contractual cooperative work relationship like Japanese long term partnership up and down the construction supply chain. Partnering is 'a management approach used by two or more organizations to achieve specific business objectives by maximizing the effectiveness of each participant's resources. The approach is based on mutual objectives, an agreed method of problem resolution and an active search for continuous measurable improvements' ^[85]. It has facilitated the further development of subcontractors, followed with the establishment of a highly specialized subcontracting market abundant with qualified specialty subcontractors in the past Japan ^[86].

(3) *Summary*

- The prohibition of *baogongtou* and restriction of subcontracting systems may be one-sided with ignorance on labor contractor's further development like becoming a professional contractor or even general contractor, and ignorance on its functioning of building a social bond to some extent.
- There is usually a large gap between regulations in principal and action in practice, suggesting that contract could not solve the problems fundamentally. An alternative solution is non-contractual cooperative relationship like Japanese long term working relationship up and down the construction supply chain. It has facilitated the further development of labor contractors, and consequently established the highly specialized subcontracting market with qualified professional subcontractors in the past Japan.

5.2 Inspirations from Japan — case of *Kajima*

Bennett et al. (1987) ^[87] points out that long term relationships contribute to the achievement of efficiency and great success of the Japanese construction industry. Seen from Japan's experience, big general contractors (GCs) play a major role in building and maintaining this long term relationships via the establishment of affiliations among their subcontractors (SCs) who then enjoy paternalistic but conclusive family relationships (referred to as Affiliated Companies), since there is a strategic vulnerability of subcontractors mostly small and medium-sized enterprises, which is to say their exposure to the consequences of arbitrary decisions by their customers.

5.2.1 Basic information

Kajima is one of the Japan's big six construction GCs. It was founded in 1840 and quickly grew to become an industrial leader in the field of construction, where it has remained as much ever since. Headquartered in Tokyo, *Kajima*'s global operations net work has evolved in Asia, Europe, Africa, the Middle East, and the United States in virtually every area of construction and real estate development. *Kajima* Group maintains an approximate workforce of over 15,000 employees around the globe. By generating annual consolidated sale of approximately 18 billion US dollar, *Kajima* ranks as one of the top construction companies in the world. Its extensive experience and expertise in the development, design, and construction of all types of structures from dams, bridges and tunnels to skyscrapers, factories, commercial facilities and resorts has led to the *Kajima* name being well recognized worldwide. These prominent capabilities and a successful track record have also garnered *Kajima* the respect, trust and confidence of the

clients and the society, which is the key to its sustainable growth.

5.2.2 Partnership mode of affiliated companies

The transition of relationships between *Kajima* and its subcontractors, particularly with the establishment of Affiliated Companies (ACs), reveals a typical Japanese practice of facilitating the development of subcontracting market (Table 5-5 and Table 5-6).

Table 5-5 Transition of relationships between *Kajima* and its subcontractors (in brief)

<i>Labour supplier</i>	<i>Kajima</i> foremen	<ul style="list-style-type: none"> labour subcontractors corporate license 				
<i>Relation-ship with Kajima</i>	<ul style="list-style-type: none"> integrated intra-company transaction 	<ul style="list-style-type: none"> exclusive inter-companies transaction 	<ul style="list-style-type: none"> indispensable 	<ul style="list-style-type: none"> as buffer independency specialization business extension 	<ul style="list-style-type: none"> less-valued 	
<i>Kajima's efforts on SCs</i>		<ul style="list-style-type: none"> full-scale training AC mode 	<ul style="list-style-type: none"> TQM AC guideline 	<ul style="list-style-type: none"> long term plan for AC localization info-share tech-share 	<ul style="list-style-type: none"> cost-based competition 	
<i>Economy</i>	<i>WWII</i>	<i>ascending</i> 1955	<i>stable</i> 1965	<i>grim</i> 1980	<i>bubble</i> 1990	<i>recession</i> 1995

Generally speaking, within the construction industry, the value-added process is distributed across several organizations between GC and SCs. Without working together in a cooperative manner, supply chain efficiencies are difficult to realize. Under Japanese long term relationships, an excellent integration between *Kajima* and its SCs in the construction supply chain is realized along the three dimensions shown in Figure 5-4.

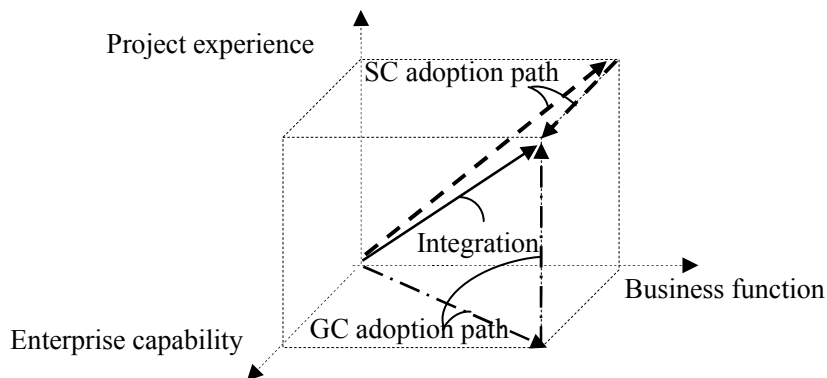


Figure 5-4 Adoption paths for GC and SC in the construction supply chain

Table 5-6 Transition of relationships between *Kajima* and its subcontractors (in detail)

Before the WW II	<ul style="list-style-type: none"> • Procurement of material, labor etc. by its own
After WW II	<ul style="list-style-type: none"> • Direct employment • Integration (Intra-company) between <i>Kajima</i> and its exclusive foremen or bosses on construction site (<i>kyouryokukai</i>), who were the main agencies to provide with labors
Economy ascending period since the middle of the 1950s	<ul style="list-style-type: none"> • Agencies and direct employment were transferred into subcontracting system accompanied with subcontract, formally like an inter-companies transaction • Associate Companies got construction corporative license
Stable Economy period since the middle of the 1960s	<ul style="list-style-type: none"> • Cognizance of the indispensable role of fostering Association Companies in ensuring labor provision and improving construction capability construction • Establishment of <i>Kaeikai</i> as Associate Companies (1975) • Full-scale training on the foremen from Associate Companies
Oil shock in 1980s (cost increase & restraints on construction investment)	<ul style="list-style-type: none"> • Independent management and accountability construction system among Associate Companies • Establishment of <i>subcontracting countermeasures committee</i> (as part of TQC movement, 1978) • <i>Basic guideline for Associated Companies</i> (1980) • <i>Fostering and strengthening Associate Companies with excellent management and technology capabilities</i> (1985) • <i>Medium-and-long-term countermeasures for ensuring excellent Associate Companies</i> (1988)
Bubble economy (expansion of domestic demand)	<ul style="list-style-type: none"> • <i>Long term plan for Associate Companies</i> (1990) buffer + self-development • Selection of Kernel Associate Companies and their reinforcement • Ensure new Associate Companies by exploiting Small and Medium-sized general contractors, and local contractors • Collection and utilization of Associate Companies' Data • Researches on Technology Sharing and HRM
Economy recession period since the 1990s	<ul style="list-style-type: none"> • Principle change from mutual coexistence into competitive • <i>reformulation of the basic guideline for Associate Companies</i> (1998) • Elimination of those unpromising Associate Companies through reducing tending opportunities • Competition based on cost (most important) • key associate companies selection and encourage their self-develop (less important) • aiming at the utilization of Associate Companies through hierarchical management based on 'comprehensive' information including building trades, regions and characteristics, etc.

Particular attentions are firstly paid to SC's development path. In short, across the various projects, foremen accumulated skills and technologies that increase operational efficiency within the GC, which provided a high value to their business functioning. Their initial business with GC was to be an intra-company transaction, and then changed into an inter-companies transaction in the capacity of labor subcontractors with a construction corporative license. Then through turning into the GC's Affiliated Companies, labor subcontractors got an opportunity to further develop their specialist skills as well as management capabilities in a secure business environment attributed to the long term working relationships. This opportunity then facilitated them to be specialty subcontractors or even general contractors along with the business extension. Normally it at least takes a foreman at the bottom subcontracting layer 7-8 years to accumulate essential construction skills and management capabilities to become a specialty company in Japan ^[88]. Thus it is inferred that gaining a regular work with the same contractor has a significant meaning in acquiring skills or technologies that are essential for future development of labor subcontractors, even though the whole process is generally informal and the time span of skill acquiring is varying ^[89]. What's more, Japanese long term relationships through Affiliated Companies mode contribute to the decrease of uncertainty of transaction up and down the construction supply chain, and give labor subcontractors an incentive to further develop their specialist skills and management capabilities. From above, we could see what should be SC's sustainable competitiveness. It absolutely should not be cheap labor or material.

5.2.3 Japanese general contractor's business model – competitiveness by relationship alignment

The difficulties lie in the concrete fulfillment process to establish and maintain this relationship. In fact, Japanese non-contractual partnering has recently been applied into construction industry in many countries, represented by UK. Around the 1980s, the UK construction industry had been ridden by conflicts revolving around competitive tendering, and adversarial working relationships up and down the supply chain. Consequently, an opportunity to accumulate skills and knowledge gained from working with the same subcontractor is lost. Since the middle of the 1990s, UK started to introduce Japanese partnering into construction, with an indicative research conducted by Sir Latham in 1994. It is found that to change the traditional adversary relationships up and down the construction supply chain; it should proceed with the changes in project organization. It has to start with the client or big GCs who have sacrificed efficiency for the illusion of control for a long period. However, UK's recent progress shows that

persuading them with economic benefits sometimes proves to be too difficult, whereas it is a commonly aware and accepted knowledge to most Japanese GCs.

In fact, it is a general and common practice to develop Affiliated Companies not only in construction general contractor but also in manufacturers in Japan. This non-contractual cooperation between up layer and down layer results in risk sharing and trust between them, as a contributor to the good performance of MLSS that generally come to be a target of public criticism worldwide. Consequently, a highly specialized subcontracting market with qualified subcontractors has been established, absorbing more than 90% of construction employment in Japan. The difficulties lie in the concrete fulfillment process to apply this non-contractual cooperative relationship. *Kajima's* case reveals that in Japan, Big GCs play a decisive and conductive role in establishing and maintaining the long term working relationships with their subcontractors under Affiliated Companies mode. Generally speaking, it is difficult to persuade them with economic benefits from the long term relationships since it takes time to discover, whereas it is a commonly aware and accepted knowledge to most Japanese contractors. A deeper exploration on *Kajima's* business model may explain (Figure 5-5).

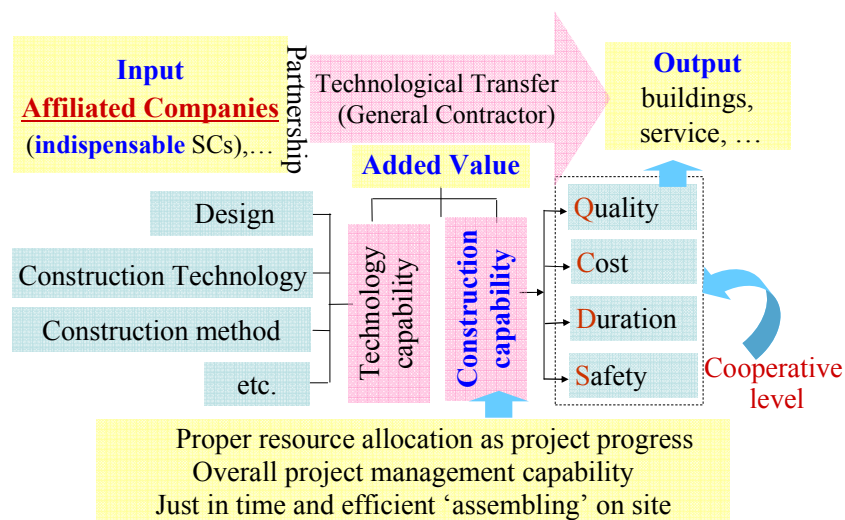


Figure 5-5 Japanese GC's business model (Based on the representative case of *Kajima*)

GC's business model reveals that Japanese construction industry has already developed into an 'assembly' industry with just in time and highly efficient assembling on construction site. From the model, it should be notice that the business strategy of GC is focused on the added value to output in the market, which depends on its technological and construction capabilities. Seeing that the outsourcing fee occupies more than 70% of the total project cost in general (Table 5-7), SCs must be viewed as an indispensable input; hence, the cooperative level with SCs is believed to directly affect QCDS on site and then determine the performance of GC. Therefore, AC mode with long term working

relationship is promoted and maintained by GC for quite a long period in believing that it could cultivate ‘good’ subcontractors with a return of high quality of service.

Table 5-7 Proportions of outsourcing cost (including labor outsourcing cost)
in the total project cost (%)

<i>Kajima</i>	<i>Shimizu</i>	<i>Taisei</i>	<i>Obayashi</i>	<i>Takenaka*</i>
73.0	68.4	68.9	71.3	76.8

Source: Based each corporation’s Annual Security Report from 2009.4.1 to 2010.3.31

Except *Takenaka* from 2010.1.1 to 2010.12.31

5.2.4 Analysis and discussions of Japanese GC’s success in cultivating SC’s roles

(1) Japanese unique business philosophy by principle of organizational market

Itami (1987) ^[90] considers the Japanese transaction pattern which emphasizes cooperation through forming long term relationships under Affiliated Companies is a mixture of Principle of Liberal Market Economy and the Principle by Complete Organization. It is mentioned as ‘organizational market’ (Hori 2010) ^[91], as a conception with prominent Japanese characteristic. Different from the Market Principle in Western countries, the criteria for Japanese business guided by organizational market lie in the followings as distributed sharing, employee empowerment, and corporate alliances. Affiliated Companies are direct embodiment of corporate alliances with three aspects shown in Figure 5-6. Guided by the principle of organizational market, a co-existence and co-prosperous relationship between GC and SC has been established and maintained for a long period in Japan.

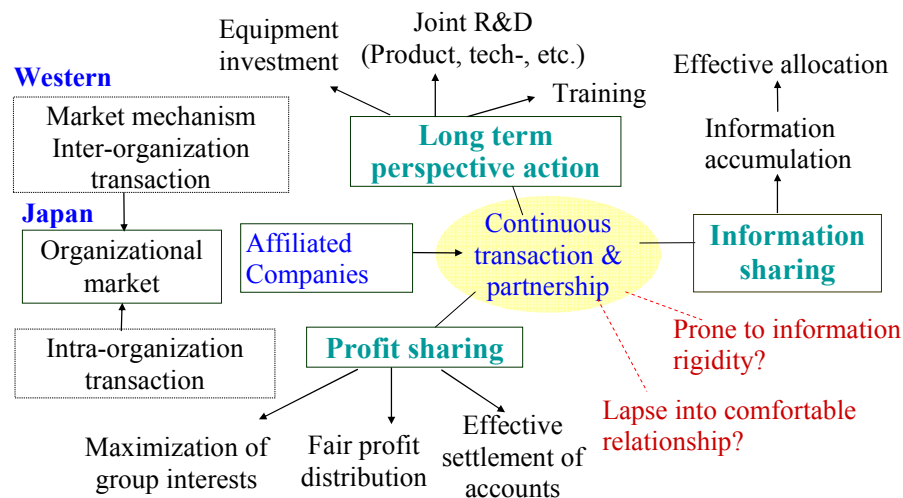


Figure 5-6 Japanese principle of organizational market

(2) Assurance systems of public procurement

Another contributor to the success in the long term relationships lies in the Japanese public procurement with the characteristics of so-called ‘assurance systems’ in the past^[92]. Bidding schemes in the assurance systems consist of *dango* and designation. In general, designation assured ‘good’ subcontractors in the construction supply chain, which in turn necessitated the further improvement of SCs as well as the laborers’ skills. *Dango* (in Japanese) means complementary and rotational bidding, which reduced business uncertainty and strengthened the accountability among participating bidders in the past Japan, even though it is severely blamed as it operates like a giant siphon, picking up construction industry funds and transferring them back to the politicians who promise to keep the pipeline full^[93]. Seen from another aspect, through *dango*, the award price for up layer’s contractor is usually more than sufficient for completion of project, which ensures the potential profits for them, and hence it could be possible for them to share profits with its down layer subcontractors following the Japanese business philosophy. In short, *Dango* makes it possible to externalize the economic benefits of long term relationships up and down construction supply chain. To be more detailed, this practice is usually carried on under the down layer’s exclusive relationship to the up layer of the construction supply chain. This exclusive relationship means that at the bid and award stage, the contractor generally stipulates the contract price, instead of letting the subcontractor estimate the price for the work; while the subcontractor trusts that the contractor will fairly represent his interests. The Japanese sub contractual relationships are more likely to be based on negotiation than competition. Thus, the subcontractor just worries about the technical and engineering issues rather than gets involved in budget and account settlement, which indicates that conflicts about payment and claims for additional expense simply do not arise. In return for all these advantages, the contractor goes to great lengths to try and provide continuous employment and fair recompense for the subcontractors. Consequently, the long-term relationships on a basis of trust and a sense of brotherhood have been established and maintained.

However, it could be inferred that this kind of relationship is liable to a sharp decrease of the overall profits up the supply chain, which has been demonstrated by recent severe competition on bidding price along with the recession of Japanese construction. Regarding *Kajima*, according to a recent investigation on its Affiliated Companies, half of the respondents said that *Kajima* is valuing more on cost in the transaction, which results in low-bidder and a damage of previous long term and trust relationship. Instead of cost, most of those Affiliated Companies expect to be evaluated by more weights on quality or cooperative level. How to balance the competition and cooperation becomes an urgent task for current Japanese construction.

(3) Summary

In short, from the case of *Kajima*, it could be included that the predominant role of general contractor, principle of organizational market, and the ‘assurance systems’ for public procurement are the three interrelated and interacted contributors to the success in establishing and maintaining the long term relationships in the past Japan.

5.3 Lessons learned and inspirations

5.3.1 Necessity of reform on current construction subcontracting systems – seen from cases of CRGC-12 and *Kajima*

One deficiency of current subcontracting systems lies in its restriction on subcontracting layers in principle, although it commonly does not work in practice. It led to an unspecialized and underdeveloped subcontracting market with incompetent and insufficient professional subcontractors and labor-service subcontractors.

From the development of Japanese construction multi-layer subcontracting systems (MLSS), it can be found that labor-service subcontractors have effectively been encouraged to develop themselves into professional contractors under growing economy, in view of unconfined business scope including material procurement. Further, most of them could then develop their specialized skills or technologies as a competitive power. By possessing materials, proprietary technologies, labor force and facilities, most subcontractors in Japan can provide independently not only professional technical proposal but integrated management as well, who then become competent and reliable partners to general contractors. What is needed to highlight here is that they have developed their own independent safety and quality management systems, which is extremely important to construction management on site^[94]. As an indispensable part of the overall construction occupational safety and health management system, subcontractors have made a great contribution to the outstanding achievement of safety management in Japan.

In a word, one prominent characteristic of Japanese construction subcontracting systems could be described as an integration of several top class general contractors and multiples of highly specialized professional subcontractors with independent capabilities. Such kind of professional subcontractors should be the long-term development objective for Chinese LSEs, even current PCEs and low-qualified general contractors as well. Only in a highly-specialized subcontracting market with promising subcontractors, construction management on site including labor-service management could be improved to ensure construction migrant laborers a better life lastingly.

However, regarding MLSS, the actual condition of China is different from that of Japan. As pointed by Mr. Yoshihito SABASE¹¹, Director from Japan CTI Engineering Co., Ltd., efforts should firstly be made based on its own practical national conditions and characteristics, which will then act as the criterion to evaluate the introduced systems from other countries. That is to say, judgment and evaluation of other countries' systems should be cautiously conducted before introduction, which reveals that Japanese MLSS should be penetrated and combined with Chinese practical situations before being introduced into China. It is certain to be a difficult, time-consuming job.

5.3.2 Understanding the competitiveness for subcontractors

Successful subcontractors are able to share in the success of their customers. What small subcontractors have to offer is predominantly experience with a particular technology; and that technology is one which most subcontractors enjoy applying to a range of customer demands. Labor flexibility and economies of scale and scope are also important sources of competitive advantage, but cheap labor seems to be of only minor relevance. Unfortunately, despite being long-term, there is evidently too little trust and communication for a fully efficient relationship. The result is considerable concern over demand fluctuations and customer continuity, and the avoidance of investment in ideal, specific technologies. The problem is particularly severe for the smallest firms, employing fewer than 10, who are also less likely to possess expensive, flexible capital equipment. Increased use of formal contracts may provide some improvement, but contracts cannot legislate for trust. Genuine, lasting improvements in the subcontracting relation must probably be built on developing a more cooperative inter-corporate culture.

5.3.3 Promotion of partnership in support of the tentative changes in subcontracting systems – seen from Japanese long term work relationships

There was an unyielding convention in the past of Japanese construction industry that each subcontractor was exclusive to a fixed general contractor without providing other contractors with service ^[95]. Japanese contractors believed that complying with this convention may affect their short-term income but could bring long-term profits. Many large general contractors had developed their own Affiliated Companies for their exclusive use, the number of which are subcontractors with stable work relationships. Instead of emphasizing on price competition or bidding among the subcontractors, the mode of Affiliated Companies promotes a more tempered and stable interdependence

¹¹Discussion in a seminar at CTI Engineering Co., Ltd, on June 25, 2009

between a certain general contractor and its Cooperation Committee members as subcontractors. Affiliated Companies mode has been proved to be valuable and effective in assuring project objectives and developing subcontractors' competencies by continuous assistance and training conducted by general contractors. In return it has brought a success for general contractors themselves. By virtue of Affiliated Companies mode, a stable and favorable partnering between general contractor and subcontractors was realized in Japan under developing economy, which guaranteed the good performance of MLSS in the past of Japanese construction industry.

However, as there has not yet any similar organization or mechanism in China, the relationship between general contractor and subcontractors is generally temporal and unstable, which results in a distrustful environment and further leads to a deterioration of project quality and safety. Affiliated Companies mode seems worth learning in view of its outstanding group strength in meeting the mutual fundamental demands for both general contractor and subcontractor. However, it should be noticed that how to select capable committee members is extremely important, which demands a sound business evaluation system, which in Japan is partly ensured by social trust, credit and integrity. Recently, the integrity mechanism is promoted among construction enterprises in China, which indicates that such kind of organization may be available in the near future in China as well.

5.3.4 Combination of cooperation and competition in labor procurement

As mentioned above, the long term relationships may easily lapse into a comfortable and less initiative business environment, a combination with market competitive mechanism may be a countermeasure to prevent the possible repercussions. Furthermore, it could be inferred that this kind of relationship is liable to a sharp decrease of the overall profits up the supply chain, which has been demonstrated by recent severe competition on bidding price along with the recession of Japanese construction. Regarding *Kajima*, according to a recent investigation on its Affiliated Companies, half of the respondents said that *Kajima* is valuing more on cost in the transaction, which results in low-bidder and a damage of previous long term and trust relationship. Instead of cost, most of those Affiliated Companies expect to be evaluated by more weights on quality or cooperative level. How to balance the competition and cooperation may also be an urgent task for current Japanese construction.

Different from Japan, China has been stressing on market competitive mechanism with ignorance on the cooperative working relationships throughout the last three decades of economy ascending. Since there is not yet 'assurance systems' for labor contractors

under current insecure business environment in China, an opportunity to accumulate skills and knowledge gained from working with the same contractor is lost. Regarding the practical situation of subcontracting market in China, the significance of combining cooperation with competition should be deeply understood up and down the construction supply chain, which may serve as a start point to regularize subcontracting market aiming at the achievement of sustainable construction labor market. Furthermore, seeing that the long term relationships are vulnerable to the economic environment particularly in economy recession, the sustainability of the long term relationships should be argued in further study.

6 Proposal and Discussion

This section is trying to promote a mutual understanding between GC and SC of what could be done and the potential economic incentives in view of unavoidable subcontracting.

6.1 Labor procurement strategy combining competitive and cooperation

As mentioned before, the uncertainty in the construction production process is a great barrier for future development of the involved parties in the construction supply chain under the practice of subcontracting, with the lower layer, the bigger impacts. It could explain the phenomenon that migrant laborers under informal employment and MLSS in China (the lowest layer) are the most vulnerable as they are usually performing as a buffer or leverage to cope with fluctuation of construction. From the level of construction management, a common result of extensive subcontracting is that GC's failure in its role and responsibility in designing and managing the construction production systems, resulting in the budget and schedule overrun, overmuch fluctuation of laborers demanded, and so on. Regarding the labor provision business, it is assumed that through working together by GC and SC, an optimal risk management solution could be achieved. The crucial thinking for improving is trying to find approaches to encourage good supply chain management to strive for stability. A labor procurement strategy under the principles combining competition with cooperation could be valuable (see Figure 6-1).

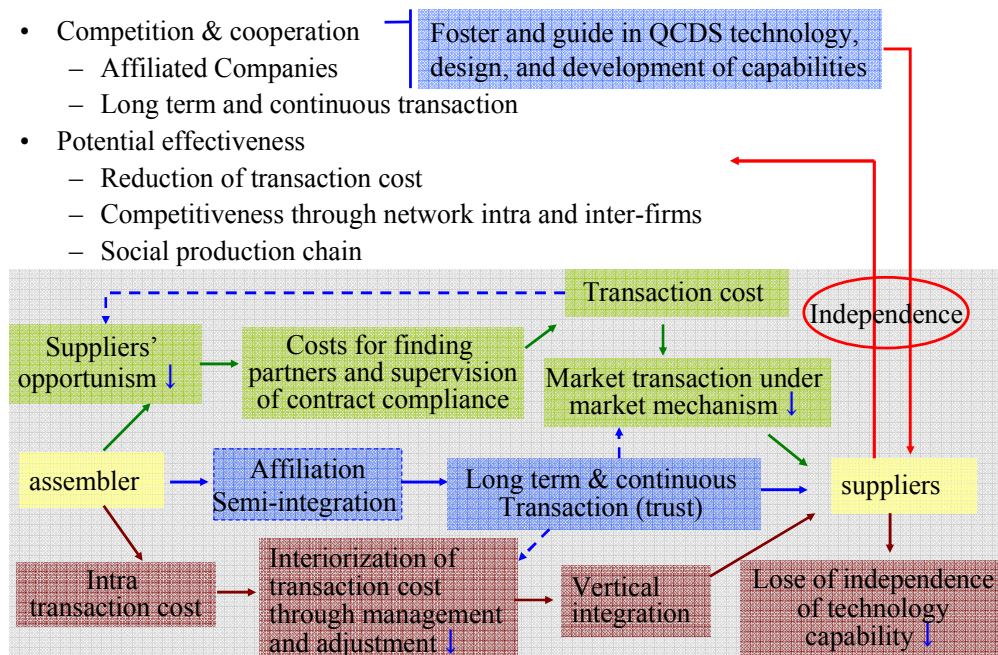


Figure 6-1 Labor procurement under principle of competition and cooperation

6.2 Tentative analysis on the potential economic incentives for promoting mutual understanding

As mentioned before, partnering could reduce the task uncertainty to some extent. Unfortunately, it is frequently adopted by SCs just as a short-term response to pressure from powerful clients or GCs, rather than being a fundamental cultural change ^{[96][97]}. Moreover, if it is not implemented properly, in turn it could exert detrimental effects on subcontractors ^[98]. As Bresnen and Marshall (2000) ^[99] point out that the real cultural change requires an understanding of factors that dictate the basic interests of the parties involved.

One of the crucial issues for a well ongoing construction process concerned by GC and SCs is the project plan. It is commonly acknowledged to those who have managed projects that the project plan is largely dependent on the reliability of subcontractors providing the necessary resources at the right time, in the right quantity, and with the right skills, equipments, and so on, along with the project progress. It happens frequently that project managers¹² impute the project delay or budget overrun largely to the subcontractors' failures to perform as expected on most occasions. Unfortunately, they seem to ignore the strength or impacts of the reverse relationship that the subcontractors are also highly dependent on the predictability or reliability of the project plan when allocating their resources. The existing working culture particularly under the practice of subcontracting is prone to ignoring the fundamentals such as production planning, analysis and control by general contractor (as one focus of severe criticism on subcontracting), at the same time devaluing subcontractors by general contractor ^[100]. Thus it is crucial to pay close attention on the work plan to facilitate a better working culture between GC and SCs.

There are many causes for the uncertainties during the project progress, which could be mainly examined from external and internal levels (Figure 6-2). The model is going to focus on the analysis of a major and commonly existing internal cause as the workflow reliability, including the degree of the stability of plan by GC, and reliability in providing necessary resources by SC. It can directly result in the task uncertainty and contract uncertainty during the transaction process between GC and SC, the degree of which will become even bigger due to organizational uncertainty and natural uncertainty.

As can be easily understood, one of the induced problems by the instability of construction production is the fluctuation of labor demands during the construction process. Correspondingly, the laborers provided by subcontractors are fluctuated with a degree of uncertainty. Without a proper ability to coordinate by GC and SC, from the project perspective, it could easily result in the waste of labor waiting or labor shortage in use, both of which have detrimental effects on the achievement of project objectives; from the labor force perspective, it is prone to arbitrary use and exploitation of laborers by subcontractors as a major measure

¹²In this chapter, the term 'project manager' refers to as the role of construction manager from general contractor

to cope with those risks inherent in the labor supply business.

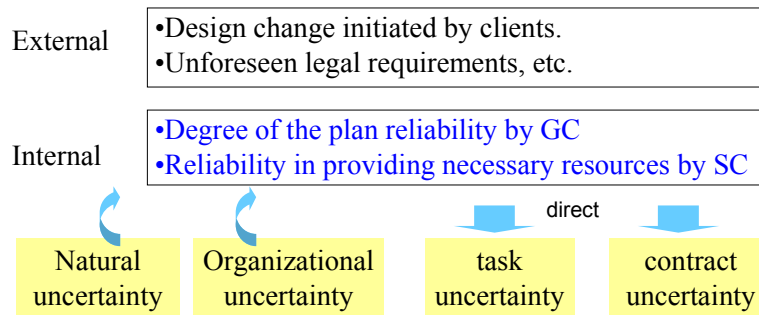


Figure 6-2 Main causes for uncertainties during the process of construction production

Again, we would like to stress on the significant influence of those uncertainties on the development of subcontractors at a firm-level. It is obvious that those potential waste or loss brought by the instability of construction production actually could not be eliminated, but in most cases it is just simply transferred through subcontracting from the upper layer (GC) to the owner layer (SC) along with the construction supply chain. Seen from the GC and SC's mutual adoption path for complete integration in the construction supply chain management (Figure 5-5), it then could be understood easily that SC is generally more fragile or vulnerable to the instability of construction production, since they are in the downstream of construction supply chain, and their further development is greatly dependent on the fundamental accumulation on projects level.

One valuable approach to improve this situation is to strive for stability by construction supply chain management, instead of the conventional behavior to transfer risks from up to down. In a word, how to deal with the uncertainties related to work plan by GC and resource allocating by SC during the production process have a significant meaning to facilitate the better ongoing development of subcontractors, in which way, may provide an opportunity to improve labor force's employment conditions continuously and sustainably.

6.2.1 Understand the economic motivation of SC

In this section, a tentative effort is made through exploring the dependent relationship between the degree of plan reliability for construction project by GC, and subcontractors' reliability in providing the resources at the right time, in the right quantity, and with the right skill, equipment, and so on.

Intuitively, it could be deduced that the more reliable a project work plan is, the more willing for SC to allocate resources readily and efficiently. Thus the work flow reliability would be improved. Vice versa, the less reliable the work plan is, the less reliable resource allocating is likely to be, resulting in a seeming vicious circle of reliability with non-trust working relationships consequently. As can be imagined, independent attempts to achieve

effective resource utilization may bring negative effects such as longer wait time for work assignment, labor lay-up, and so on, which could ultimately reduce the work flow reliability. It is necessary to work together by GC and SCs to strive for stability, which firstly calls for a rigorous understanding of this relationship. The following model is aiming at helping GC understand the economic motivation of SCs, and thus helping simulate some supply chain management approaches which could contribute to the stability amid an increasing and unavoidable subcontracting practice.

Firstly, a basic view with a focus on SC's economic motivations by allocating resources under the uncertain business environment is provided. Resource allocation here is defined as the process of allocating resources among the various projects or business units. Here the uncertainty only caused by internal factors (Figure 6-2) in the subcontracting business between GC and SC will be considered. And given the contract price between client and GC is reasonable so that GC does not have to worry about their payment by client, but just consider how to finish work efficiently with the coordination by SCs.

We have some knowledge as below, consistent with the empirical observations during the investigation and interview in CGRC-12.

- SC's reliability of providing resources is largely dependent on the reliability of work plan by GC.
- SC tends to provide fewer resources than demanded in practice.
 - There is a potential of lower reliability in providing resources by SCs.
- SC prefers to subcontract more services such as materials, equipment, and so on, rather than labor-only provision.
 - SC could be less influenced by the uncertainties inherent in its business, and have a potential to gain a proper profit.

(1) Two primary start points to understand subcontractors' economic behaviors

Generally speaking, subcontractors behave to maximum their profits according to the ways in which they are measured. With regard to construction subcontracting, the basic rules are mostly set in the subcontract, which is almost based on a fixed unit price or lump sum contract for the work. It is one primary start point to understand subcontractors' business environment, who are employed by general contractors.

Another start point to understand their business environment is that subcontractor works on multiple projects simultaneously, which does take place in most cases. Therefore, the economic incentives for subcontractors ought to focus on not on any one particular project, but on all those multiple projects.

These two points should be kept in mind for better understand subcontractors. Moreover, how the long term relationship will affect the subcontractors' economic behaviors is supposed to be examined in order to put forward concrete management approaches on a basis of mutual understanding by general contractors and subcontractors.

(2) With regard to the income over one single project

The model will firstly focus on the expression of the net income to be earned, or the loss to be incurred by a subcontractor in any particular project over a single planning period T, and then from a long-term view.

The net income of a subcontractor in any particular project over a single planning period T could be:

SC's net income	=	Total income from the work actually performed	—	Total cost of the resources actually occurred
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Its simplified function is expressed as follows, derived from Sacks ^[101]:

$$\begin{aligned}
 I &\approx \min\{k, q\} W_D (U - C_M) - kW_D C_S \\
 &= \begin{cases} kW_D (U - C_M - C_S) & k < q \\ qW_D (U - C_M) - kW_D C_S & k \geq q \end{cases} \quad (6.1)
 \end{aligned}$$

Here are the descriptions of the variables and some attributes.

- $k(k = R_p / R_N)$ represents the ratio of the actual resources provided by SC to the quantity of resources needed to complete the full quantity of work planned or demanded by GC. In short, it can be understood as the capacity of resources actually provided, or perceived as the reliability of subcontractor.
- $q(q = W_A / W_D)$ represents the reliability of the project plan by GC, in which
 - W_A represents the quantity of work actually made available
 - W_D represents the quantity of work demanded
 - The actual value of q occurs with uncertainty $P_r(q)$ in practice. Koskela (1992) points out that the planned work amount will only actually become available for execution when all of the seven preconditions are fulfilled, in view of each item's inherent uncertainty for productive execution of work packages ^[102]. According to Koskela, those seven preconditions for project to proceed as planned are: completion of any precedent tasks; accessibility of the space of the work; availability of labor; availability of materials; availability of equipment; provision of update and complete information; and fulfillment of external conditions (such as statutory permissions and financing).

(3) Analysis of the parameters affecting subcontractors' behaviors

In this scenario of resource allocation, SC knows the unit price for the work set (U) in the subcontract, the unit costs of materials (C_M), and the cost of the resources per units of work planned (C_S), and the quantity of work demanded (W_D) by project manager. The decision for SC is to set the value of k that will optimize its net income.

Figure 6-3 shows the relations between SC's net income, resource allocation strategy and

GC's plan reliability, given that $(U - C_M - C_S) / C_S = 1/4$ for simplification.

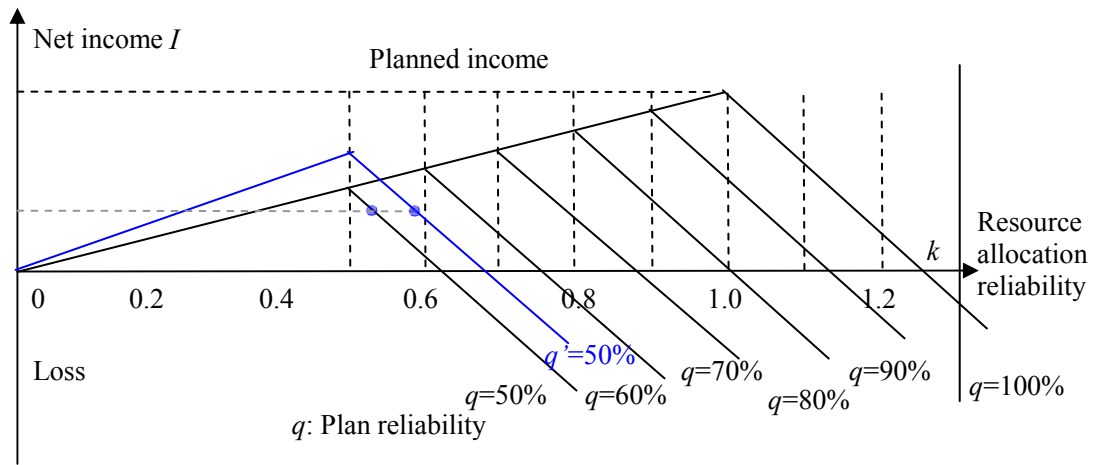


Figure 6-3 Relations between SC's net income (I), resource allocation strategy (k), GC's plan reliability (q)

From the figure above, it could be inferred that:

- The net income of SC is dependent on the reliability of work plan by GC (q), resulting in different behaviors of allocating resources (k) by SC.

As q declines, not only is the total expected income (I) will be reduced, but the point at which the loss is incurred (below the vertical axis) also occurs by increasingly smaller levels of resource allocation. Given this relationship, in order to maximize its income in any project, a rational subcontractor must try to estimate the most like value for q and then choose to allocate resources most appropriately (i.e. try to seek $k = q$). It indicates that if the work plan is less reliable (means less value of q), SC also tends to provide less than demanded resources to prevent a potential loss (if SC provides sufficient resources, from Figure 6-3, we could see that the loss will occur much easier). From the SC's perspective, non-trust work relationships will lead to its behavior like not to be of honest or integrity. It is consistent with our perception that subcontractors usually tend not to provide the resources demanded by project managers along with the projects progress, such as cheat on labor and materials (jerry building).

- The vulnerability of subcontractor to the unreliability of work plan by GC could be influenced by its business scope in subcontracting

If subcontractor supplies labor alone (labor-only contractor), the slope becomes steeper, making the subcontractor more vulnerable to the degree of reliability of the work plan (q). On that occasion, with the same value of q , SC needs a bigger value of k to get a same profit (usually we consider the right half of the curve). In other words, if the subcontractor supplies a significant proportion of the materials needed for the work, its vulnerability is decreased. Here vulnerability means the extent to which changes (the reliability of work plan in this case) could affect SC's income.

- Regarding the impact of profit margin, higher profit margin indicates a potential for higher income for subcontractor. It tells that in an industry where the projects are unstable, average subcontract unit prices should be high enough to sustain a degree of waste to some extent.

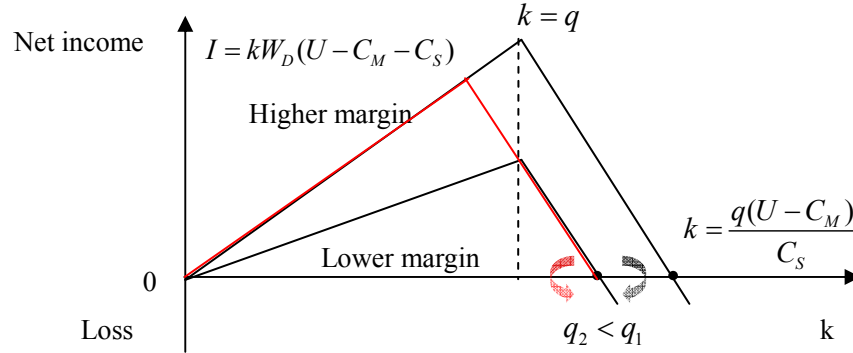


Figure 6-4 Relations between profit margin, resource allocation (k) and work plan reliability (q)

Assume that there are two projects under the condition of

$$\frac{U_1 - C_{M_1} - C_{S_1}}{C_{S_1}} > \frac{U_2 - C_{M_2} - C_{S_2}}{C_{S_2}} \quad (6.2)$$

It indicates that project 1 has a higher margin than project 2, it could be inferred (Figure 6-4) that where the profit margin is higher, the income becomes greater (under the same value of q). Moreover, with a higher margin, a positive net income can be sustained for lower value of q (less reliable work plan) under the same value of k , indicating that on this occasion the subcontractor is less sensitive to fluctuations in the plan reliability.

(4) With regard to the income over multiple projects

As mentioned before, one characteristic of subcontractor's business is that it usually conducts several projects concurrently. Thus it has to allocate resources as much as possible to multiple construction sites at a certain period. In view of the possibility of cost occurred because of any resources that are not allocated to any project, the jointly expression of SC's income over those multiple projects is:

$$I_n \approx \sum_{i=1}^n \left\{ \min \{k_i, q_i\} W_{D_i} (U_i - C_{M_i}) - k_i W_{D_i} C_{S_i} \right\} - C_R \quad (6.3)$$

Here, C_R represents the cost of any resources not allocated to any project by SC, in short the cost for the remained resources.

Because the unallocated resources are only a source of cost and can not generate any income, SC will attempt to avoid this situation. Given that there is uncertainty about the values of q_i at any time, there are two possible strategies that are commonly seen amongst subcontractors.

- Contract for more projects to ensure the total work amount likely to be available will

be more than the total capacity of its resources, in terms of overbooking. Thus, all its resources could be allocated by SC to gain a potential profit.

- Identify the reliability of work plan. It is especially useful where the total amount of work planned from GC is less than the total capacity available from SC. On that occasion, try to identify which project is more reliable. If the amount of work planned is underestimated, then set $k > 1$. Thus there may arise a phenomenon that resources are provided than that is needed according to GC's work plan.

The previous one gives some explanation to the Japanese practice. In Japan, SCs tend to focus on a stable and more market share, rather than focus on the profit in one project. It may be inferred stability of workflow and big work amount will be beneficial to encourage SCs to perform better in allocating resources, which could support the strategy of introducing long term working relationships between GC and SC.

(5) *Impacts of work plan reliability*

Since the value of q varies over the multiple planning periods, if a frequency distribution can be collected, then the expected value of q is possible to be estimated. It would be valuable for SC, but it could only happen under a long term working period. In practice, even if subcontractors can not get access to the records of the value of q for each project, they usually have a mental impression of the plan reliability in each project. As can be inferred, under a stable and long term work relationship, this kind of estimation could be more accurate and helpful for a subcontractor in its resource allocation.

Here, we use the distribution $P_r(q)$ as a measure in a long-term period of the plan reliability, through which a subcontractor could estimate the expected value of q . We are trying to find some useful phenomenon by assuming some frequency distributions for projects. Through that, we can calculate the expected values of the SC's net income that will be gained by a project in a planning period, for any strategy taken by SC (here the strategy could be deciding the ratio of the resources to be allocated, shown by the value of k).

An example is given here for easy understanding. Suppose that both projects 1 and 2 have the same unit price and costs. But project 1 is less reliable than project 2. The probability distributions of the work plan reliability q are shown in Table 6-1).

Table 6-1 An example of probability distribution of work plan reliability for two projects

q_1	70%	80%	90%	100%	110%
$P_r(q_1)$	0.05	0.2	0.4	0.3	0.05

q_2	70%	80%	90%	100%	110%
$P_r(q_2)$	0	0.05	0.5	0.4	0.05

In which, $\text{Exp}(q_1) = 0.91 < \text{Exp}(q_2) = 0.945$; $\text{Var}(q_1) = 0.0089 > \text{Var}(q_2) = 0.004475$.

Given different values of k , a subcontractor could estimate the expected value of its income. Table 6-2 shows the expected values of subcontractor's net income under a range of different choices for the value of k , given that $(U - C_M - C_S) / C_S = 1/4$, $C_S = 40$. It could be inferred that the optimal value for k for project 2 is expected to be greater than that for project 1. Thus a rational subcontractor who has some knowledge of the reliability of work plan would choose to consistently provide fewer resources than demanded by project's plan) to project 1 than to project 2.

Table 6-2 Expected income of two projects

k	70%	80%	90%	100%	110%
Exp(I_1)	7	7.75	6.6	5.25	1.5
Exp(I_2)	7	7	8.75	7	3.25

Moreover, it can be inferred that not only the expected value of q is important, but also its degree of dispersion. When allocating resources to two projects with equal mean values of q , of course the subcontractor will tend to prefer the one with a smaller standard deviation.

(6) Summary

SC is likely to allocate resources to any project according to its perception on GC's work plan reliability. Furthermore, in most cases, the capacity of resources allocated is prone to being lower than that demanded, since the potential loss of supply more is greater than that of supply less. That can be seen in Figure 6-3 that the slope defined by $W_D(U - C_M - C_S)$ where $k < q$ is generally less steeper than that defined by $-W_D C_S$ when $k > q$.

If the same resources can be employed in alternative projects, then the lower income in any one project due to under-supply of resources could be offset by applying those resources elsewhere, in view of the overall income by SC. It indicates that through overbooking, the subcontractor could achieve a maximum overall income even they are not achieving a maximum possible income in a single project. It seems advantageous for SC. However, project manager from GC will tend to worry about whether the subcontractors could finish the work amount demanded. As can be inferred, it will bring the undesirable consequence of further reducing plan reliability. It indicates that independent attempts to achieve full resources utilization usually will result in longer waiting times for assignments, ultimately reducing work flow reliability. In order to change, GC and SC need to cooperate regarding the work plan and execution, which could be achieved under long term work relationships.

However, even the model shows the significance of working together, any exchange relationship between a buyer and supplier is likely to happen in practice. That is to say, the subcontracting in construction is in fact a series of games, in which project manager (buyers) and SCs (sellers) seek to optimize their returns ^[103].

6.2.2 Game behaviors between GC and SC

In the previous section, we explain SC's tendency of dishonest behaviors in providing resources, such as to overbook its resources, and to provide fewer resources than demanded by work plan as the project progress, and so on. However, as mentioned before, in practice, this tendency could also be acknowledged by project manager, who generally has the ability and responsibility to coordinate the SC's work. A likely response by project management is to demand more resources than needed in order to counteract this situation. Intuitively, this would have a predictable result of damaging SC's confidence in resource allocation, which will exacerbate the problems over time. Even worse, the excessively competitive strategies will spur the situation to come to the final equilibrium at lose-lose (Figure 6-5), resulting in a non-trust work relationships. This mutual-effect behavior (game relations) between GC and SC certainly could not be neglected when pursuing for strategies to facilitate SC's development.

That is to say, in fact subcontracting in construction production is a series of games, in which project manager (buyers) and SCs (sellers) seek to optimize their returns by ordering resources and allocating resources. According to the frequency of cooperation, there can be two kinds of games:

- short term and never or rarely repeated (one-off game)
- long term and with degrees of repeatability (repeated game)

This section is trying to explain the mechanism of non-trust working relation, explore incentives to change, and put forward the strategies or efforts that could be done by GC and SC to prevent from the worst results.

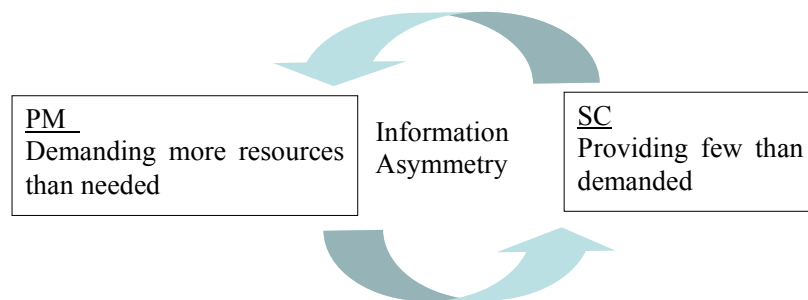


Figure 6-5 The consequence of competitive strategies with the final equilibrium at lose-lose

(1) Formulation of the game scenario between GC and SC

We will exemplify the game behaviors of GC and SC through modeling the allocation resources at the start of planning period in a project. Two players are project manager from general contractor (GC) and the subcontractor (SC). The players make 'moves' (referred to as actions) one after the other through the repeated cycles of the game.

In each round of game, GC will set the work amount that is to be performed by SC in each

period based on the project plan. In response, a rational SC will evaluate the amount of the work demanded will actually become available, and then take actions to supply the proper amount of resources.

Since the actions are taken sequentially, this process turns out to be a series of dynamic games. What is needed to stress here is that both GC and SC have imperfect knowledge about the outcome in terms of the work amount that will actually be completed until it happens.

This one-off game in each round between GC and SC is a dynamic game with incomplete information. In this game, the project manager must take an action with imperfect knowledge of the actually work amount that are made available (W_A) before the next planning period. Similarly, the subcontractor also has imperfect knowledge about whether the project manager has demanded more, exact or fewer resources than necessary. In a word, the action collections of GC and SC are supposed to be greatly influenced by the degree that they know about the actually available work amount. The work plans are not always necessarily reliable. In other words, it is often unknown with uncertainty at the beginning of each planning period. In reality, the amount of work that will actually become available at a future date can not be entirely 'known' by either GC or SC. In turn, it also is unlikely to happen that either of them would have absolutely no knowledge of the likely value of q at all.

(2) Harsanyi transformation

To explore the impact of plan reliability on the expected behaviors of GC and SC, we will use information set with regard to the plan reliability. It will then make it possible to model the scenario in which each player either knows or does not know the variable value of 'nature' (N), in this case the value of q , which measures the amount of work that will actually become available.

This process of adding 'nature' as a player in the game is known as the Harsanyi transformation¹³. John Harsanyi won the Nobel Prize in economics for devising a method for analyzing games of incomplete information. Games in which the payoffs are not common knowledge are known as games of incomplete information. In that case, the players remain ignorant of the strategy adopted by their opponent until the play is made by the Harsanyi transformation. He proposed to consider a player who has different payoffs under different circumstances as a player of different types. That means that in this kind of game, a player must form beliefs about the strategy that an opponent will play and the player must also form some beliefs about the type of game he/she is playing. The game is then modeled as though 'nature' moves first and chooses the type of that player.

In this scenario, the incomplete game between GC and SC will then be converted into two stages of dynamic games, with an extensive form shown in Figure 6-6.

¹³http://isc.temple.edu/economics/Econ_92/Game_Lectures/10th-IncompInfoStatic/incomplete_info_01.htm

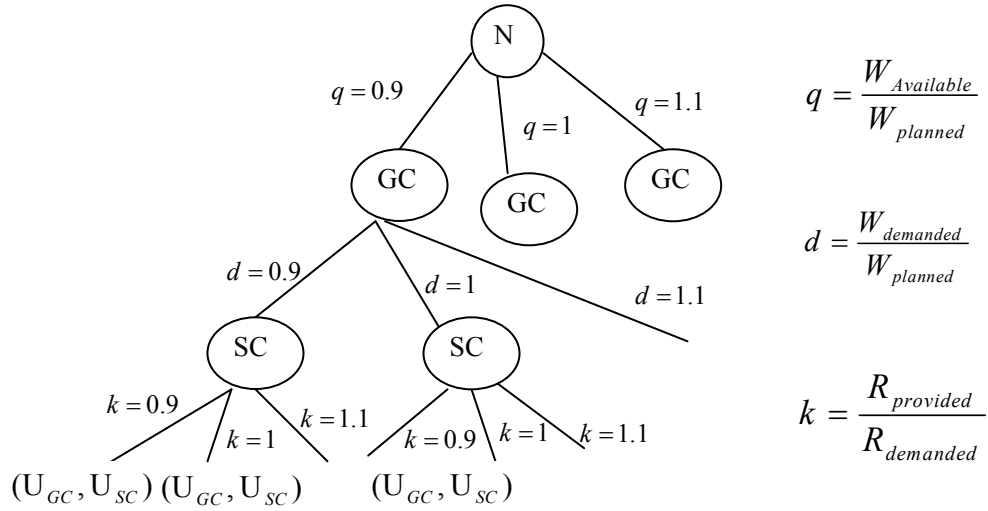


Figure 6-6 The one-off game between GC and SC by Harsanyi Transformation

We state again that the values of q at the left of the tree represent the range of possible results of the ratio of the work that will actually become available (in terms of work available) to the amount of work planned. At the first stage, the nature will choose q , and then the next stage will become a static game of complete information between GC and SC.

The GC's possible actions are detailed at the second level in Figure 6-6 by d , which represents the ratio of the work demanded to the work that GC estimates will actually become available (in terms of work plan). Here, the value of d is also modeled by discrete values: demand for less work amount than estimated ($d = 0.9$), exactly the amount estimated ($d = 1$), and more than estimated ($d = 1.1$).

In response to GC's demand, SC can select the amount of resources to be allocated according to the amount required for the work demanded. Here, k represents the ratio of resources supplied to those demanded ($k = 0.9$), exactly the amount required ($k = 1$), or more than demanded ($k = 1.1$). The latter value tells a situation in which the SC has resources available, and is willing to allocate more of them in the hope that more work amount than expected will actually become available, so they would be utilized profitably.

Then the action set of each one-off game is:

$$A_1 = \{(0.9, 0.9), (0.9, 1), (0.9, 1.1), (1, 0.9), (1, 1), (1, 1.1), (1.1, 0.9), (1.1, 1), (1.1, 1.1)\}.$$

(3) Utilities for GC and SC

The utilities or payoffs for each player are calculated at the end node of each branch of the tree. Here, we assume that the utility of GC is to be the total work amount that will be actually completed in the planning period. Thus, the expected utilities for GC and SC are:

$$\begin{cases} U_{GC} = \min(q, dk) \\ E(U_{GC}) = \int \min(q, dk) P_r(q) dq = \int_0^{dk} q P_r(q) dq + \int_{dk}^{\infty} dk P_r(q) dq \end{cases} \quad (6.3)$$

$$\begin{cases} U_{SC} = \min(q, dk)(U - C_M) - kC_S \quad \text{suppose } W_D = 1 \\ E(U_{GC}) = \int [\min(q, dk)(U - C_M) - kC_S] P_r(q) dq \\ = (U - C_M) \left(\int_0^{dk} q P_r(q) dq + dk \int_{dk}^{\infty} P_r(q) dq \right) - kC_S \end{cases} \quad (6.4)$$

Note: The labor cost is independent of the amount of work performed.

(4) An example of probability distribution of q

In practice, even the value of q could not still to be estimated, construction professionals would not estimate a continuous probability distribution, but rather use discrete values at significant intervals. Here, for simplifying the model analysis, we suppose that the probabilities for the values of q are described by a probability distribution shown in Table 6-3. An interpretation is that the cumulative probability that at least 100% of work planned will be performed is 70% and the weighed average of the distribution is 98%, expressed as $P(q \geq 100\%) = 70\%$, $E(q) = 98\%$.

Table 6-3 An example of probability distribution of q

q	0.9	1	1.1
$P_r(q)$	0.3	0.6	0.1

(5) Equilibrium and discussion

Then we could have the payoff matrix of the one-off game between GC and SC under the information sets of plan reliability, shown as Table 6-4.

Table 6-4 Payoff matrix of the one-off game between GC and SC

GC \ SC	0.9	1.0	1.1
	0.9	1.0	1.1
0.9	$(0.81, 0.81(U - C_M) - 0.9C_S)$	$(0.9, 0.9(U - C_M) - C_S)$	$(0.963, 0.963(U - C_M) - 1.1C_S)$
1.0	$(0.9, 0.9(U - C_M) - 0.9C_S)$	$(0.97, 0.97(U - C_M) - C_S)$	$(0.98, 0.98(U - C_M) - 1.1C_S)$
1.1	$(0.963, 0.963(U - C_M) - 0.9C_S)$	$(0.98, 0.98(U - C_M) - C_S)$	$(0.98, 0.98(U - C_M) - 1.1C_S)$

The equilibrium of this game is (1.1, 0.9), which means that GC is likely to demand more resources, and SC is prone to supply with less resources. A game theory ‘equilibrium’ as used here, represents a set of strategies taken by the players that result in a situation where neither player has anything more to gain by changing only his or her own strategy, so long as the

other player does not change their strategy.

However, under the long term work relationships with GC's strategy moving to $d = 1$, the equilibrium would reach at (1.0, 1.0). It means that a trust work culture would be created between GC and SC. Moreover, as can be seen, the utilities for both GC and SC would increase to a certain extent. It is supposed to be a better equilibrium for the involved players.

6.2.3 Recommendations

1) Make SC more reliable in the resource allocation through more cooperative production management techniques based on the mutual understanding between GC and SC.

2) Strategies of efforts could be done by GC:

- Enlarge the subcontracting business scope, like materials and even design, not only labor resources (this is in accordance with the previous model with incentives from SC)
- Rebuilt the risk management ideology with shifting part of the risks back to themselves (GCs)
 - Risk should be apportioned in accordance with the ability to control the risk
 - For example, the formula of work payment for SC adding risk shifting factor
 - Of course, it must be agreed by both through communication and mutual understanding of the pay-off
- Assign more work to fewer subcontractors

3) Strategies or efforts could be done by SC

- Developing the abilities to deal with subcontracting business, including not only labor management, but the business management, risk management, construction technology, design ability, etc. It is not only consistent with GC's strategy, but could reduce the impact of task uncertainty or fluctuation of work on their income, which is essential to the sustainability and development of themselves.

7 Conclusion and future study

To solve the employment problem, in particular for rural surplus labor force in China is the foremost urgent task for the Chinese central government nowadays. To accomplish this objective, the construction industry should play a more positive role through facilitating subcontractors' development.

(1) *Cultivating SCs' roles more in improving labor employment and building future labor force through promoting long term working relationships*

It is concluded firstly that the interventions for regularizing the labor subcontracting market in current China ought to accept current labor practices (like reconsideration on *baogongtou*). Meanwhile it is necessary to take the possible coming future into consideration even when facing negative repercussions of those practices. The dilemma in Chinese construction labor market is believed to be rooted in current construction subcontracting systems that restrict the subcontracting market excessively with ignorance of further development of labor contractors under the uncertain and futureless business environment. *Kajima's* experience points that establishing long term relationships between general contractor and subcontractors could be a valuable initiative to the achievement of the specialized subcontracting market that provides labor contractors with a more promising future. Only by taking their further development into consideration, the construction labor market could probably sustain with the development of construction industry. The main conclusions drawn from the experience of *Kajima* are demonstrated as followings:

- From *Kajima*, it could be inferred that Japanese big GCs play a decisive and conductive role in building the long term relationships with SCs in that making great efforts on cultivating SCs in developing their capacities of both business management and technologies under Affiliated Companies mode.
- Japanese Affiliated Companies mode is derived from the Japanese business principle by organizational market, which contributes to establishing and maintaining long term relationships, particularly with strong initiatives from GC who regards SCs as an indispensable input for its business success.
- The 'assurance systems' for public procurement consisting of two schemes as designation and *dango* are supposed to be another contributor to the success in the Japanese long term relationships in that they externalize the economic benefits of long term relationships.

However, the long term relationships may easily lapse into a comfortable and less initiative business environment, a combination with market competitive mechanism may be a countermeasure to prevent the possible repercussions. Different from Japan, China has being

stressing on market competitive mechanism with ignorance on the cooperative working relationships throughout the last three decades of economy ascending. Since there are not yet ‘assurance systems’ for labor contractors under current insecure business environment in China, an opportunity to accumulate skills and knowledge gained from working with the same contractor is lost. Regarding the practical situation of subcontracting market in China, the significance of combining cooperation with competition should be deeply understood up and down the construction supply chain, which may serve as a start point to regularize subcontracting market aiming at the achievement of sustainable construction labor market. Furthermore, seeing that the long term relationships are vulnerable to the economic environment particularly in economy recession, the sustainability of the long term relationship should be argued in further study.

(2) Establishment of a new business evaluation system to regulate the subcontracting market and support partnership

Another deficiency of the overall construction subcontracting systems lies in the widely-adopted business evaluation system for the service selection using the criterion of Cost-Based-Selection. The harm and restriction of CBS on the development of LSEs in China have already been demonstrated in Chapter 5. The reform of evaluation system must be done thoroughly from the top layer (client and general contractor) to the bottom layer (general contractor and subcontractor). Without the changes in the top layer, it would be extremely hard to change the business evaluation system in the bottom layer. Some researches have conducted concerning the selection of subcontractors ^[104].

Japanese contractors stayed in the long-term relationship in the past, largely due to the previous Japanese public works systems with characteristics of so-called ‘assurance systems’ ¹⁴⁾. The designated competitive bidding scheme and *Dango* were the two important components of the assurance systems, although *Dango* is severely blamed in most countries. Regarding the selection of contractors, Qualification-Based-Selection (QBS) was developed because public owners lacked procurement tools for services for which price competition made no sense. However, owing to *Dango*, the transparency of QBS was doubted, which is then being replaced by Comprehensive Evaluation Scheme nowadays in Japan. Maybe it is also necessary for China to establish such an evaluation system from now on, aiming at a more fair and sustainable market for construction enterprises. However, merely taking a look at the extremely strong human relationship here and there in China, it is certain to be a tough job.

(3) Establishment of professional training and education system for labor supply pool from society

Considering the poor situation of professional training and education currently in China, the administration (central and local) should make big efforts on the establishment of professional

training and education systems thoroughly among not only LSEs (involving migrant laborers), but GCEs and PCEs as well, from the view of Mr. Yoshihito SABASE from CTI. Actually, it should be the most basic action to ensure the implementation of any improvement by a provision of sufficient and capable construction laborers.

(4) *Future work on empirical research*

This article has drawn on little empirical research. This could be the next stage of assessing the usefulness of those proposals on facilitating construction subcontractors and consequent achieving a fundamental change in laborers' situations. I hope that this presentation of the issues will stimulate research that will test some of the proposals in this study, and investigate the ways in which they will affect the economic motivations combining social responsibility amongst construction enterprises.

Figure 7-1 illustrates an overall picture to achieve for the establishment of sustainable construction labor market in China, which calls for all involved parties' efforts. This study may serve as a start point to regularize the subcontracting market aiming at the achievement of sustainable construction labor market in China.

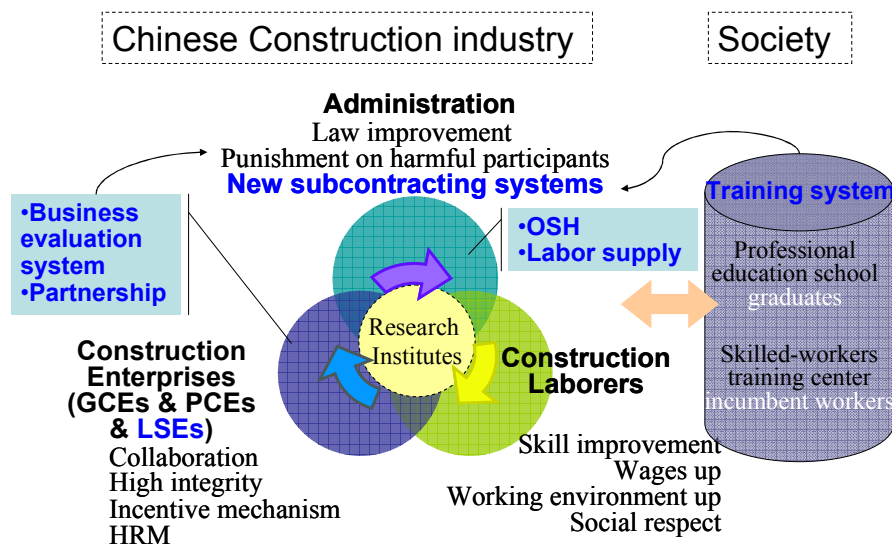


Figure 7-1 Overview picture for the achievement of sustainable Chinese construction labor market

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