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STRATEGIC ANALYSIS OF LARGE LOCAL CONSTRUCTION COMPANIES IN CHINA

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Strategic Analysis of Large Local Construction Companies in China

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Abstract

Since the establishment of the open door policy in 1978, China's economy has sustained a high growth rate. As one of the important pillars supporting China's economy, the construction industry has also grown rapidly along with the rapid development of the country. Nevertheless, many construction companies in China are still performing poorly. There are two main reasons: the environment that they faced is not favorable; the other is the lack of strategic directions to improve on their performance. Meanwhile, although many strategic management theories are widely studied in the academic field and applied to various industries in western countries, practical cases and empirical findings related to the Chinese construction industry remain lacking. Indirectly, this becomes one of the factors hindering the efforts in guiding the Chinese construction enterprises.

This research aims to build a conceptual model to help construction enterprises in China develop a sound corporate strategy and strive for better performance in the long-run. The conceptual model integrates two main streams of strategic management theories – the Industrial Organization (IO) theories and the Resource-Based View (RBV), as well as other proposed models that had been developed for the international construction context. The critical variables in the conceptual model and their relationships are identified through environmental analysis and a series of case studies, which consist of 12 large Chinese construction companies. It is postulated that competitive strategies and imperative resources and competencies (iRCs) are two main sources of competitive advantage of a firm. Furthermore, the competitive strategies could be supported by the iRC variables, and the iRC variables are in turn supported by more fundamental strategic and organizational (S&O) variables.

The model is verified and refined through statistical analyses of survey results, which has a sample size of 85 valid responses. The analytical results show that two competitive strategies – differentiation and market/product diversification, and three iRC variables – technological and innovative capabilities, financial capabilities and

Guanxi (connection/relationship), directly affect firm performance as measured by sales growth and profit growth.

Keywords: China, competitive advantage, competitive strategies, importance resources and competencies

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Chapter 1 Introduction

1.1 Background of the Research

Since the establishment of the open door policy in 1978, China has gradually transited from a centrally planned economy to a socialist market economy. In 1992, the China Communism Party (CCP) launched a new campaign for faster and bolder economic reforms. Since then, China's economy has sustained a high growth rate while maintaining relatively stable prices. In 2004, the country's GDP reached RMB 13,651.5 billion, and the growth rate of GDP amounted to 9.5%.

As one of the important pillars supporting China's economy, the construction industry has also grown rapidly along with the rapid development of the country. Since 1992, the rapid pace of growth has increased the pressure on the already strained transportation infrastructure and energy supply, as well as the over crowded commercial office space and residential building. All these have created a huge demand for the construction industry. Each year, a lot of investments plunged into many infrastructure and building projects, such as highways, railways, bridges, airports, dams, mines, business offices, residential buildings, and factories. According to the National Bureau of Statistics of China (2003), the contribution of the construction industry to the GDP of China increased from 3.8% in 1978 to 6.7% in 2002. The number of construction enterprises grew from 6,604 in 1980 to 48,688 in 2003. In fact, the average annual growth rate of the industry has been sustaining at around 20% since 1995. Using investments in fixed assets and capital construction as proxies for construction demand (Chen, 1998), Figure 1.1 shows the rapid growth of the demand and output value of the Chinese construction industry. In 1992, the average level of demand in construction was only RMB 301 billion (USD 36.4 billion), while in 2002, it had reached RMB 1,767 billion (USD 214 billion), indicating a growth of nearly 6 times. Meanwhile, the average output value of the Chinese construction industry also grew very rapidly, from RMB 217.4 billion (USD 26.3 billion) in 1992 to RMB 1,852.7 billion (USD 224 billion) in 2002, recording an expansion of 9 times.

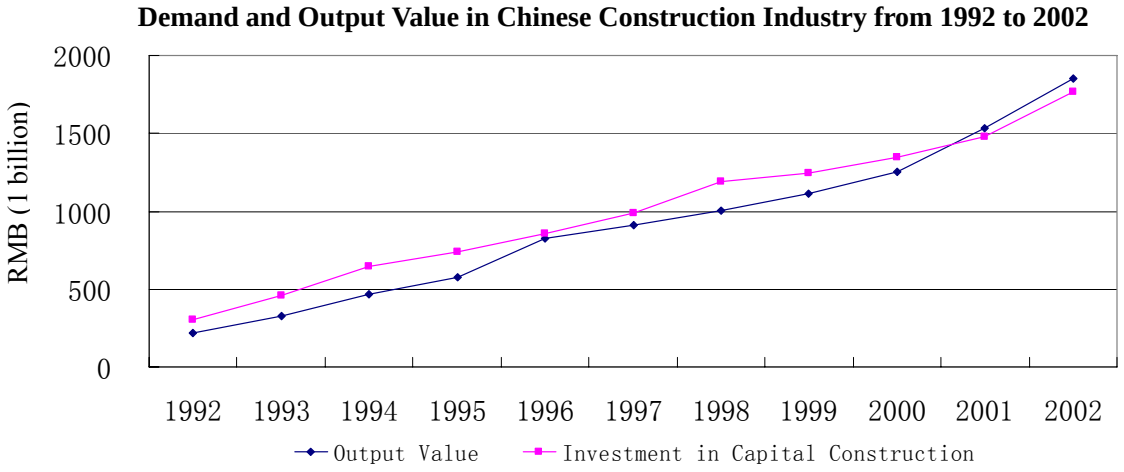

Figure 1.1 Investments in Capital Construction and Output Value in China from 1992 to 2002
Source: Chinese Statistical Yearbook (2003)

As part of China's transition to a socialist market economy, the construction industry has been going through continual changes in a process of transition to make it more effective and efficient. First, governance and administrative system of the industry has gradually changed (Luo and Gale, 2000). In the old planning system, the Chinese government had maintained a tight control over the industry. They planned, and financed all the projects, with close supervision and monitoring during construction (Wang, 2004). Now, particularly since China's accession to the World Trade Organization, the government has gradually withdrawn its "invisible hands" over the industry, although the administrative systems at various hierarchical levels will not be fully developed and matured in the near future. The second set of changes comes from the various mechanisms set up to manage the construction process. Some of these mechanisms include: new bidding procedures, construction supervision systems, and contract management systems (Yao, *et al*, 2001). Third, more and more large Chinese construction companies are now capable and competent enough to venture into the international market. Table 1.1 shows that in 1993, there are only 9 companies in the Engineering News Records' list of "Top 225 International Contractors", and the total output value accounted for only 1.33% of the total output value of the Top 225. While in 2003, there are 47 companies in the Top 225, accounting for 6% of total output value of the group. Finally with China's accession to the WTO in 2001, the country is

committed to gradually diminish trading limitations and industry barriers. More international enterprises would increase their direct investments and set up factories in China. This would increase the demand and growth of the industry. On the negative side, domestic firms will now have to confront the rivalry of foreign firms, which largely possess stronger financial and technological capabilities.

Table 1.1 The Number and Output Value of the Chinese Construction Companies Who are in the Engineering News Record's List of "Top 225 International Contractors"

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
No. of Company	9	23	23	27	26	30	33	34	39	43	47
Output Value (Billion US$)	2.07	2.96	2.97	3.82	4.08	5.03	6.10	5.36	5.36	7.13	8.33
Percentage of output value of Top 225 (%)	1.33	3.25	2.8	3.2	3.7	4.3	5.1	4.6	5.0	6.1	6.0

Although the prospects of the Chinese construction industry have become more attractive and brighter, many local construction companies are still facing serious difficulties during the transition from a planned economy to a market economy. As a result, many of these companies are plagued by low profitability. Figure 1.2 shows the average profitability level of Chinese construction companies from 1997 to 2002. From this figure, it can be seen that the profitability level is low. On average, the pre-tax profit margin is about 4.6%, and the after-tax profit margin (net profit margin) is only about 1.5%. In general, huge demand and rapid growth of output value, as previously indicated in Figure 1.1, should lead to higher profitability since opportunities are abound. However, Figure 1.2 shows that the general situation for the Chinese construction industry is quite different. Whereas the demand and output value signify plenty of business opportunities in the industry, the low level of profitability indicates that many Chinese construction companies have not been able to capture such opportunities to attain a higher level of performance.

There are many reasons that could lead to the problem of low profitability. From the external perspective, the construction industry is believed to be experiencing "excessive competition". In China, there are so many construction enterprises and the market is even more fragmented than in other countries. None of the construction firms

occupy a remarkable market share. Also, none of them can exert significant influence to the industry. Thus, "excessive competition" remains as the outlook of the industry (Shanghai Jinxin Security Research Institute, 2002). From a corporate and an internal perspective, it is reported that many Chinese construction companies have the following problems: a) low quality projects in their portfolios; b) low technology level; c) lack of financing capability; and d) most importantly, a lack of corporate strategy and directions which can guide them on how to improve their performance in the long-term (Yao *et al*, 2001).

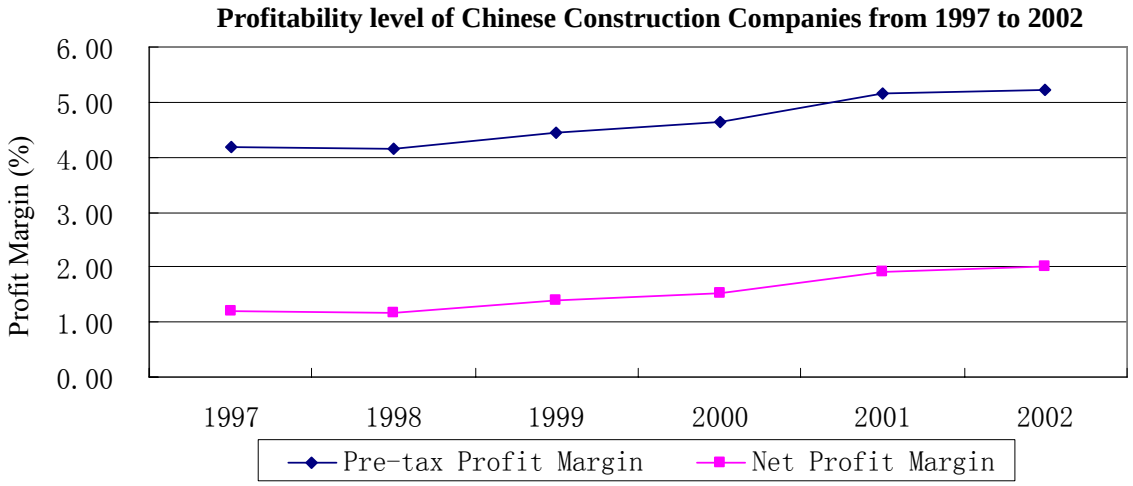

Figure 1.2 Profitability Level of Chinese Construction Companies from 1997 to 2002
Source: Chinese Statistical Yearbook (2003)

1.2 Objectives of the Research

The main objective of this research is to construct a conceptual model to help the senior level management of large Chinese construction companies develop a sound corporate strategy and strive for better performance in the long-run. The model should fit with the local industrial environment, and aims to identify critical strategic variables and their inter-relationships that would contribute to the performance of a firm.

Therefore, the objectives of this research can be outlined as follows:

(1) Through a detailed environmental analysis, determine a number of critical strategic variables that may potentially affect the performance of a firm.

(2) Study the inter-relationships of these variables by examining the cases of selected large or influential Chinese construction firms.

(3) Construct a conceptual model that captures the linkage along "industry environment – firm conduct – competitive advantage – performance".

(4) Verify the inter-relationships of variables and settings within the conceptual model based on industry survey feedback.

(5) Lastly, linking back to the primary objective – present the finalized model that is hoped to provide valuable guidance to local Chinese construction companies in designing their long-term strategies.

Ideally, the conceptual model should capture dynamic components that assist top management to conduct strategic planning for their firms. The inter-relationships among these components should not be fixed; rather, they would vary over time due to changes in the external environment. Through this conceptual model, the Chinese practitioners would better understand the important sources of competitive advantage. In addition, the conceptual model lays out the possible ways to cultivate, develop and combine different strategic variables that will collectively contribute to firm performance.

1.3 Scope of the Research

Active players in the Chinese construction industry include domestic companies and foreign companies, and the domestic firms are further divided into several classes. The scope of this research is limited to those Chinese construction companies belonging to the "First Class" qualification, which are relatively larger in size than the companies in other classes and are capable of undertaking construction work of a greater scale or complexity. It should be noted that the main scope of this research is based on the Chinese construction context, although the discussion of the strategies of some "First Class" companies may involve slight details on their efforts in internationalization.

According to the classification of the Ministry of Construction (MOC) in China, the Chinese construction companies can be classified into four qualification classes based on factors such as the professional qualifications of employees, capital, annual

construction output, management skills, and value of machines etc. First Class firms are permitted to undertake construction work of any size or complexity anywhere within China. Second, Third and Fourth Class firms may only undertake smaller projects at the provincial, city, and county levels. Other firms without the class qualification can only work on small projects, mostly located in the countryside.

It is obvious that companies in different class faced different challenges when competing in different market segments and tasks. Consequently, the strategies of companies dealing with separate operating environment would differ. According to Li (1999), companies in First Class qualification collectively account for 31.45% of the total output value, while the Second, Third, Fourth Class companies and those without qualification account for 18.73%, 15.99%, 7.06% and 26.77% respectively in year 1999. Thus, companies with First Class qualification constitute the most major part of the Chinese construction industry and would deserve more attention.

Other than the local companies, the presence of foreign companies is also becoming more significant in China. China has set up strict rules governing the engagement and activities of foreign contractors within the local industry. Although China has gained accession to the WTO in 2001, by and large, foreign contractors in China are still active only in certain kinds of projects: (1) those that are wholly invested by foreign capital or endowment; (2) those supported with loans from international financial organizations and involving international public bidding; (3) joint-venture projects in which foreign investments make up at least 51%; (4) domestic invested projects, for which domestic companies have difficulty executing alone and require the expertise and resources of foreign companies (Wang and Yang, 2002). In 2003, the total number of foreign contractors was only 287 (excluding companies from Hong Kong, Macau, and Taiwan, for which the total number is 533) (China Statistical Yearbook, 2003). The output value of these 287 foreign contractors only accounted for 0.56% of the total output value in 2003. Thus, due to market limitation and relatively smaller in number, the influence of foreign companies still remain relatively weak as compared to that of the domestic companies, especially companies belonging to the First Class qualification.

1.4 Significance of the Research

The main contribution of this research derives from filling the gap between western theories of strategy and selected applications that are tailored to the Chinese construction industrial context. Although a great many western researchers study and propose various theories on strategic management, its application to the construction context remain limited (Chinowsky, 2000), and even fewer construct models and typologies are directly related to the Chinese construction industry. There are two main reasons behind this observation. First, the kind of environment that the Chinese construction companies are facing is different from the type of environmental conditions that those researchers had originally perceived in their models. The environment in China is made up of a very complex system influenced by political, social, and cultural conditions, which are vastly different from those in the western countries. Second, even the limited number of models of strategic management in construction are broad and general – they only present critical elements but run short in illustrating the interactions among elements at a more detailed level. These factors limit their usefulness to provide specific guidance to the Chinese practitioners. Thus, it is hoped that the research output from the current study will help to fill some of these gaps.

In addition, strategic management studies building on either practical cases or empirical findings related to the Chinese construction industry are seriously lacking. Indirectly, this becomes one of the factors hindering the development of strategic management practices in Chinese construction companies. To address this issue, the conceptual model in this research is initially derived based on the study of 12 case companies which have relatively strong performance and reputation in China. Also, the research model is verified by a questionnaire survey that involves the responses of 85 companies in China.

Finally, one main reason for the low profitability of some Chinese construction companies is that the top mangers in those companies are lack of long-term strategic thinking. This research aims to provide directions to build long-term competitive

advantage through cultivating the identified critical variables. The thesis could serve as a good reference in promoting long-term strategic thinking by focusing on the issues highlighted on these variables.

1.5 Organization of the Thesis

The structure of this thesis is organized as follows:

Chapter1 Introduction

Chapter 1 gives an introduction of this thesis by describing the background of this research. It also describes the objectives, scope and significance of this research.

Chapter 2 Literature Review

Literature review can be divided into two parts. The first part outlines general strategic management theories and past research on strategy that is related to construction in general and the construction industry in China. The second part zooms into more specific theories that form the basis and theoretical foundations of the conceptual model to be constructed in this research.

Chapter3 Research Methodology

This chapter describes the methodology used in the research. The overall methodology is divided into two stages: 1) an ongoing literature survey and review of publications related to development in China at the practical end and management theories at the academic end; 2) the analytical stage, which include environmental analysis, case studies and questionnaire survey.

Chapter 4 Environmental analysis

This chapter analyzes the external environment of the Chinese construction companies based on the information gathered from relevant literature and publicly available data. The chapter studies the market structure – a few parameters that could affect the performance of the company, the conditions of related horizontal and vertical

markets, the project procurement system in China, and the impact of WTO. Based on the environmental analysis, some critical variables which best fit with the local operating environment are identified. In the final part of this chapter, a couple of hypotheses are put forward.

Chapter 5 Case Study

Based on the critical variables identified in Chapter 4, this chapter further identifies other critical variables and their inter-relationships by conducting a series of case studies. A total of twelve case companies are selected based on their relatively strong performance and local reputation in China. Using the analytical results gathered from both Chapter 4 and 5, a conceptual model is finally built together with several additional hypotheses that predict the inter-relationships among the underlying components of the conceptual model.

Chapter 6 Questionnaire Analysis

This chapter verifies the hypotheses identified in Chapter 4 and 5 by use of the questionnaire survey method. After describing the sampling procedure and the basis of designing the questions, descriptive statistics of each variable are given. Linear regression and binary logistic regression analyses are subsequently conducted to test the hypotheses. Along with the presentation of the statistical findings, some discussions will be given on the analytical results.

Chapter 7 Conclusions

This chapter summarizes the main conclusions of the thesis and contributions made by this research. Also, recommendations are given on possible future research directions. Some limitations that cannot be fulfilled by this thesis are acknowledged in the final part.

Chapter 2 Literature Review

This chapter reviews the different streams of strategic management theories. First, it elaborates on the different schools of thought in strategy, before narrowing down to the strategy theories related to the construction industry in general and the Chinese construction industry in specific. Finally, the chapter reviews those theories that would provide a sound foundation for the conceptual model constructed later in this research. The details of this chapter are depicted in Figure 2.1.

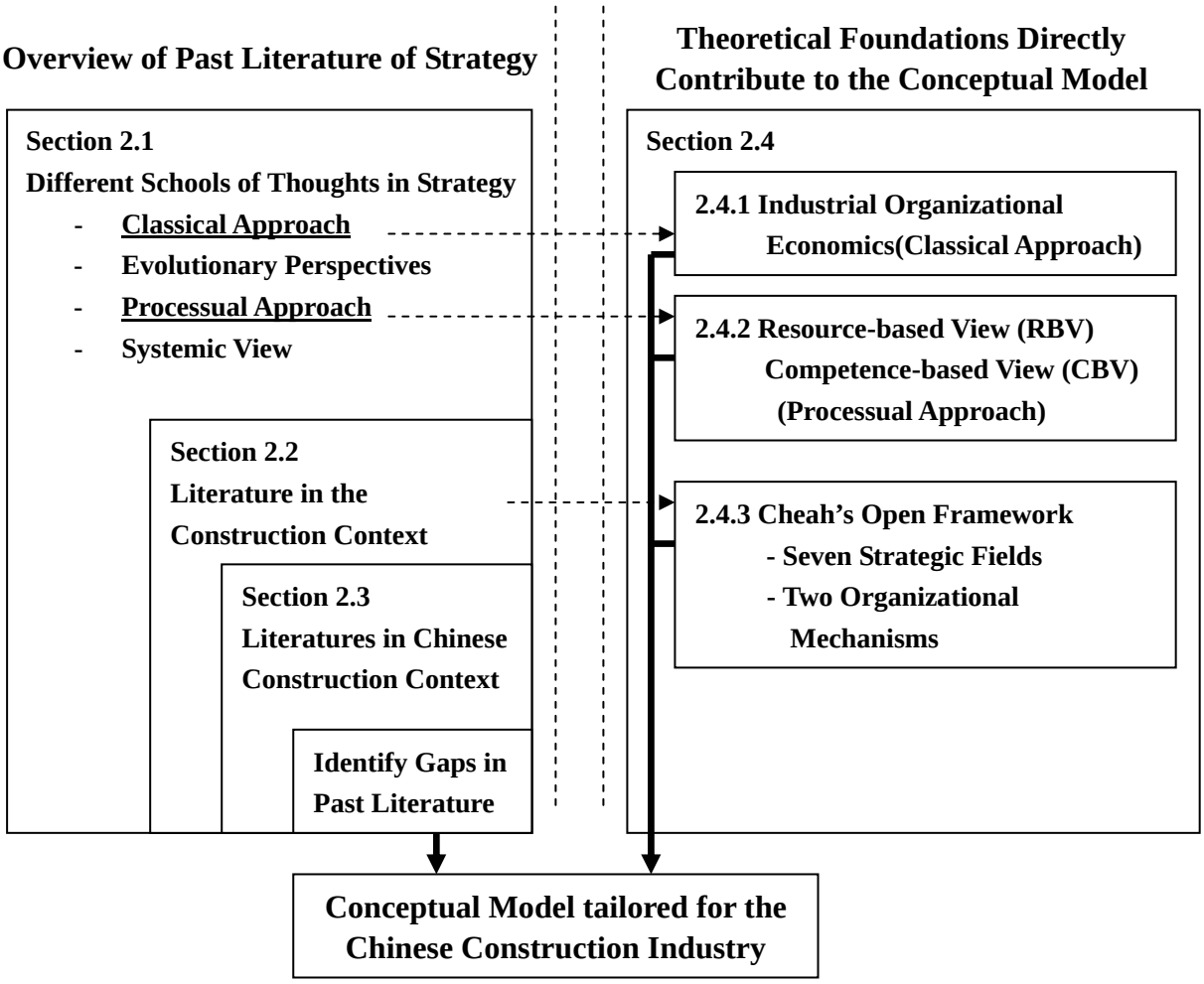

Figure 2.1 Main Flows of Chapter 2

2.1 Overview of the Schools of Thoughts in Strategy

Historical factors have created the nature of complexity in China, giving it very different characteristics from those typical of Western industrial countries (Boisot and Child, 1999). When assessing the universality of the macro and micro theories of organization that have been largely developed in North America. Shenkar and von

Glinow (1994) found that the theories vary in their degree of applicability to the Chinese context. It is therefore legitimate to assume that Chinese construction firms behave and react to their environment differently from firms in other economies. Although there are numerous publications reporting issues confronted by the Chinese firms, most of them are expressed in the form of opinions with a lack of theoretical rigor and content.

Indisputably, there is a great potential for management studies specifically related to the Chinese construction industry to expand. With China's accession to the WTO in 2001, many contextual variables are currently in a flux. Despite China's unique culture, its gradual transition from a centrally-planned system to a more open market-oriented economy implies that Western management theories would be selectively applicable. This view is confirmed by Cheah and Wong (2004). Construction management researchers studying this field require a closer examination of theoretical underpinnings to: (1) avoid the adoption of a narrow mindset in shaping their scope of study; (2) structure their research findings as facilitated by the existing theories; (3) understand the limitations of existing theories due to inapplicability of some to the Chinese context.

The concept of strategy and its implications on the performance of a company have received considerable interest from a wide range of academic disciplines including finance and economics, organizational sociology, political science, and cognitive psychology. In addition, it is not only restricted to the academicians in these disciplines but also studied by diverse players ranging from managers to consultants concentrating on different industries and sectors. Naturally, the heterogeneous composition of disciplines and players ensures that strategic management theories are diverse. Thus, it necessitates a succinct review of different schools of thoughts before exploring the implications of strategic theories in the context of Chinese construction industry.

Faced with these diversified strategic thoughts and fields, Whittington's (2001) work is found to be extremely helpful in streamlining such diversity and narrowing down to four basic conceptions of strategy – rational, fatalistic, pragmatic, and relativist.

He finds that these distinct schools of thoughts can essentially be mapped along two axes: outcomes of strategy, and the processes by which it is made, which are shown in Figure 2.2. The vertical axis examines the degree to which strategy either produces profit-maximizing outcomes or deviates to allow other possibilities to intrude. The horizontal axis considers the fact of whether such outcomes are derived from deliberate planning, calculation and formulation, or simply as an emerging product of accidents, chance, and social and organizational inertia.

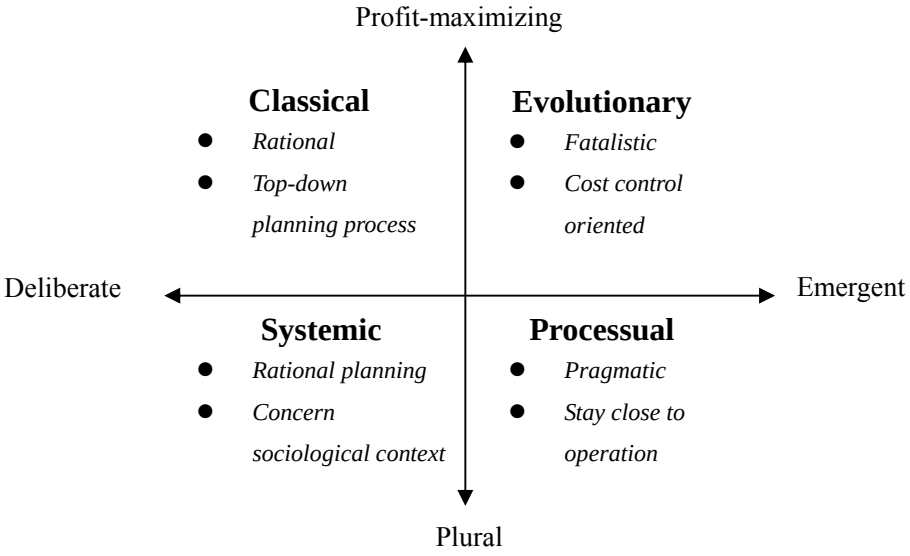

Figure 2.2 The Four Generic Approaches of Strategy
Source: Whittington (2001)

The basic assumptions of the four approaches to strategy can be read off from the relative positions along the two axes in this figure. Along the vertical axis, Classical and Evolutionary approaches thought that profit-maximizing is the main outcome of strategy-making; Systemic and Processual approaches are more pluralistic – many complex outcomes such as social responsibilities other than profit-maximizing are realized.

Along the horizontal axis, Evolutionary and Processual approaches see strategy as emerging from processes governed by chance and accident. On the other hand, Classical and Systemic approaches think that the strategy-making process should be derived through deliberate planning, calculation and formulation.

The next few sections provide a brief summary for each of these four generic approaches.

2.1.1 The Classical Approaches

The Classicists believe that profitability is the supreme goal of business, while rational planning is the means to achieve it. According to Chandler (1962), strategy is "the determination of the basic, long-term goals and objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for those goals." Its emphasis is placed on the long run, explicit and deliberate conception of goals, and it utilizes the top-down planning process. Just as Mintzberg (1990) had identified, there are two basic premises of Classical thought. First, strategy formation should be a controlled conscious process of thought, and second, implementation is a distinct phase in the strategy process.

Essentially, strategy is regarded as a rational process of deliberate calculation and analysis, designed to maximize long-term advantage. This is derived from the notion of a "rational economic man", who pursues maximization of his economic advantage. It can also be traced back to the time of Adam Smith, when profit-maximizing is simply the economic expression of his notion of "self-interest". Pursuit of this self-interest is governed by "prudence"; "prudence" embodies the dual principles of "reason" (the ability to foresee consequences and to discern advantage) and "self-command" (the readiness to abstain from short-term opportunism in order to benefit more substantially in the long run). It can be seen that the principle of "prudence" is the heart of modern long-term strategic planning.

Secondly, many classical theories constitute strategy as a top-down planning process with a hierarchical command system. The formulation of strategy can be separated from the implementation, and organizational structure should be built to follow this hierarchical system. So, top management is removed from the routine operational activities and focus on the strategic responsibilities. Once the strategic plan is formed by top management, the actual execution is carried out by the middle-level management and operating core of the corporation. Many classicists in their works illustrated this idea. For example, Sloan (1963), in his great biography "My Years with General Motors", stated the importance that the policy must be kept independent of

policy execution.

Among the great many strategic theories developed by the Classical researchers, Porter's (1980, 1985, 1987, 1990) works are among the more prominent ones. Table 2.1 lists the main models developed by Porter along with the strategic dimensions that he had contributed to.

Table 2.1 Dimensions of Porter's strategy

The context of strategy	**The content of strategy**
Five Forces Framework (Porter, 1980)	Porter's generic strategies (Porter, 1985)
Diamond Framework (Porter, 1990)	Value Chain Framework (Porter, 1985)

This table illustrates that Porter in particular contributes to the two dimensions of the strategy: context and content. The widely used Five Forces Framework (See Page 28, Section 2.4.1) is a typical example of a framework describing the context dimension of strategy; in this case the influence of the industry environment on the competitive strategy of the firm. Although the firm can use this framework as input for strategy formation and in particular for formulating the strategy content, the framework, as such, is more related to context than to content. The diamond framework consists of four determinants and two additional variables, together forming a mutually interacting system. Porter's generic strategies are more related with the content of the strategy. A firm could pursue the generic strategies based on the underlying theories of industrial economics. The generic strategies identified by Porter include cost leadership, differentiation and focus, which will be further discussed in Section 2.4.1. Another framework related with the content of the strategies is the value chain framework, which describes a business as a collection of interdependent activities, which in turn, form part of a continuous system that stretches back to suppliers and forward to channels and customers. This framework could help a firm to clarify the kinds of values it offers to buyers and suppliers over the competition.

The Classical approaches suffer from several main criticisms:

Firstly, Classical approaches ignore "soft" issues within the organization, such as

political, regulation, culture, human behavior etc. These issues are important in the modern era, especially in the construction industry.

Secondly, the foundation of Classical approaches is based on the assumption of "rational economic man", which is questionable at times. Men and corporations alike do not always behave as such, since they can be affected by many other factors such as culture, social context etc.

Thirdly, the simple separation of strategy formulation and execution does not apply in many cases. As Mintzberg (1987) commented, strategy is a continuous and adaptive process, with formation and implementation inextricably entangled.

2.1.2 The Evolutionary Perspectives

Comparing to the Classical perspectives, the Evolutionary theorists have less confidence about top management's ability to plan and act rationally. Instead, they believe that deliberate planning is futile because the general environment is constantly changing.

Many authors, including Henderson (1989), Hannan and Freeman (1988), borrowed the concept "evolutionary" from biological studies. Their belief is based on natural Darwinism, in which only the "fittest" will survive under the hostile environment. In other words, it is the market that selects the survivor, not the firms select the most profitable market. This differs greatly from classical mainstream theories, which focus on the rational analysis of the industry structure (Porter, 1980). Thus, Evolutionists insist that markets are typically too competitive for expensive strategizing and too unpredictable to control.

Besides holding this belief, at the same time, the Evolutionists also believed that markets are too efficient to permit the creation of any sustainable advantage. In a competitive environment, deliberate strategies can only create a temporary advantage, because competitors will be quick to imitate and erode any early benefits. Thus, the market is "too perfect". Based on the above argument, the only strategy that the firms should adopt is to stay at the lowest level of cost. Effectively, the only real comparative

advantage is relative efficiency.

The Evolutionary perspectives similarly suffer from some criticisms:

Firstly, it is overly pessimistic about strategy, totally denying human's rationale. It is left to "fate" to decide on survivors. This theory makes players in the society feel uncomfortable, for it seems that they have little power to dictate how to improve the companies' performance.

Secondly, it assumes that the market is perfect; while in the real world, information asymmetry, and the intervention of government, just to name a couple, can easily lead to market failure and hence breakdown of prejudications put forward by these perspectives.

2.1.3 The Processual Approaches

Similar to the Evolutionary perspectives, the Processual approaches reject the rational strategy-making method embraced by the Classicists. At the same time, they also have less confidence about markets in ensuring profit-maximizing outcomes. They think that market conditions are imperfect and turbulent, so even firms with bad performance can still survive.

There are two foundations of Processual thought that had been uncovered by the American Carnegie School: the cognitive limits on rational action, later extended by Mintzberg (1978, 1987) in particular; and the micro-politics of organizations, developed by Pettigrew (1973, 1985). Different from the "rational economic men" notion implicit in Classical approaches, Processual approaches believe that people have only "bounded rationality". So, actions such as environmental scanning and deliberate strategy making that are commonly advocated by Classicists tend to be flawed and incomplete. The micro-political view of organization recognizes that firms are not just united in optimizing as one single utility. Rather, each individual in the firm brings its own goal and cognitive bias to the organization. Thus, strategy is the compromise of all these different micro-political objectives, and not just of profit-maximizing calculation.

Consequently, Mintzberg (1987) proposed the metaphor of strategy as a kind of

"craft". For him, crafting strategy is a continuous and adaptive process, with formulation and implementation inextricably entangled. So, strategy is discovered in action (March, 1976), coupled with a "bottom-up" approach. The key is to stay close to operation and accumulate knowledge about the demanding factors of both internal and external operating environment.

On top of the above points, the resource-based view further enlarges the sphere of Processual beliefs. Because market imperfections inhibit opportunity-maximizing strategies, resource-based theorists propose that the origin of a firm's competitive advantage lies in the firm's unique and embedded resources, which constitute core and distinctive competencies (Grant, 1991). In other words, the source of sustainable superior performance lies internally in the capacity to exploit and renew distinctive resources, rather than externally in simply positioning the firm in the right markets. Strategy involves building on core competencies (Hamel and Prahalad, 1994), not chasing each and every opportunity.

On the negative side, the main weakness of processual theories is the lack of control. It also lacks the objectivity that the analytical tools of Classical approaches can provide. For example, the resource-based view only identifies the type of distinctive resources and competencies which form the basis of sustainable advantage, but it cannot illustrate exactly how these distinctive resources and competencies should be nurtured and implemented to acquire sustainable competitive advantage.

2.1.4 Systemic Views

Different from the propositions of Evolutionary and Processual theorists, Systemic theorists still believe in the capacity of organization to plan forward and to act effectively with their environments. Nonetheless, unlike the Classical approaches, the Systemic perspectives have a more outward looking nature in considering the external environment especially political, regulatory, social and cultural issues. Consequently, firms' missions, goals and strategies are not purely owed to economic rationales.

According to the Systemic perspectives, firms differ depending on the social and

economic systems in which they are embedded. The goal is not just profit-maximizing, as the Classical theory and Evolutionary theory thought. Also, the norms that guide strategy derive not so much from the cognitive bounds of the human psyche – as proposed by the Processual theorists, but from cultural rules of the local society.

The Systemic views effectively provide valuable lenses to examine external political, regulatory, social and cultural issues. The rich vocabulary and complexity of sociological arguments offer plenty of resources and norms of conduct to explain and legitimize a wide range of business behaviors. Also, Systemic views are a good starting point to explore the role of public policies and how institutional changes can affect corporate strategy.

Similar to the shortcoming of Processual approaches, the main weakness of the Systemic perspectives is also the lack of control. Furthermore, this stream of theories only prompts companies to think of their actions from a broader system view point. Overall, it lacks the basic analytical methodology and tools to implement.

2.2 Strategy Theories in the Construction Context

Relatively few researchers from the mainstream of strategic management have applied strategic theories to the construction industry. On the other hand, most construction management researchers have chosen to concentrate on implementation issues at the project level, rather than elevating their focus on corporate-level management issues. The lack of interest in the study of corporate strategy in the construction industry may be due to three primary reasons (Cheah and Chew, 2005): (1) the construction industry encompasses a broad range of sub-sectors and involves multiple parties. The complexities and "messiness" involved often elude even the construction professionals themselves, and impose further barriers for researchers of a more generalist nature to conduct insightful studies; (2) Construction is often painted as a "low-growth, low-tech" industry, thus lessening its appeal as a research context to some; (3) Industries such as automobile and pharmaceutical consist of large, dominant players with concentrated market shares. The prominence of these players usually

implies relatively easy access to data. A higher level of scrutiny of organizations' actions and behavior is feasible. By and large, the construction industry posits at the other extreme.

In order to fill such knowledge gap and provide guidance to construction business practitioners, some researchers have introduced general strategic models and typologies for the construction context along different schools of strategic thoughts. Some of these researchers studied strategy in the construction context under the Classical domain.

Kale and Arditi (2002) studied the concept of competitive positioning in the context of the United States construction industry based on Porter's (1980, 1985) generic strategies. Their research findings reveal that the choices of construction companies regarding scope and mode of competition are significantly related to company performance. The mode of competition may include competing on quality of products/services, process innovations, cost and time. The scope of competition may adopt either a narrow or a broad market, which means either concentrating its resources and efforts within a focused market segment, or exploiting synergies that emerge from sharing a company's resources in many different projects and locations. They suggested construction companies to outperform their rivals by placing varying degrees of emphasis on more than one mode of competition rather than focusing on a single mode of competition. Their research however did not provide any empirical supports in favor of either a narrow or a broad approach in terms of the scope of competition. Instead, they suggested construction companies to adopt a neutral approach to the scope of competition to outperform their rivals.

Chinowsky (2000) introduces a strategic planning model which is focused on the development of strategic concepts based on the inputs provided by the seven areas of strategic management, namely, vision, mission and goals, competition, markets, finance and economics, education, core competencies and knowledge resources. This model helps construction companies evaluate their strategy and determine progress toward achieving strategic objectives. He also suggested that the differences between successful and failure organizations is precisely the desire to fill the gaps in these

strategic management areas. At the same time, an organization needs to be realistic about its efforts to fill these gaps. It must set priorities and balance its available resources.

Warszawski (1996) presented another methodological procedure for strategic planning suited for the construction companies, which includes: (1) examining the company's mission; (2) analyzing the business environment; (3) analyzing the main resources; and (4) developing the final strategy. The mission reflects the owners' views with regard to the objectives and scope of activities of a company. The analysis of the business environment of a company is to reveal the opportunities that a company should exploit and threats from which it should be aware. The main resources of a company include construction capacity, procurement system, marketing system, organization, personnel, finances, and knowledge. Identification of the relative strengths and weaknesses of each resource should meet the market need. The development of a strategy should be based on the analysis of company's mission, business environment, and the main resources of a company. Finally, the strategy can follow one of several generic types, such as cost leadership, differentiation, focus, and growth strategy, and the choice of the optimal strategy should follow a careful analysis of the costs and benefits inherent in the implementation of each.

Similarly, Venegas and Alarcon (1997) developed a general framework to support the strategic planning of a construction firm. It provided a structured path and tools to carry out the planning process. The strategic planning process is divided into three modules: entry module, formulation module and implementation module. In the entry module, some preliminary internal and external analysis should be conducted, such as culture, philosophy, human resource, environment, etc. In the formulation module, mission and goals need to be first addressed, followed by conceptual modeling, mathematical modeling and strategies evaluation. Finally, in the implementation module, the annual strategic plan and implementation plan are developed, and some control activities are conducted. Their framework is flexible enough to be adapted to particular company characteristics and strategic planning. It also allows management to test different combinations of company long-term strategies and predict sales, market

share, or other measures of company performance.

Besides the Classical approach, resource-based theories, which are one of the major parts of strategy theories under the Processual approach, have also been applied to the construction industry.

Haan *et al*. (2002) in their study validate the core competence approach in the construction industry. Their study focused on the analysis of the fit between strategies of construction firms and their core capabilities. By conducting multiple case studies, they identified three core capabilities – innovation capability, market management capability and production capability, which are important in contributing to the companies' superior economic performance and support the companies' marketing strategies. Kale (1999) pointed out that external firm-specific resources, such as relationships with clients/owners, design/consulting firms, subcontractors, sureties, material vendors and governmental regulatory bodies, can directly contribute to the performance of a construction company.

It should be noted that the four schools of strategic thoughts listed in Figure 2.1 are not mutually exclusive. Some researchers' works have combined some or all of the four strategic domains together. For example, Male and Stocks (1991) and Langford and Male (2001) synthesized a wide range of knowledge covering competitive advantage, economics, organizational behavior, culture and sociology. They described the industrial context of construction, focused on fundamental concepts of strategic management, and dedicated to record some applications of strategic management which may be useful to the practitioners. Cheah and Garvin (2004) also formulated a conceptual model suited for construction by combining fundamental analysis and different schools of strategic thought. This conceptual model is supported by and refined in consideration of factual information observed from a sample of twenty-four large international engineering and construction firms.

Some researchers explored strategic theories in the context of the construction industry in one specific nation. For example, Male and Stocks (1991) and Langford and Male (2001) based their arguments on the context of U.K. Wang and Yang (2002) used

the five forces model of Porter (1980) to analyze the Australian construction industry, and proposed some useful business and growth strategies for the Australian construction companies. Finally, Scoubeau (2002) studied the possibility of applying some strategic theories to the Belgian construction industry.

Finally, although corporate strategy in its entirety may not have an extensive background in construction, some specific issues related to corporate management are getting increasingly prominent. In the academic world of construction, there has been a number of research works published on knowledge management as related to construction. Some examples include: the provision of a knowledge management framework (Kamara *et al.*, 2002); knowledge transfers between organizations (Fernie *et al.*, 2001); the impact of knowledge management on construction innovation (Egbu *et al.*, 2001); the impact of knowledge management on business processes and performance (Preece *et al.*, 2000). Parallel to these theoretical endeavors are other empirical and case studies of specific construction companies.

2.3 Literature Related to the Chinese Construction Industry

Very few researchers when studying the Chinese construction industry explored strategy from the perspectives of internal mechanisms and provide practical guidance to high-level managers of the companies. On the other hand, many of them focus on aspects that are external to companies.

Some researchers studied the external environment of the Chinese construction industry from the political viewpoints and identified problems related to the political and regulatory systems.

Zhu and Hu (2001) analyzed the Chinese construction regulatory system and found that there are many aspects in the construction legal system that requires further improvement and development. It main includes the lack of farsightedness, lack of implementation and supervision, clients' legal status, regulatory functions, supply-side responsibilities, health and safety legislations, judiciary and enforcement problems.

Chen (1998) identified that overall, it is the lacking of standards and consistency in legal and regulatory frameworks, pricing mechanism, competitive bidding, quality control, tax framework, construction financing and human resource development that prevent the industry from playing a more effective and efficient role in the country's economic development. After examining the overall Chinese construction laws and regulations, Lam and Chen (2004) found the existing construction regulations and rules in Chinese construction industry are not completely satisfactory. The lack of proper infrastructure in terms of laws and rules and regulations will hinder the development and growth of the Chinese construction industry. Li (2001) examined the evolution of the governance of China's construction industry, and found that government intervention has reduced in the recent years, leading to increased stability for the construction industry.

Some researchers studied the external environment based on the strategic theories in Classical approach. Wang (2004) analyzed the Chinese construction industry based on the industrial organizational theory. She investigated the market structure in terms of concentration ratios, the Herfindahl index, firm size distribution by employment, the Lorenz Curve, and the associated Gini coefficient. Based on the analysis, she concluded that the market structure is inappropriate. Because of the inappropriate firm size distribution, and a low degree of specialization and the underdeveloped contracting system in the Chinese construction industry, competition is excessively intense. Lan and Jackson (2002) used a modified Porter's (1980) five forces model to analyze industry competition. They systematically examined the main stakeholders in the Chinese construction industry in the following dimensions: shifts in government intervention, problems between contractors and subcontractors, new entrants, the bargaining power of clients, and the bargaining power of suppliers. Finally, it is found that the Chinese construction industry is a fragmented one and is poorly regulated.

The Systematic approach is also used to analyze the characteristics of China environment, such as some cultural and social elements. Park and Luo (1998) analyzed the impact of Guanxi (connections and relationships) on the performance of the Chinese firms. They argued that in a transition economy with ambiguous property

rights and weak legal constraints on market competition, Guanxi provides an opportunity to enhance market share through improved competitive positioning and other applications of collaboration with competitors and government authorities. Given the legal uncertainties in China, there are also practical benefits to be derived from personal connections and loyalties. Scarce resources are allocated primarily according to Guanxi relations rather than bureaucratic rulings. Thus, Chinese firms often develop Guanxi as a strategic mechanism to overcome other competitive and resource disadvantages by cooperating and exchanging favors with competitive forces and government authorities. They also identified that Guanxi in China can be divided into two dimension – horizontal connections with buyers, suppliers, and competitors and vertical connections with political governments, industrial departments, and other regulatory authorities.

Boisot and Child (1999) treated China as a complex system, and developed an institutional Information-Space (I-Space) framework to analyze the characteristics of this type of system. They identified three dimensions in the system, namely, "codification", "abstraction", and "diffusion of information", and found that China falls into the regime of "uncodified, undiffused and concrete". They also recommended two modes of adaptation to complex environments: complexity reduction and complexity absorption. They suggested that western firms operating in China therefore face a choice between maintaining their norms of complexity reduction and adopting a strategy of complexity absorption that is more consistent with the Chinese culture. Among these two choices, they suggested to adopt the complexity absorption approach by establishing a set of enduring relationships both within and outside the business venture. In other words, these companies would need to build Guanxi with their related business parties.

Some other researchers studied from the viewpoint of foreign participants. Chen (1997) verified that foreign participants will be most successful in project management, supervision and training of local construction companies in the fields of power generation, energy exploration, transportation, telecommunication and housing. Joint ventures were also highly recommended for foreign investors for doing business in

China. Luo and Gale (2000) discussed the practical aspects of implementing construction joint ventures in China. Current market conditions for FDI were considered along with the procedures, relevant laws and regulations for establishing construction joint ventures.

Other than the above research findings, Cheah and Chew (2005) provided a conceptual framework for the Chinese construction companies. Their framework was built upon the characteristics of the Chinese construction industry, such as the government policies, conditions of capital markets, conditions of other industrial markets related to construction, conditions of commodity and resource markets, trends of new technologies, trends of local and regional growth and some other unique circumstances. Their framework also identified that within the internal aspects of the company, business imperatives, core competencies and resources are in turn cultivated by a proper alignment between strategic fields and organizational mechanisms. The interactions among various internal and external components therefore create a perpetual feedback loop.

From the above review, it is obvious that most researchers had focused on the environment of Chinese construction industry, which is largely beyond the control of Chinese construction companies. Very few of them studied strategy emerging from the Chinese companies' viewpoints. There is clearly a need to fill in this gap by developing a conceptual model to help the Chinese construction companies strive for better performance in the long-run, and providing empirical findings related to strategic management in the Chinese construction industry.

2.4 Theoretical Foundations for Building a Conceptual Model Tailored for the Chinese Construction Industry

From the previous literature review, it is found that there is a lack of research on specific components forming the competitive advantage of Chinese construction companies. Thus, in order to build the conceptual model, there is a need to first trace the source of competitive advantage from the theoretical foundations.

According to Kale (1999)'s definition, *competitive advantage* refers to the ability of a firm to outperform its rivals on some performance criteria, such as profitability and market share. One source can be traced from industrial organizational theories; the other can be traced from the resource-based view.

2.4.1 Industrial Organizational Economics and Theories

The origin of industrial organizational economics and theories, which belong to the Classical approach, may be traced to the works of Edward S. Mason in 1938.

(1) Industry Structure – Firm Conduct – Performance' Framework

Mason's work is known as the famous 'industry structure – firm conduct – performance' framework (SCP) (Figure 2.3). The nature of this model is that the performance of a firm in the industry depends on the characteristics of the environment in which it competes. The term *industry structure* (S) in this framework refers to the characteristics of an industry. The term *firm conduct* (C) refers to specific firm actions in an industry, such as strategies, research/development, and investment behaviors (Kale, 1999). The term *performance* (P) refers to the individual firms' performance, such as profitability and sales growth. This framework means that a firm's performance is primarily dependent on the characteristics of the industry in which it compete. Firstly, the industry structure is the major force to determine the conduct of the firm (such as the strategy), and this conduct can determine the performance of a firm. Secondly, the dotted line in this framework also shows the direct influence from the industry structure to the firm's performance. This means that sometimes the characteristics of the industry directly affect a firm's performance without considering a firm's conduct. Since the underlying logic of this framework is to first understand the environment and next position the firm, it is also referred to as the "outside-in" approach (Bosch, 1997).

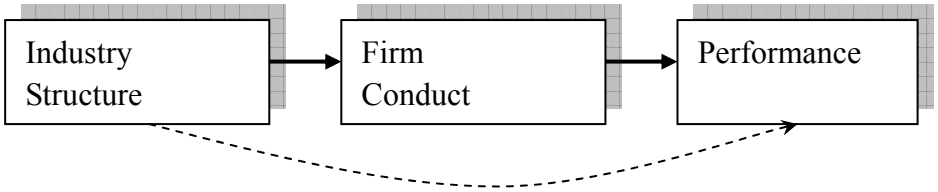

Figure 2.3 Industry Structure – Firm Conduct – Performance Framework

The 'industry structure – firm conduct – performance' framework has provided a useful way for analyzing industry structure and evolution, firm positioning within industries, and competitive interaction among firms. Among many researchers in this field, Porter (1980, 1985)'s work such as the 'five forces' model and the 'generic competitive strategy' are the most popular ones.

(2) Porter's 'Five Forces' Model

Porter posits that every industry has an underlying structure, or a set of economic and technical characteristics that gives rise to competitive forces. Thus, in order for a strategist to best position his or her company within the environment, he or she must assess the environment and the five forces affecting competition: the threat of new entrants, the bargaining power of customers, the bargaining power of suppliers, the threat of substitute products, and the rivalry among existing firms (see Figure 2.4).

This model provides the company with a framework for assessing the forces affecting competition in an industry. The underlying assumption within this model is that there exists a direct relationship between the strength of competitive forces and industry profitability (Bosch, 1997). Thus, companies that are successful in defending themselves against the competitive forces can anticipate above-average profits.

In the construction context, this model had been widely applied to analyze different countries' construction industry or different construction market segment (Betts and Ofori, 1992; Lan and Jackon, 2002). It enables a construction enterprise to analyze product and geographical segments of a construction market and identify areas where superior business performance is more likely due to a favorable configuration of the five forces. It is therefore of fundamental strategic importance in helping an organization to decide whether it is in the right segment of the business and which conducts should be taken according to the characteristics of the industry.

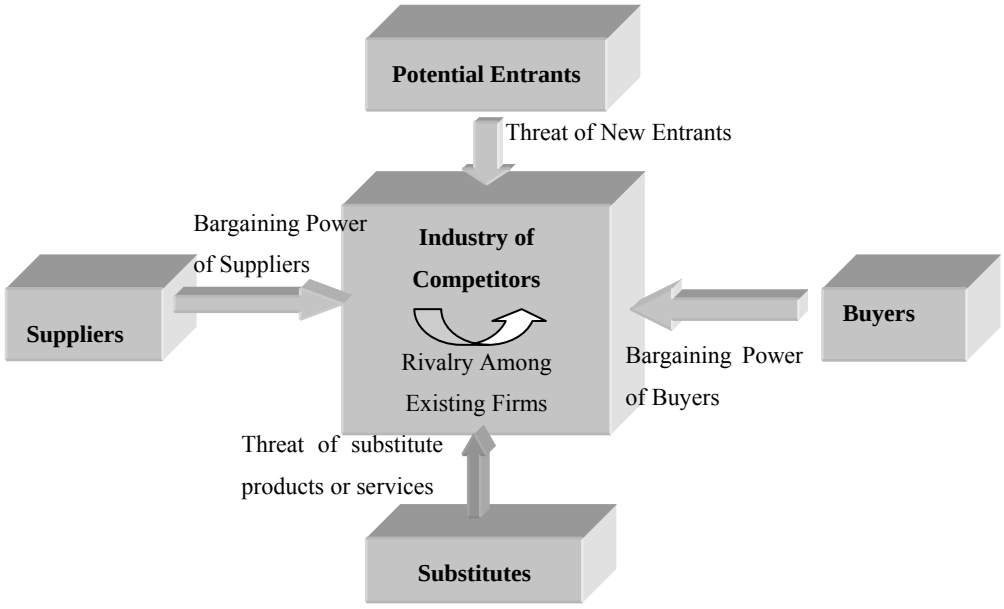

Figure 2.4 Porter's Five Forces Model
Source: Porter (1980)

(3) Porter's Generic Competitive Strategies

The five forces model is based on the assumption that the environment largely determines the ability of a company to take action. As such, a company must find a position that is defensible against the unfavorable industry conditions. Thus, the five forces model leads to the identification of three generic competitive strategies to achieve a defendable competitive position. Porter (1980) argues that these generic strategies would provide companies with the ability to achieve a competitive advantage and outperform the other companies in their industry.

Porter claims that there are just two basic types of competitive advantages a firm can possess: low cost or differentiation. These two basic types of competitive advantage combine with the scope of activities for which a firm seeks to achieve (broad vs. narrow focus) and lead to the generic strategies depicted in Figure 2.5.

Although Porter's model actually delineates four quadrants, he argues that there are actually only three generic strategies for achieving above average performance: cost leadership, differentiation, and focus, with focus further divided into two segments – cost focus and differentiation focus.

		Competitive Advantage	
		Lower cost	*Differentiation*
Competitive Scope	*Broad Target*	Cost Leadership	Differentiation
	Narrow Target	Cost Focus	Differentiation Focus

Figure 2.5 Generic Competitive Strategies
Source: Porter (1980)

Following Male and Stocks (1991)'s definition, *cost leadership* requires management to focus its attention on competing on cost. This necessitates that systems and procedures are directed totally towards controlling cost. Meanwhile, d*ifferentiation* is concerned with creating the perception that something is seen by buyers as being unique. This approach implies that a firm offers something unique and unmatched by its competitors, and valued by the industry, which enables the firm to command higher prices than industry average. Porter proposes that successful firms should follow one of these two strategies, and suggests that the firms that attempt to follow a hybrid approach (e.g. combining both cost leadership and differentiation at the same time) will be at the risk of 'stuck in the middle' and cannot achieve above industry average performance. The reason behind this is that the stuck-in-the-middle firms have to compromise in their critical resource deployments and therefore create a disadvantage, compared to firms that are dedicated to a single mode of competition.

Focus could also be known as *Scope of Competition,* which refers to a firm's decision on the breadth of developing competitive advantage (Kale and Arditi, 2002). It means that the companies could compete in either a narrow or a broad market segment, which can vary in three dimensions: *market/product, geography* and *function* (Cheah, 2002). In the construction context, market/product refers to the different types of projects and market segments, such as construction of residential/commercial buildings, civil works, and environmental engineering. The dimension of geography implies the act of diversification into different domestic regional and international markets. The dimension of function relates to the degree of vertical integration of different functions.

For a contractor, it would imply backward integration into engineering design or construction materials/equipment manufacturing, and forward integration into real estate development.

(4) Limitations of Industrial Organization Economics and Theories

The 'SCP' framework and Porter's positioning strategies all suggest that the conditions and the characteristics of the external environment are the primary determination of strategies that firms should formulate and implement to achieve competitive advantage. Nonetheless, these models have received some criticisms over the years.

One important shortcoming is that these models minimize the significance of individual company differences, and overemphasize the importance of the industry structure and the environment as determinants of the profit rate of the company. Empirical research results conducted by Rumelt (1991) found that the industry structure can only accounts for between 8-15% of the variance in profit rates across companies, and the majority of the remaining variance could be explained by the individual company differences. Thus, industrial organization economics do not address the internal mechanisms by which a company converts the influence of a challenging external environment into useful internal abilities.

2.4.2 Resource-based View (RBV) and Competence-based View (CBV) Theories

(1) Resource-based View (RBV)

The resource-based view (RBV) of a firm, which belongs to the Processual approach, complements the industrial organization economics view of competitive advantage. It shifts the focus from the industrial organization economics, which takes the environment as the key factor determining the organization's strategy, to the firm's internal resources and competencies (Barney, 1991). Therefore, RBV is based on the notion that firms are fundamentally heterogeneous in terms of their resources and

competencies (Wernerfelt, 1984; Peteraf, 1993). Firm heterogeneity is defined as "relatively durable differences in strategy and structure across firms in the same industry that tend to produce economic rents and a sustainable competitive advantage" (Oliver, 1997). According to this theory, RBV assumes that the critical factors for success lie within the firm itself in terms of its resources and competencies, and the firm's choices are not dictated by environmental constraints, but by evaluating how the firm can best exploit its resources relative to opportunities and threats in the external environment (Barney, 1991). The strategy of the firm, therefore, is discussed in terms of balancing existing firm resources in order to utilize them towards competitive advantage.

According to Dunning (1988), the resources include financial resources, tangible resources (such as plant, equipment, buildings), and intangible resources (such as patents, know-how, brands, experience, etc). The resource-based view of the firm points out that not all the resources could contribute to the firm's competitive advantage, but only those that could meet a number of conditions: value, rareness, imperfect imitability and non-substitutability.

Valuable. Firm resources can be a source of competitive advantage only when they can be employed in such a way as to exploit an opportunity or neutralize a threat (Barney, 1991). A valuable resource is one that allows the firm to either reduce costs or further differentiate relative to competitors by improving quality or enhancing attractive features (Grant, 1991), thereby enhancing access to markets or influencing customer preferences. If a resource is valuable, it has the potential of yielding superior rates of return (Mahoney and Pandian, 1992).

Rareness. A firm can enjoy competitive advantage when it is implementing a value-creating strategy not simultaneously implemented by a large number of other firms. Thus, rareness means a resource can contribute to competitive advantage if it is not possessed by a large number of competitors or potential competitors.

Imperfect Imitability. The resource of a firm is imperfectly imitable when other firms are incapable of duplicating the resource. A firm may possess valuable and rare

resources, but such an advantage can only be sustained if competing firms cannot similarly obtain these resources. Peteraf (1993) argued for the need to establish ex post limits to competition. He said, "Therefore, subsequent to a firm's gaining a superior (resource) position and earning rents, there must be forces which limit competition for those rents. Competition may dissipate rents by increasing the supply of scarce resources".

Non-substitubility. This means there must not be any strategically equivalent resources for a firm to pursue the competitive advantage. According to Barney (1991), substitubility could take at least two forms. First, although it may not be possible for a firm to imitate another firm's resources exactly, it may be possible to substitute with a similar resource that enables the firm to devise and execute the same strategies. Second, a combination of different firm resources can be used as a strategic substitute. Therefore, it is asserted that if enough firms have these valuable substitute resources, then none of these firms can expect to gain a sustainable competitive advantage.

In summary, only when the resources meet the above mentioned four conditions that they could help a firm sustain its competitive advantage.

(2) Competence-based View (CBV)

Complementary to the resource-based view, a competence-based view of a firm has gained a great deal of popularity among some researchers in strategy (Hamel and Prahalad, 1994; Snow and Hrebiniak 1980). The competence-based view holds the point that firms should formulate their strategies based on their distinctive competencies.

Although the fundamental arguments of a competence-based view have been agreed by academics, many researchers tend to have different views on the notion of competence. Some of them view competence as *cross-functionally based* (Prahalad and Hamel, 1990, Grant, 1991). According to Hamel and Prahalad (1994), a competence is a bundle of skills, aptitudes or technologies that enable a firm to deliver a particular benefit to customers. It involves many levels of people and all functions. On the other

hand, other researchers view competence as *functionally based* (Hitt and Ireland, 1985, Snow and Hrebiniak, 1980). For example, Hitt and Ireland (1985) describe that 'competencies occur through development of specific activities associated with each function.' Based on the functionally based competence notion, Ansoff (1986) developed the 'competence grid' model in which the individual skills and resources can be organized according to major functional areas. The different functional areas, such as marketing, research and development, operations and general management and finance, are listed along with the equipment, personnel skills, organizational capabilities and management capabilities for each function in what Ansoff describes as a competence profile. This research will adopt the second view, the functionally based competence, which recognizes that more important competences may be those stem from individual functional competences.

As many contemporary researchers have used the word competence and capability interchangeably in the literature, in this dissertation, capability is defined as the capacity for a set of resources to integratively perform a task or an activity (Hitt, Ireland and Hoskisson, 1996). Thus, capability is a subset of competencies.

Similar to RBV, the competencies which could contribute to competitive advantage should also meet some conditions: (1) valuable; (2) competitively superior (Collis and Montgomery, 1995), which suggest that the competences should be relatively better than competitors; (3) inimitable; and (4) unsubstitutable.

(3) Summary of Resource-based View and Competence-based View

The major contribution of the resource-based view and competence-based view is that they attempt to explain the differences of the profitability of a firm with a given set of industry conditions. The choices of a firm are not dictated by environmental constraints, but by exploiting the specific resources and competencies of a firm which could match the opportunities and threats in the external environment (Barney, 1991; Ansoff, 1986; Andrews, 1987). The resource-based view and competence-based view assume that the specific resources and competencies of a firm can provide the basis for its strategy and ultimately contribute to the firm's competitive advantage. Furthermore,

the differences in resources and competencies, which other firms may not be able to easily duplicate or obtain, and the specific way in which they are used within a firm, form the basis of competitive advantage.

(4) Definition Adopted for this Research

Based on the above notions, this research defines the term 'important resources and competencies' (hereafter referred to as "iRCs" in short) as those resources and competencies of a firm that would match the opportunities and threats of the environment and contribute to establishing the competitive advantage of a firm.

2.4.3 Cheah's Conceptual Model for Large International Engineering and Construction Companies

Figure 2.6 shows a conceptual model developed by Cheah (2002) for corporate strategy development of large engineering and construction global enterprises. While incorporating the empirical findings from the success and failure of twenty-four large international construction firms in the United States, Europe and Japan, the model is also built upon theoretical viewpoints gathered from mainstream strategic studies.

The starting point of the basic model realizes that any discussions of corporate strategy should always parallel the internal mechanisms of an organization, as shown in Figure 2.6. Distinctive components link corporate strategy and the mechanisms and drive the interactions between them.

Figure 2.7 shows the seven strategic fields inside corporate strategy. It has some similarity to Porter's (1985) value chain model, but the crucial difference lies in the scope of the strategic fields. Instead of merely serving as value activities, these strategic fields have evolved into broad disciplines that dictate separate strategic planning and execution consideration. These strategic fields would interact and integrate to derive an overall coherent corporate strategy. Likewise, the internal mechanisms of an organization are confined to two fundamental components: organizational structure and corporate culture, as shown in Figure 2.6.

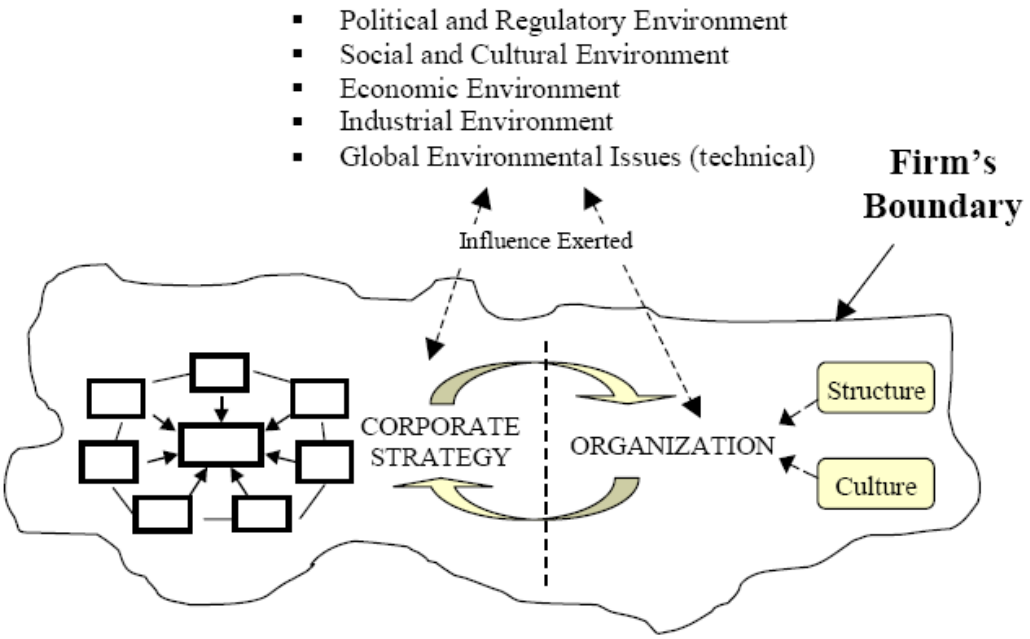

Figure 2.6 Overview of Cheah's Conceptual Model

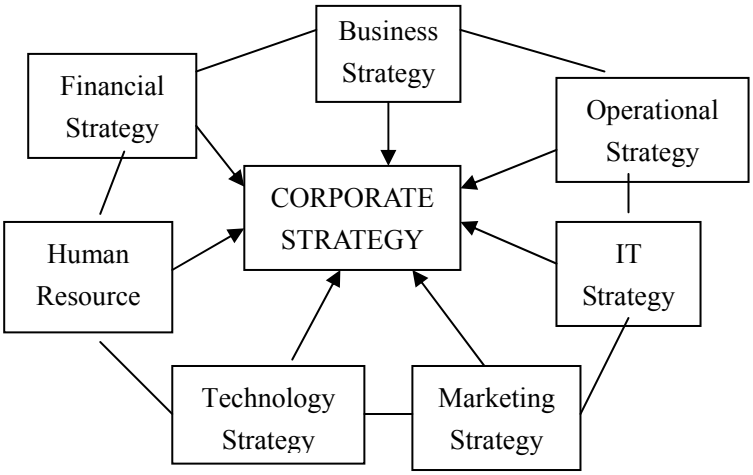

Figure 2.7 Seven Strategic Fields of Corporate Strategy in Cheah's Model

The seven strategic fields and the two internal mechanisms of organization are treated as dynamic, interdependent variables of corporate strategy. These variables create the fluidity of the firm boundary and interact with each other to fit with the external environment. Interaction among these variables consequently promotes higher order differentiation factors that would enhance the strategic outlook of a firm. Some key points of these variables are summarized in Table 2.2.

The shortcomings of Cheah's model are as follows:

(1) This conceptual model proposes that the seven strategic fields and the two

internal mechanisms of organization should interact with one another, but further illustrations on how exactly such interactions take place would require consideration on a case-by-case basis and vary from one firm to another. In addition, Cheah made no attempt to differentiate the order of importance among the seven strategic fields.

(2) Cheah emphasized that the Strategy and Organization (S&O) variables should fit with the external dynamic environment, but again the exact configuration is scenario-dependent. For example, the exact configuration for a firm competing in China would be different when the firm expands its operations to other countries.

Table 2.2: Scope, Definitions and Descriptions of Seven Strategic Fields and Two Organizational Mechanisms

Strategic Fields	**Scope, Definitions and Descriptions**
Business	Generic strategies of business units: differentiation versus cost Market segmentation: focus versus diversified Products/services that firm could offer, should offer, and target to offer
Finance	Investment decisions and project evaluations: NPV; decision analysis; optimization techniques; portfolio analysis; real options Financing decisions: capital structure – layers of equity and debt; cost of capital; tax issues; dividend policy Risk management: surety and payment bond; insurance policies Special project financing arrangements: BOT; turnkey
Operation	Engineering design Site management: inbound and outbound logistics; resource planning Project works scheduling and materials procurement Construction methods: conventional RC; steel; precast; composite
Technology	Adoption policy: pioneer versus follower Innovation policy: autonomous versus systemic; in-house versus off-the-shelve solutions; Basic versus applied research
Information and Knowledge	Organizational learning Knowledge transfer from one project to another: codified versus tacit knowledge IT investment policies: internalization versus outsourcing
Human Resource	Personnel: recruitment; training programs; job rotation Industrial relations: union-management relationship Compensation policies: incentives; reward systems
Marketing	Branding and reputation building Value added to clients: foresee clients' needs; signaling value to clients Relationship marketing: Guanxi
Organizational Mechanisms	**Scope, Definitions and Descriptions**
Organizational Structure	Four dimensions: functions; markets; geographies; clients Formal versus informal structures Power centralization versus delegation of authority
Corporate Culture	Social control systems and normative order Artifacts; espoused values; tacit assumptions in an organization Interaction with industrial and national cultures

Source: Cheah (2002)

2.5 Summary

In summary, past literature on the different schools of thought in strategy, the strategy theories related to the construction industry in general and current research of the Chinese construction industry confirm that there is a lack of research on the strategy of Chinese construction companies. In order to fill in this gap, some theories are reviewed in order to set up the basic theoretical foundations for subsequent development of the model. It has been identified that the relevant foundations include: industrial organizational economics, which belongs to the Classical approach; resource-based view and competence-based view, which belong to the Processual approach; and Cheah's conceptual model, which is a strategic model related to the construction industry combining insights from the different schools of strategic thought.

Finally, Figure 2.8 shows some of the outstanding issues that need to be addressed in academic research based on the review of existing works. These issues will form the basis of the conceptual model in this research.

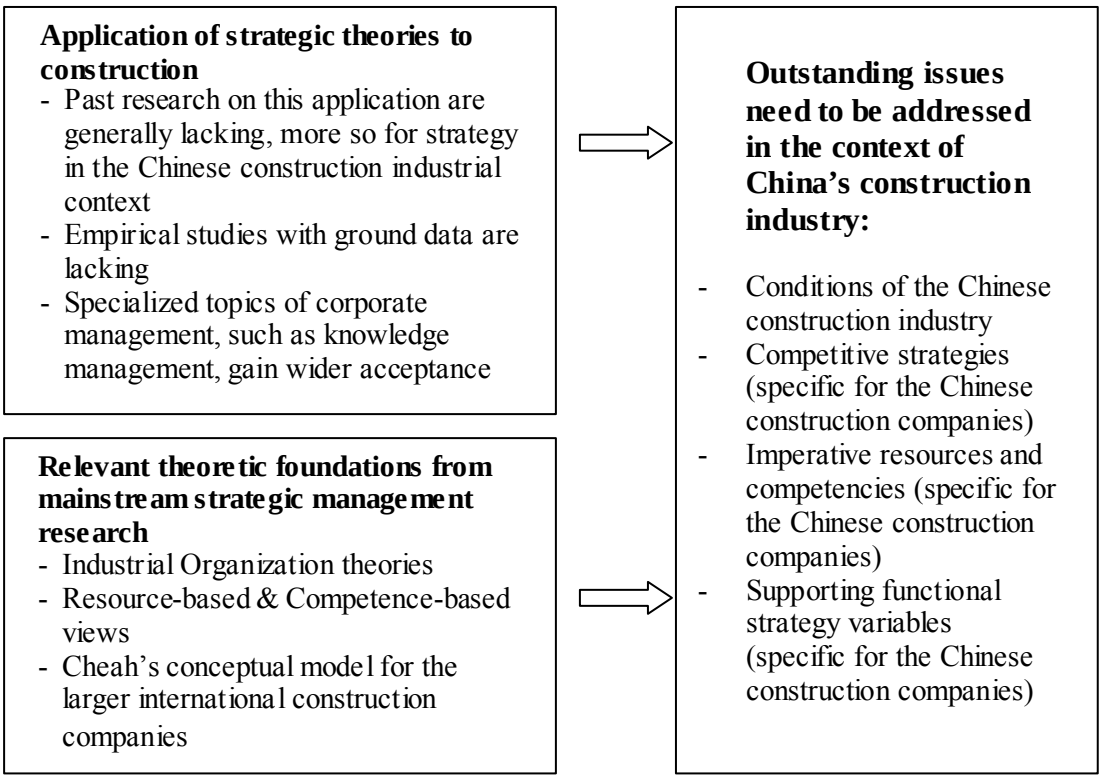

Figure 2.8 Towards a more Holistic Conceptual Model

Chapter 3 Research Methodology

This chapter outlines the overall methodology adopted for this research. Figure 3.1 illustrates the major components, which include literature review, environmental analysis, a series of case studies and a questionnaire survey.

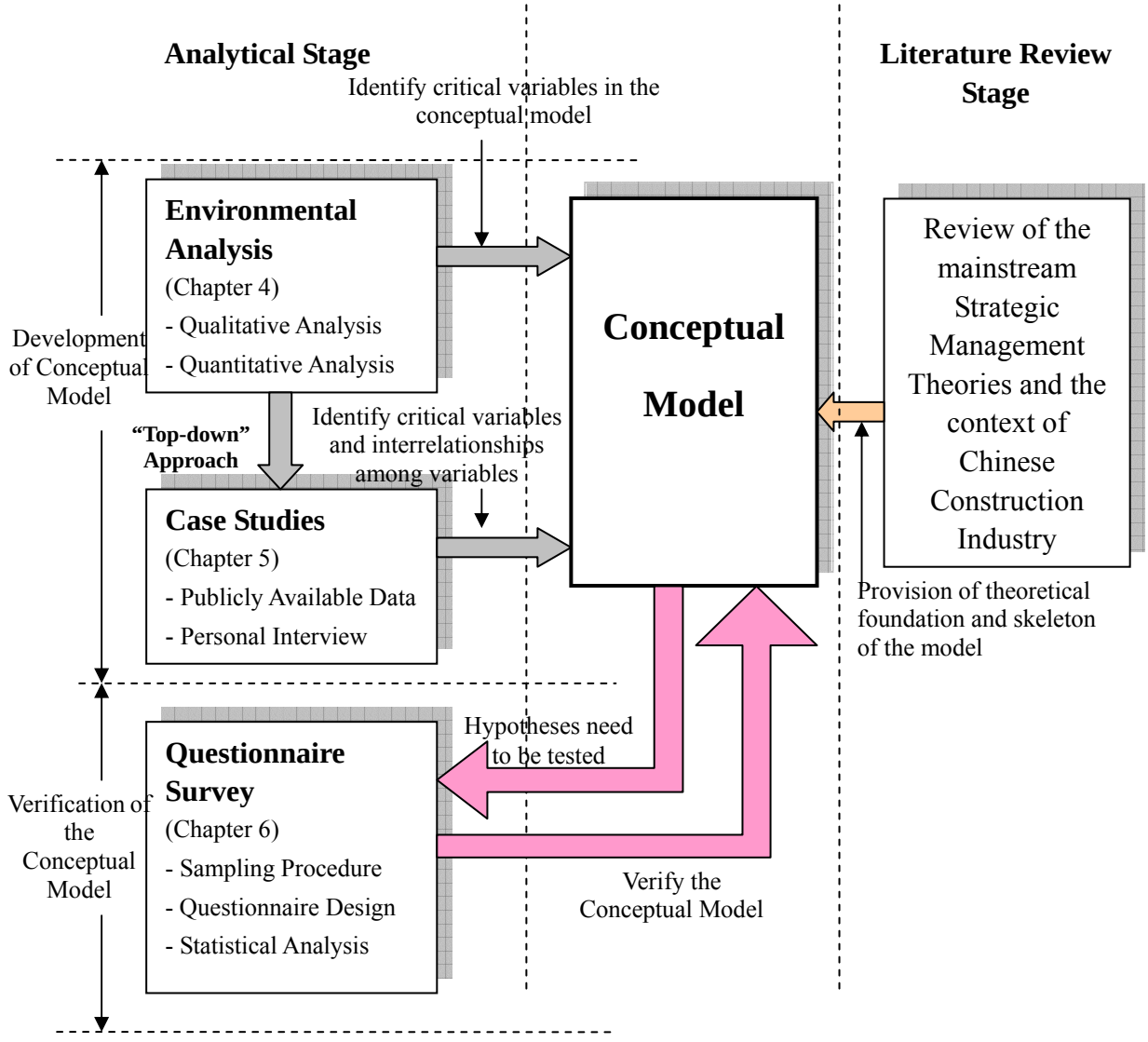

Figure 3.1 The Overall Research Methodology

As part of the overall research methodology, the "top-down" approach plays an important role. It links the environmental analysis and the case studies together. The environmental analysis in Chapter 4 could only help to identify those critical factors originating from the external environment which could affect the performance of the

Chinese construction companies. This gives only a very general picture beyond the boundary of the companies. In order to identify more specific variables contributing to the performance of a company and strengthen the conceptual model, the "Top-Down" method, sometimes also known as the "Outside-In" method (Benninga, 1997), will be employed. This method is further illustrated in Figure 3.2.

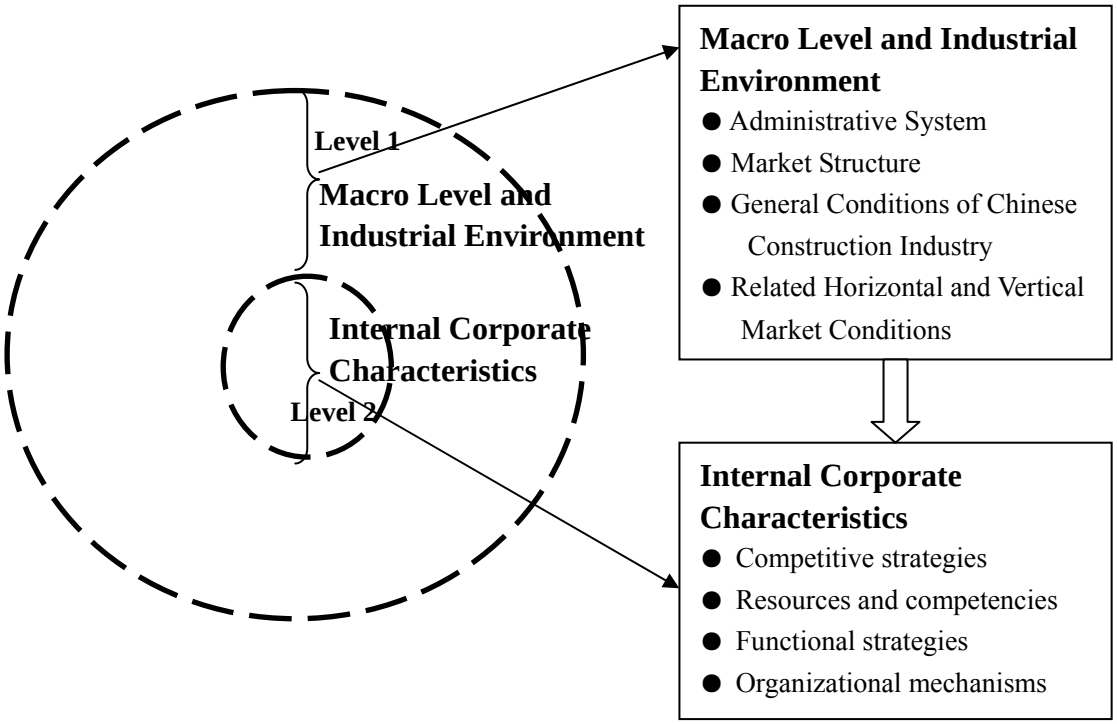

Figure 3.2 "Top-down" Approach Adopted in this Research

In Level 1 analysis, those specific conditions related to the external environment are first studied. Then, the analysis zooms into Level 2, where those identified variables are examined in more detail within the corporate framework in the case studies chapter (Chapter 5).

3.1 The Literature Review Stage

This stage involves a comprehensive review of journal papers, books, proceedings, dissertations and other publications. It is divided into two parts. The first part studies the diverse theoretical schools of thought in strategy and also analyses the limitations of applying these streams directly to the context of the Chinese construction industry.

Based on the review of the first part, the second consolidates selected theories towards forming a basic model that is more suitable to the context of the Chinese construction industry. The outcome of this stage has been presented earlier in Chapter 2.

Literature review is one of the core components in the entire research methodology. It was an ongoing exercise throughout the entire research due to two reasons:

(i) The landscape of strategic theories is dynamic and ever-changing. New propositions published from time to time add new insights to refine the basic model.

(ii) The context of Chinese construction is also ever-changing due to the fast pace of growth and economic development in the country.

The skeleton of the basic conceptual model is constructed through incremental and logical deduction from all sources gathered at anytime.

3.2 Environmental Analysis

The environmental analysis (Chapter 4) combines both qualitative and quantitative aspects. As Denzin and Lincoln (2000) pointed out, qualitative analysis involves the use and collection of a variety of empirical materials, such as interview, personal experience, real life stories and visual texts. In this research, a plethora of materials and reports are reviewed, which were published by agencies such as the World Bank, the Chinese government, local and international newspapers that comment on the economic status of the country and certain industries. The main findings in some relevant journal papers are also extracted. Besides reviewing these materials and journal papers, personal interviews with some professionals in the Chinese construction industry are also conducted. These are useful resources for analyzing the environmental conditions that Chinese construction companies would face.

The quantitative analysis uses statistical methods to analyze the environmental information gathered from public available materials (such as China Statistical Yearbook) that is related to the economic, business and industrial environment in China.

Two sets of statistical tools – parametric and non-parametric statistical methods, are employed to test the relationships among selected environmental economic parameters and the average performance of the companies in each geographical region of China.

In parametric statistics, the usual measure of correlation is the Pearson product-moment correlation coefficient *r*, which measures the linear correlation between samples of data points. For this method, observations are assumed to be sampled from a bivariate normal distribution. Moreover, the Pearson product-moment correlation coefficient measures the degree to which there is a linear functional relationship between the variables (Siegel, 1988).

If the assumptions associated with the Pearson product-moment correlation coefficient *r* are not tenable or unrealistic, then non-parametric correlation coefficients and their associated significance tests are more practical. Non-parametric measures of correlation are available for both categorical and ordered data. The tests make no or few assumptions about the population distribution from which the scores are drawn. Among many non-parametric measurements, this research adopted the Spearman rank-order correlation coefficient r_s.

3.3 Case Studies

It should be noted that the research focus in this study is limited to larger companies which belong to the Class One qualification. Although it is believed that some of the findings are potentially applicable to larger Class Two companies as well, it is never the intention to represent the entire construction industry of China.

The selection of the case companies is largely based on a few criteria, listed below in order of priority: (1) They must possess strong performance; (2) They must have established a strong reputation in their domestic markets in China; (3) Availability and accessibility to information of these companies; (4) Possibility of conducting interview with high-ranked officers in the companies through the author's contact. Based on this selection process, 12 case companies are finally confirmed. The general information about these 12 case companies is summarized in Appendix B.

Data gathered from the above selected case companies are mainly drawn from two sources: (1) publicly available materials, such as website, newspaper, and annual report of public listed company; and (2) through personal interview. Publicly available materials (e.g. through the internet and other types of reports) about case companies form the preliminary source for gathering data. Nonetheless, the research cannot solely rely on this type of data, because most of the publicly available materials are very general, and may not provide sufficient information. Thus, the personal interview constitutes a complementary source for gathering data. In order to get these unpublished information, face-to-face conversations with directors, managers and staff in the case companies were conducted. The interviewing syllabus prepared before the interviewing process is based on the strategic themes and critical variables identified during the literature review stage and environmental analysis stage. The interview questions are shown in the Appendix E.

Finally, data gathered from publicly available materials and interview results for each case company need to be combined and summarized to fill into the data collection template. The data collection template is organized around the strategic management themes and critical variables. One example of the data collection template is shown in Appendix C, which presents the case of China Huanqiu Contracting & Engineering Corp (HQCEC).

3.4 Questionnaire Survey

After the case studies stage, the format and components of the conceptual model are constructed, coupled with a number of hypotheses that postulate possible inter-relationships among these components. A questionnaire survey will be used to verify the format of the conceptual model and test those relevant hypotheses.

Firstly, the questionnaire is designed based on the critical research variables identified earlier in the environmental analysis and case studies. The questions used to test the extent of each variable are also designed with reference to the previous design experience of other researchers.

Secondly, the survey sampling is meant to target those larger and more influential construction companies in China. The sampling procedure did not target for a simple random sample, since random sampling usually gets a very low response rate in China. Instead, 300 questionnaires were sent out by the authors' collaboration parties in China, who have close relationships with the targeted companies. Further contacts – through e-mail, telephone, and face to face interview, were also conducted if the respondents indicate their consent in their feedback. Altogether, 85 questionnaires were returned, and they were all valid responds for the analysis.

Finally, linear regression analysis and binary logistic regression analysis (where the dependent variables are the dummy variables) are conducted to verify the hypotheses and to refine the postulated inter-relationships among the components and variables in the conceptual model.

Chapter 4 Analysis of the Macro and Industrial Environment

In this chapter, the industrial environment of the Chinese construction companies will be analyzed at the macro level. The objective is to identify external factors that may have a role in dictating the general strategic outlook. In order to achieve this, the major characteristics of the macro and industrial environment are extracted from relevant sources such as journal papers, reports, news articles, and other publicly available materials, such as the China Statistical Yearbook. Also, since the chapter concerns a macro overview of the business environment, it would be useful to conduct statistical analyses using regional economic data. These are essentially cross-sectional analyses of the 31 provinces and special administrative regions in China. The Pearson product-moment correlation test and Spearman rank-order correlation test are conducted for selected parameters. From the preliminary findings, several variables, which include competitive strategies and iRCs for the research model, are identified together with a couple of hypotheses.

The main structure of this chapter is shown in Table 4.1. The table highlights the topics and industry conditions that will be discussed under each section, followed by the specific strategies or variables that will be identified as helpful in coping with such industry conditions.

Table 4.1 The Structure of Chapter Four

Section	Industry Conditions of the Industrial Environment	Suggested strategies and iRC variables to cope with the conditions
4.1	**Governmental Influence and Regulatory Factors**	Guanxi
4.2	**Market Structure**	Differentiation Strategy
	● Concentration Ratio	
	● Lorenz Curve	
	● Entry Barrier	
	● Exit Barrier	
4.3	**Selected Operating Conditions of the Chinese Construction Industry**	
	● Quality of the construction work in China	Project Management Competencies
	● Technological Advancement	Technological and Innovative Capabilities
	● Financing conditions	Financial Capabilities, Guanxi
4.4	**Related Horizontal and Vertical market conditions**	
	● Different market/product conditions	Market/Product Diversification
	● Different regions conditions	Regional Diversification
	● Related sectors in the value system	Vertical Integration
4.5	**Project Procurement System in China**	Cost leadership/Differentiation, Guanxi
4.6	**WTO Impact**	
	● Main advantage	
	● Main disadvantage	Guanxi, Technological and Innovative Capabilities, Financial Capability, Project Management Competency, Reputation
4.7	**Summary**	

4.1 Governmental Influence and Regulatory Factors

4.1.1 Governmental Influence

Through its administrative power of intervention, the Chinese government can play a significant role in the construction industry, thereby affecting the market structure of the industry. In China, the construction works are governed under complicated administrative arrangements set up by government authorities at different levels.

The Ministry of Construction (MOC) is the key authority of construction, and takes the leading role of overseeing all construction activities in the country. Figure 4.1 shows the hierarchy of the construction authorities in China.

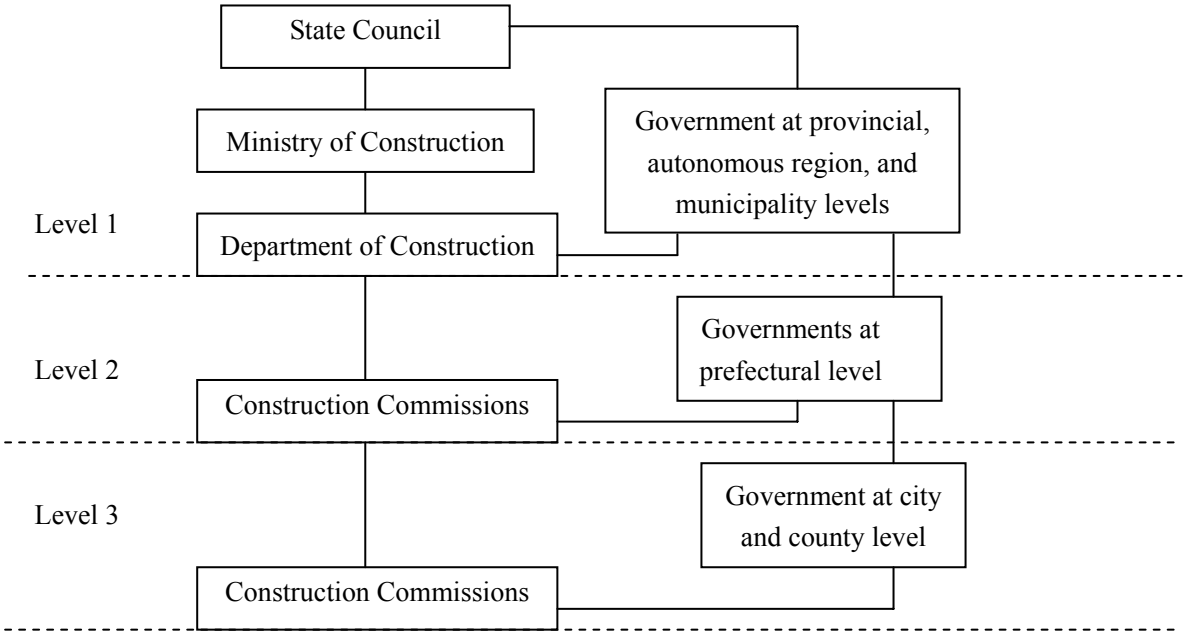

Figure 4.1 Hierarchy of Construction Authorities
Source: Luo and Gale (2000)

As shown in this figure, the Ministry of Construction (MOC) has its local authorities at three levels. The construction authorities at the provincial, autonomous region and municipality levels are directly under the control of the central government – these are collectively structured within the Department of Construction. Those at the prefectural, city and county levels are the Construction Commissions.

The MOC's main responsibilities include:

- Administration and supervision of construction activities;
- Formulation of policies;
- Establishment of all kinds of national building standards;
- Planning and guidance of urban and rural construction activities;
- Administration of national development of building, real estate, and urban infrastructure facilities throughout the country;
- Development of the foreign construction market for Chinese firms, bidding for overseas contracts, and export of building materials and machinery.

Besides the MOC, some other ministry-level government agencies, such as the Ministry of Railways, the Ministry of Transportation, and the Ministry of Electrical

Power, also possess regulatory power over construction activities that are related to their jurisdictions. Each of these ministries has its own systems, and they conveniently divide construction market segments into exclusive "territories" based on their administrative power through their central and local divisions. For example, although the MOC takes charge of city and town building, public works construction and general building works, other construction works, such as railways, roads, ports, docks, dams, water and power stations and special industrial facilities, are separately governed by the Ministry of Railways, the Ministry of Transportation, and the Ministry of Irrigation. Furthermore, Land uses that are closely related to these construction or built environment activities are controlled by the Ministry of Land Resource (Zhu and Hu, 2001). One implication of such governmental influence is that a typical construction project may be administered and influenced by multiple authorities if it spans the boundaries of jurisdictions of these ministries.

The level of involvement of the government also differs between China and other countries. In most developed countries, the government passes legislations and imposes mandatory codes on the construction industry, and the level of involvement is only limited to inspection to ensure compliance at a lower level. In China, the government is involved in more details including the management and supervision of construction works, even stipulating activities that are required at every stage of the construction.

The government authorities in China are not only regulators of construction, they also act as legislators. Unlike in many western countries, where judiciary functions, legislation and administration are independent, in China they are largely controlled by the same level of government. The central government and various departments can promulgate various rules to regulate or change the operating environment of construction enterprises. In turn, local authorities can also promulgate strong measures of protectionism to protect their local enterprises. One example is the local protectionist policies that can prevent firms from freely entering into some local regions. Local authorities at the provincial, city or county levels may develop regulations to limit the participation of external firms in bidding for local projects in order to protect its own regional benefits (Shanghai Jinxin Security Research Institute, 2002).

Next, government authorities can also influence the financing environment of construction. By directly involving in the operation of banking institutions (China's central government directly control some state-own banks, such as the China Construction Bank, the Agricultural Bank of China, the Bank of China and the Industry and Commercial Bank of China), the government can intervene and influence the market through its credit lending policies.

Finally, as in many countries, government agencies represent important clients in public sector projects. In 2002, investment projects initiated by the central government amount to RMB 453 billion, nearly 26% of the total demand in the Chinese construction industry. Besides the central government, the local authorities also play an important role in domestic economic development. Many infrastructure projects, such as airport, toll road, power supply, water supply and treatment, telecommunications and transportation, are directly run by these local authorities (Chen, 1997).

4.1.2 Legal and Regulatory Systems

During the 1990s, China has enacted a number of laws and regulations to cope with changes in the construction industry. According to Lam and Chen (2004), the construction legal system in China mainly consists of laws and regulations developed at three levels.

The highest level of governing laws for the Chinese construction industry include two laws promulgated by the National People's Congress of the People's Republic of China (PRC): the Construction Law (1997) and the Bidding and Tendering Law (1999). The Construction Law (1997) is the most important one, which provides the governing legal framework for construction activities in China. Its legal effect prevails over construction rules and regulations. In 2004, a newly drafted Construction Law was issued, which sought to consolidate the regulations of all construction-related activities under the Construction Law. As the Construction Law only states several basic rules regarding bidding and does not provide any detailed tendering procedures, the Bidding and Tendering Law (1999) was then promulgated to provide specific tendering and

bidding procedures.

The second level of governing laws is the administrative regulations promulgated by the State Council of PRC. They are mainly concerned with issues such as project quality management, registration regulations for architects and engineers, etc.

The third level is departmental regulations and rules. These regulations and rules are promulgated by the MOC and other ministries. They are numerous in number and involve many specific aspects that govern construction activities.

Although China has made a great progress in drafting new laws and regulations since economic reform, many problems still exist. Some of these problems are discussed below.

(1) Lack of a fully developed and matured legal system

There are many uncertainties related to legal aspects in China. Although China has made great efforts and progress to enact appropriate laws, a number of fundamental and important laws still need to be enacted and modified. According to the Ministry of Construction's report "Legislative Program of Construction Laws System" in 1991, eight construction laws, thirty-eight construction regulations and some additional local regulations need to be developed (Zhu and Hu, 2001). Until now, only the two laws that are mentioned above have been enacted.

(2) Excessive administrative regulations

It is stated previously that there are many authorities taking charge of construction works and many departments having enforcement responsibilities and controlling power over construction works. All these authorities would structure regulations according to their own benefits and interests, and exercise their legal enforcement power according to regulations set in their own fields. Furthermore, the extent of enforcement frequently depends on the subjective opinion of individual officials.

In short, contradictions exist among different regulatory authorities – each of which has the power to influence the operational issues of a particular construction

project. This introduces unnecessary uncertainties to the industrial environment. Such non-uniformity of operating conditions from one project to another potentially limits the ability of a construction firm to pursue any stable long-term plan or strategy in an effective manner.

(3) Lack of implementation, supervision and actual enforcement

It is not impossible that government authorities sometimes indirectly influence the market for their own profit making (Chen, 1998). Rulings of arbitration and judgments of litigation are frequently not enforced. There are clear descriptions about how to execute these arbitration and litigation rulings, but real enforcement is rarely seen because of shortages in manpower and funding. The situation of "winning the case but losing the money" is very common. As a result, some businesses have lost faith in the legal system (Chen, 1997).

In summary, the existing regulatory systems in construction are complex due to the combination of political influence and the lack of development and maturity in the regulatory systems. This situation would affect the industrial structure and finally the corporate strategy of individual firms.

4.1.3 Guanxi – the Way to Cope with Governmental Influence and Regulatory Factors

The complexities and uncertainties arising from issues related to government influence and regulatory factors represent a major problem in the Chinese construction industry. This would affect the behaviors of the companies. Here, the institutional Information-Space (I-Space) framework is used to determine a way to cope with these complexities and uncertainties.

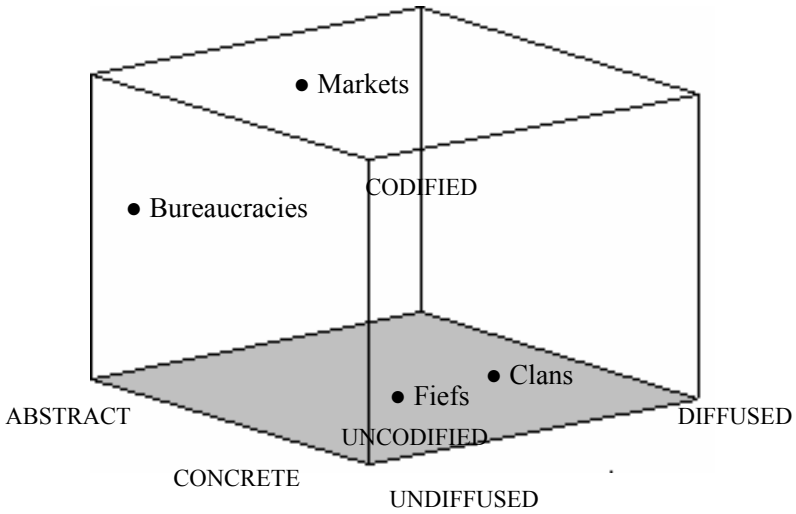

Figure 4.2 I-Space Framework
Source: Boisot and Child (1999)

Figure 4.2 shows the I-Space framework, which was developed by Boisot and Child (1999). This model classifies an institutional environment along three dimensions: codification, abstraction and diffusion. Codification involves the assignment of data to categories. A phenomenon is well codified when the basis of assignment is clear and it can be performed speedily and unproblematically. Contrary to the codified phenomenon, an uncodified phenomenon assumes that the task has too many exceptions to be easily routinizable. For example, the legal systems of some developed countries are said to be codified due to its clear procedures of implementation. The second dimension – abstraction, which is related to codification, involves a reduction in the number of categories to which data needs to be codified. In this dimension, "abstract" means that one apprehends the structure that underlies a given phenomenon, while "concrete" means otherwise. The third dimension – diffusion, refers to the population of data-processing agents by which information could be diffused. Together, the codification and abstraction dimensions can be referred as cognitive complexity, while the diffusion dimension can be known as relational complexity. Along these three dimensions, an institutional environment can be classified as either belonging to bureaucracies, markets, fiefs or clans, as shown in Figure 4.2.

One example related to the use of the I-Space framework is the Singapore

construction industry. As a well developed and matured economy, most information in the Singapore construction industry (such as submission procedures, buildability and quality scores, etc.) is *codified* and can be considered as *abstract* (as most important categories of information have been wisely consolidated and refined). Unlike the tedious administrative procedures in China, the legal and regulatory systems in Singapore are fully developed and clearly defined. Secondly, since the industry is much smaller in size, the government dictates the main direction of the domestic group, which demonstrates an *undiffused* phenomenon. Thus, going by the I-Space framework, the Singapore construction industry exhibits *bureaucracy*-like characteristics.

Relating the previous analysis of governmental influence and regulatory factors to Boist and Child (1999)'s framework, it is found that the Chinese construction industry fall into a regime that has the following characteristics: (1) uncodified (lack of a fully developed and matured legal and regulatory system, lack of implementation and supervision), (2) concrete (complex, tedious, and overlapping administrative procedures and regulations), and (3) diffused (many authorities participate in the industry, and a huge number of construction companies). Therefore, according to Figure 4.2, and based on the above characteristics, the Chinese construction industry would exhibit clan-like characteristics.

The significance of having clan-like characteristics leads to the recommendation of two approaches to handle this highly complex institutional context in China. One approach is to reduce cognitive complexity by imposing routines and standards. This approach requires the Chinese government/ legislative authorities to develop a clear and matured legal and regulatory system in order to reduce the uncertainties, which obviously is progressing too slowly, as reviewed previously. Another approach is to absorb the complexity. This approach requires the companies to establish a set of enduring relationships with the different levels of governments and other participants in the industry in order to reduce the uncertainties. In the Chinese culture, setting up enduring relationships means building up "Guanxi" or relationship. Guanxi is a cultural characteristic that has strong implications for interpersonal and interorganizational dynamics in Chinese society (Park and Luo, 2001). Its importance is not just limited to

the construction industry; Guanxi is actually important in almost all businesses in China. This latter approach is at least within the control of the companies as compared to the first approach. Therefore, from the analysis in this Section 4.1, "Guanxi" is one important resource that needs to be cultivated by the Chinese construction companies to deal with the environmental factors highlighted in this section.

4.2 Market Structure

The factors that will be discussed under the theme of market structure include: concentration ratio, Lorenz Curve, and barriers to entry and exit.

4.2.1 Concentration Ratio

Concentration is a measure of the intensity of competition in an industry. It is usually indicated by a concentration ratio – denoted as CR_4. CR_4 is the summation of market shares of the four largest firms. As such, CR_4 helps to describe the degree of horizontal market power held by the leading firms in this market (Shepherd, 1990):

CR_4 = 100 x (output value of largest four firms) / total output value of the industry (4-1)

There are several categories of markets which can be defined by the use of CR_4. This is shown in Table 4.2.

Table 4.2 Types of Market Structure According to CR_4

Value of CR_4	Concentration	Types of Market Structure
<25%	Low	Competitive
25-50%	Moderate	Loose oligopoly
50-75%	High	Oligopoly
75-100%	Very high	Tight monopoly

Source: Buzzelli (2001)

The value of CR_4 for the Chinese construction industry was 5.85, 4.97 and 5.2 in 1999, 2000 and 2001 respectively (Shanghai Jinxin Security Research Institute, 2002). This indicates that the Chinese construction industry has a very low degree of concentration (<25%). The market is extremely competitive, and no single group of companies could dictate a trend or impact on the general market.

4.3.2 Lorenz Curve

The Lorenz Curve indicates the degree of competition in a market by measuring inequality in the size distribution of firms (Buzzelli, 2001). In this section, three countries, China, US, and Japan are compared based on their Lorenz curves to examine the degree of competition in the Chinese construction market. Usually, firm size can be measured by a firm's output, number of employees, revenues, total net assets, or registration capital (Li *et al*, 2001). Here, the firm size distributions in US and Japan are measured by registration capital (See Table 4.3 and 4.4).

Table 4.3 Size Distribution of US Construction Companies by Registration Capital in 1997

Registration Capital (1 USD)	Firm Number		Output Value	
	Number of firms	Percentage of Total	Output value (Billion USD)	Percentage of Total
0-99,999	146,796	22.40%	7.7	0.8%
100,000-249,999	166,948	25.40%	27.4	3.2%
250,000-499,999	118,463	18.00%	41.75	4.9%
500,000-999,999	89,765	13.7%	62.96	7.3%
1,000,000-2,499,999	75,105	11.4%	116.37	13.6%
2,500,000-4,999,999	30,250	4.6%	104.41	12.2%
5,000,000-9,999,999	16,021	2.4%	110.21	12.8%
10,000,000 and above	13,101	2.0%	387.76	45.2%
Total	656,448	100.0%	858.58	100.0%

Source: Li *et al* (2001)

From this table, it is found that in the US, the smallest firms account for 22.4% of the total number of the firms, while the share of the output value of these firms only amount to 0.8%. Contrary to the smallest firms, the largest firms account for 2% of the total number of the firms, while they have 45.2% of the total output value.

Similar to the US, the smallest firms in Japan (with registration capital less than 5 million Yen) account for 26.45% of the total number of the firms, but they contribute only 3.99% of the total output value. The largest firms (with registration capital larger than 100 million Yen) account for only have 0.16% of the total number of firms, and yet they contribute 30.2% of the total output value.

Table 4.4 Size Distribution of Japan Construction Companies by Registration Capital in 1997

Registration Capital (1,000 Japanese Yen)	Firm Number		Output Value	
	Number of firms	Percentage of Total	Output value (Billion Yen)	Percentage of Total
0-1,999	480	0.25%	45.4	0.04%
2,000-4,999	50,373	26.21%	4,396.6	3.95%
5,000-9,999	29,291	15.24%	3,509.5	3.15%
10,000-29,999	93,360	48.58%	31,924.1	28.66%
30,000-49,999	13,007	6.77%	13,315.4	11.95%
50,000-99,999	4,068	2.12%	10,925.1	9.81%
100,000-999,999	1,315	0.68%	13,736.9	12.33%
1,000,000-4,999,999	183	0.10%	8,319.9	7.47%
5,000,000 and above	111	0.06%	25,209.7	22.63%
Total	192,188	100.00%	111,382.6	100.0%

Source: Wang (2004)

Unlike these developed countries, the official statistical data for the Chinese construction industry do not categorize firms by employment size or registration capital. Instead, firms are classified based on a qualification system that was established by the MOC. According to the MOC's classification, there are four classes of construction firms, which are classified based on factors such as the professional qualifications of employees, capital, annual construction output, management skills, and value of machines. The "Class One" firms are permitted to undertake construction work of any size or complexity anywhere within China. The Class Two, Three and Four firms can only undertake smaller projects at the provincial, city, and county levels. Other firms without these qualifications are only permitted to work on the smallest projects, mostly in the countryside area.

Table 4.5 list the firm distribution and output distribution according to this classification system.

From Table 4.5, it is found that firms that are without class qualification account for 54.13% of the total number of the firms, while they contribute 26.77% of the total output value. Firms with Class One qualification make up 2.05% of the total number of the firms, but they contribute 31.45% of the total output value.

Table 4.5 Size Distribution of Chinese Construction Companies by Qualification Class in 1998

Qualification Class	Firm Number		Output Value	
	Number of firms	Percentage of Total	Output value (Billion RMB)	Percentage of Total
Without Class	51,939	54.13%	333.6	26.77%
Class Four	18,324	19.10%	88.0	7.06%
Class Three	17,277	18.01%	199.3	15.99%
Class Two	6,445	6.72%	233.8	18.73%
Class One	1,971	2.05%	3919.6	31.45%
Total	95956	100.00%	12462.6	100.00%

Source: Li (1999), Chinese Statistical Yearbook (1999)

Based on the data from Table 4.3, 4.4 and 4.5, the Lorenz curves of China, US and Japan are derived accordingly in Figure 4.3.

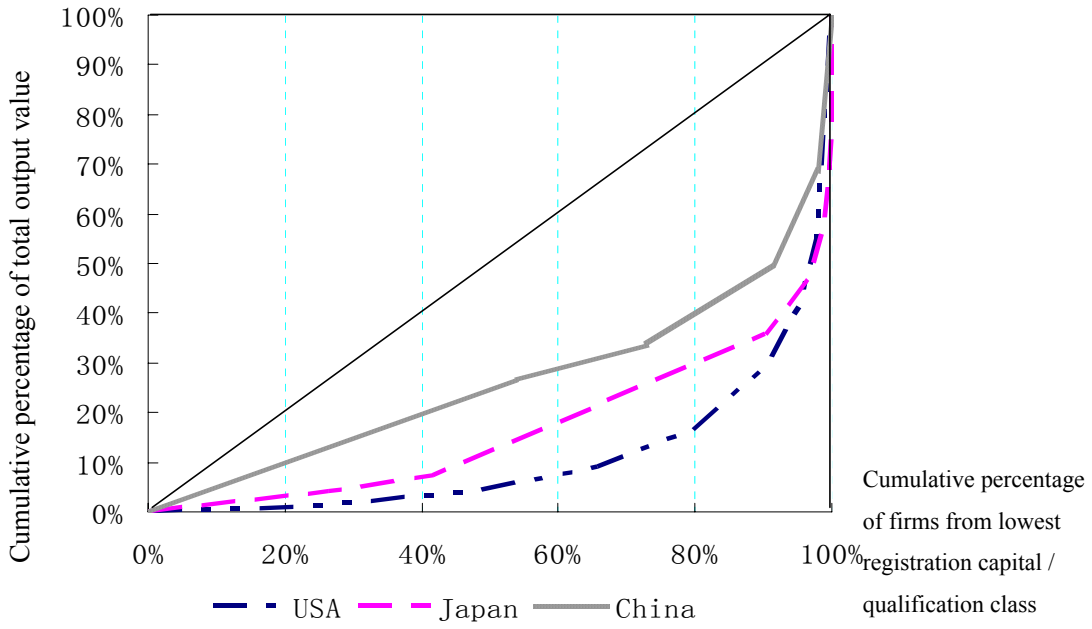

Figure 4.3 Lorenz Curves of Construction Enterprises in China, US, and Japan

This figure clearly shows that the Lorenz Curve for the case of China is closer to the diagonal than those of the US and Japan. This demonstrates that the firm size distribution of construction enterprises in China is more evenly distributed. This implies that the differences among small, medium, and large construction firms are smaller and the market is less concentrated compared to the US and Japan. This would also suggest the existence of a more intense level of competition in the Chinese construction market.

4.2.3 Barriers to Entry

The market concentration ratio discussed in Section 4.2.1 reflects the extent of competition among the existing companies within the market. The entry barriers would illustrate the dynamics between the existing companies in the market and potential competitors from outside of the market. Higher barriers increase the cost of entry by potential competitors, causing them more disadvantaged compared to the incumbents. Higher entry barriers would also restrict the number of competitors in the market and affect market competition.

In general, barriers to entry and exit would vary with the type of industries depending on its value system and characteristics. Consider a capital-intensive industry like oil and gas, this industry would have a very high barrier to entry, and the barrier to exit is also high because of asset specificity. On the other hand, in the context of the Chinese construction industry, the entry barriers are generally low due to some specific characteristics as discussed below.

The first aspect that needs to be considered is the economies of scale. When the effects of economics of scale are large, it would be more difficult for new firms to enter and establish a firm footing during the initial period, since their fixed costs would be higher. Due to the uniqueness of each construction project, the uncertainties in the contracting construction process, and the low concentration ratio, the effects of economies of scale would not be very significant in the Chinese construction industry. In other words, the entry barrier based on this factor would be low.

Another aspect that needs to be considered is the local government policies. In order to secure short-term profits and lighten the pressure of local employment and fiscal problem, many local governments and authorities have chosen to lower the entry barriers to local firms in most sectors, hence allowing more and more local construction companies – even those that may not be very qualified, to freely enter the industry (Shanghai Jinxin Security Research Institute, 2002). On the other hand, in order to protect these locals, the local government has set up many administrative ordinances to

raise entry barriers to prevent the entry of competent companies from outside the region. As a result of such local protectionist policies, unfair and ineffective competition exists in some local markets.

4.2.4 Barriers to Exit

Comparing with the low entry barrier (at least to the local companies within a region), the barriers to exit are generally high in the Chinese construction industry, which are again caused by several factors:

(1) The resource market in China is not very organized, so assets cannot be sold or transferred effectively in the market place when companies exit. This affects even labor, as workers cannot easily find alternative employment without a structured mechanism such as job market advertising.

(2) There are no comprehensive legislations in place to bail companies out of the industry. Unlike in the case of U.S. and many western countries, procedures for bankruptcy filing, mergers and acquisition remain unclear in China.

(3) For political reasons, in order to provide employment to the local community, the local authorities again set up hurdles to "prevent" the exit of companies. Since most state-owned enterprises are carrying the bulk of the social burden – such as welfare costs and retirement pensions of their employees, most of them are simply "forbidden" to exit in order to maintain the status quo of the society.

Therefore, it can be said that the high exit barriers are mainly formed by an immature economic system and an entrenched social system on top of the various administrative hurdles.

4.2.5 Differentiation Strategy as the Solution to Cope with the Market Structure

The low level of concentration ratio and low entry barrier indicate that there are too many construction enterprises in the industry, with none of them capturing a remarkable market share and exerting significant influence on the development of the

industry. Coupled with the local protectionist policies, the delayed demise of underperforming construction enterprises has led to excessive competition in the industry. The high exit barriers essentially further create a surplus of production capacity. All these factors hinder free and effective competition.

In order to cope with these unfavorable market conditions, large companies in the construction industry should provide something unique as perceived by the clients to avoid competition that is not placed on a level ground. This would require them to pursue a differentiation strategy to distinguish themselves from their competitors.

According to Male and Stock (1991), the differentiation strategy is concerned with creating something that is perceived by the buyers as unique. In the Chinese construction context, the uniqueness provided by a company may include quality improvement, strong innovation and reputation and Guanxi with various parties.

4.3 Selected Operating Conditions of the Chinese Construction Industry

In this section, a few major aspects concerning the operating conditions, such as quality, technological advancement and financing conditions, will be discussed. Correlation analysis will also be conducted to determine whether these parameters would affect the profitability of a firm. Two correlation methods – parametric analysis (Pearson product-moment correlation analysis) and nonparametric analysis (Spearman rank-order correlation) are used.

The Pearson product-moment correlation analysis assumes that the sampled observations are drawn from a bivariate normal distribution. If this assumption is not realistic, the Spearman rank-order correlation coefficient r_s should be applied, which makes no or few assumptions about the population distributions. Essentially, in the computing process, the Kolomogorov-Smirnov test is first conducted to see whether each variable belongs to a normal distribution. If either of them fails the test, the Spearman rank-order coefficient will be computed. Alternatively, both Pearson and Spearman analysis can be conducted to see whether the results from the two would

agree in terms of the significance of the computed coefficients.

4.3.1 Quality of the Construction Work in China

Poor quality of construction work was recognized as one of the major problems in the Chinese construction industry (Chen, 1998). Figure 4.4 shows the ratio of high quality projects from 1991 to 2002, which is provided by the Chinese State Statistical Bureau as a critical indicator.

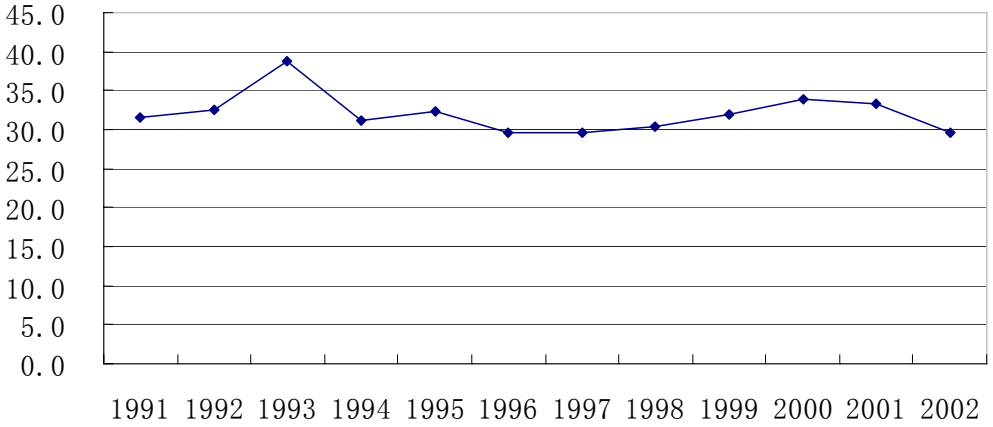

Figure 4.4 Ratio of High Quality Projects
Source: Chinese Statistical Yearbook (2003)

This figure shows that the average ratio of high projects remains between 30-40% from 1991 to 2002. The poor quality could be explained by poor designs, inferior materials, weak management and lack of skilled workers. In order to obtain a general picture of whether quality control has any significant relationships to the average pre-tax profit margin of firms from various regions, the correlation analysis between these two variables is examined. The average pre-tax profit margin and percentage of high quality projects in year 2001 are summarized in Appendix A-1.

Before conducting the correlation analysis, the tests of whether these two variables belong to a normal distribution is conducted. The results of the Kolmogorov-Smirnov test for these two variables are 0.184 and 0.20 respectively. This means that the two variables do not belong to normal distributions. Thus, a non-parametric analysis – the Spearman rank-order correlation coefficient r_s, is

computed. The results presented in Table 4.5 shows that at a 10% level of statistical significance, the two variables are negatively correlated.

Table 4.6 Correlation Analysis between the Ratio of High Quality Projects and Pre-tax Profit Margin

		Profit Margin
High Quality Projects	Spearman correlation	**-.328***
	Sig. (2-tailed)	.072

n=31

*P≤0.1; **P≤0.05; ***P≤0.01

The results indicate that quality control does have a significant impact on pre-tax profit margin, but ironically, a higher percentage of quality projects would reflect a lower average pre-tax profit margin for firms in the region! This result may be unexpected by most people, since in general, a higher quality project should lead to higher customer satisfaction – hence higher profitability in the long-run. Nonetheless, in the Chinese construction industry, higher quality may not automatically lead to a successful demand of higher premium, while on the other hand it definitely requires much improved design, materials, managerial skills and workmanship – all of which impose significantly higher costs on a company. Figure 4.5 illustrates this relationship between quality level and profitability.

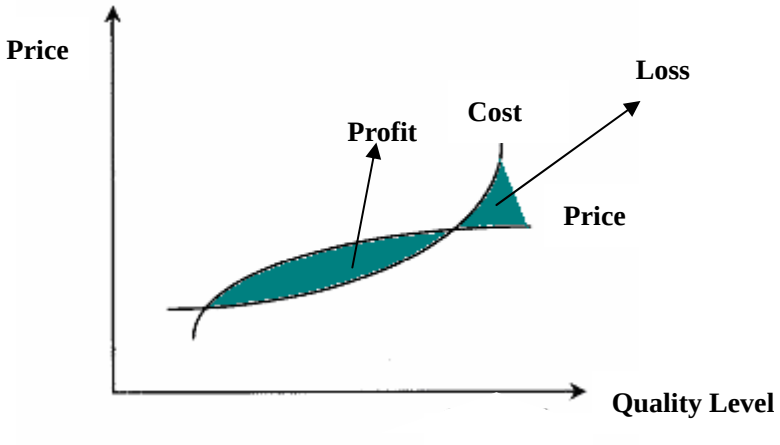

Figure 4.5 Relationship of Quality Level and Profitability

This figure indicates that as the quality level increases, the cost of the project may exceed its price and a firm may even incur losses. This argument helps to explain the negative relationship between quality and profitability. Therefore, in China, sometimes quality is intentionally kept at a low level by the contractors in order to earn more

immediate profits. Essentially, Figure 4.5 suggests a company to seek a level of compromise between cost and quality, or, put differently, to effectively integrate cost management, quality management, and procurement. As all these activities may be classified as project management competencies, it implies that the cultivation of these competencies would enhance the performance of a company.

4.3.2 Technological Advancement

Technological advancement has become more and more important in the construction industries of developed countries. According to Sun and Ofori (2001), technological advancement can be examined in two critical aspects: mechanization and labor productivity. Mechanization is represented by value of machines per labor, and labor productivity by value-added per person. In the case of China, poor technological advancement has been reported (Qi and Deng, 1999). Consider the fact that in 1999, 70% of the use of construction equipment in China only managed to achieve the same level of output as the developed countries did in the 1960's (this is equivalent to stating that the level of utilization of machineries in China is at least 30 years' behind that of the developed countries!).

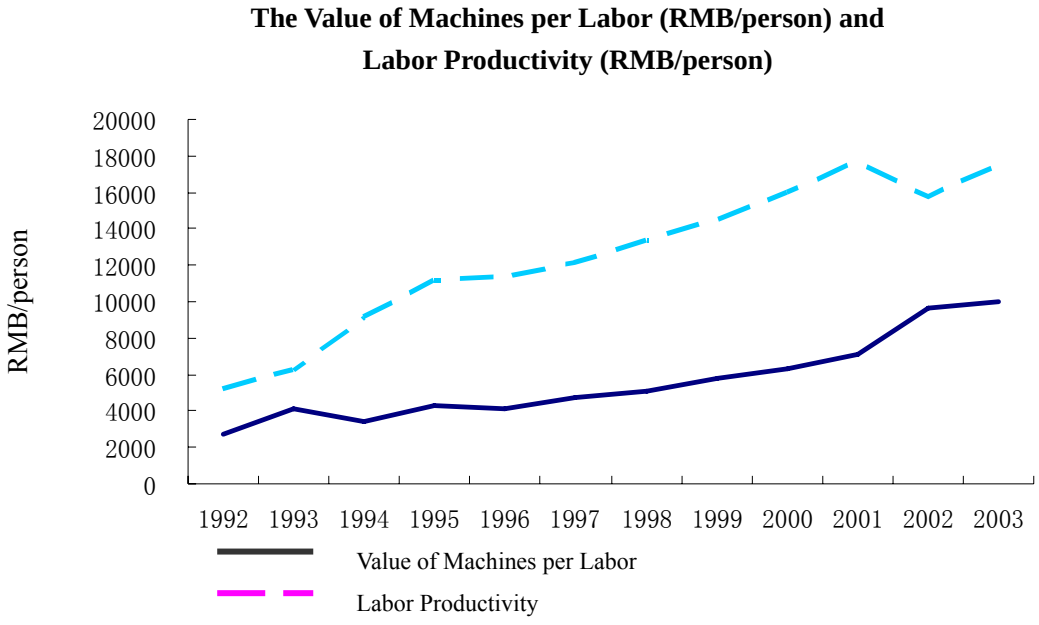

Figure 4.6 The Value of Machines per Labor and Labor Productivity Growth in Chinese Construction Industry from 1991-2003
Source: Chinese Statistical Yearbook (2004)

Figure 4.6 provides a broad picture of the aspect of technological advancement as indicated by the two indicators (mechanization and labor productivity) for the Chinese construction industry from 1992 to 2003.

A rapid growth of the mechanization and labor productivity of the Chinese construction industry can be seen from the above figure. In 1992, the value of machines per labor was just 2719 (RMB/person), while in 2003 it amounted to 9957 (RMB/person), growing by nearly 4 times. Similar to mechanization, labor productivity also expanded by about 3 times from 1992 (5515 RMB/person) to 2003 (17476 RMB/person).

However, the values of these two parameters are still low compared to those of the developed countries. In 1992, the value of machines per labor for the German construction industry was 11,236 USD/person (about 91,000 RMB/person), almost 33 times larger than its Chinese counterpart. Similarly, labor productivity of the Chinese construction industry is only about one sixth of that in the developed countries.

In general, high mechanization and labor productivity would lead to higher profitability. Whether this proposition holds for the case of China would be examined. The value of machines per labor, the level of labor productivity, and pre-tax profit margin of year 2003 for each region are shown in Appendix A-2. The Kolmogorov-Smirnov test results for the value of machines per labor, labor productivity, and pre-tax profit margin are 0.014, 0.004, and 0.000 respectively, which are all significant at the 5% level. Both Pearson correlation analysis and Spearman rank-order correlation analysis are explored. The results are shown in Table 4.7.

Table 4.7 Correlation Analysis of the Value of Machines per Labor/Labor Productivity and Pre-tax Profit

		Pre-tax Profit Margin by Regions
Pearson Correlation coefficient r	Value of Machines per Labor	-.169
	Labor Productivity	.176
Spearman Rank-order coefficient r_s	Value of Machines per Labor	-.297
	Labor Productivity	.252

n=31

$^{*}P\leq 0.1$; $^{**}P\leq 0.05$; $^{***}P\leq 0.01$

No statistically significant relationships can be identified from the results. One possible explanation is the high cost accompanying the efforts of technological advancement, which would offset part of benefits derived from output growth. Based on the above analysis, although it seems that technological advancement is not a major factor contributing to the profitability of the industry, it should be noted that we have limited our proxies to "value of machine per labor" and "value-added per labor". Conclusions extending to the broader definition and scope of technological advancement should be cautioned.

Besides profitability, another interesting issue is whether technological advancement is related to the output value of a company. The average output value per enterprise is also included in Appendix A-2. Intuitively, a company with a higher level of mechanization and labor productivity would capture a larger market share. Here, the correlation analysis between the value of machines per labor and output value per enterprise, and between the labor productivity and output value per enterprise, are conducted. The Kolmogorov-Smirnov test results for the value of machines per labor, labor productivity, and output value are 0.014, 0.004, and 0.034 respectively, which are all significant at the 5% level. Table 4.8 shows the results for the Pearson correlation analysis and Spearman rank order analysis.

Table 4.8 Correlation Analysis of the Value of Machines per Labor/Labor Productivity and Output Value per Enterprise

		Output Value per Enterprise
Pearson Correlation coefficient r	Value of Machines per Labor	-0.107
	Labor Productivity	0.693^{***}
Spearman Rank-order coefficient r_s	Value of Machines per Labor	-.007
	Labor Productivity	0.624^{***}

n=31

$^{*}P\leq0.1$; $^{**}P\leq0.05$; $^{***}P\leq0.01$

Both tests agree that labor productivity has a statistically significant relationship with the output value at the 1% level, while the value of machine per labor has no significant relationship with the output value. This implies that a company with a

higher labor productivity could achieve a higher output value.

In summary, based on the discussions in this section, it is concluded that technological advancement (as represented by value of machines per labor and labor productivity) is still very low in the Chinese construction industry compared to the developed countries. Meanwhile, the correlation analyses confirm that development of technological advancement is actually important – companies with higher labor productivity could achieve higher output values. Thus, it needs to invest more to enhance the level of technological advancement and improve on labor productivity. For a particular firm, it is necessary to build up strong technological and innovative capabilities (Wang and Guo, 2003, Li and Jin, 2002, Tatum, 1986).

4.3.3 Financing Conditions

By and large, the financing conditions in the Chinese construction industry are not favorable. There are several factors that contribute to this outlook.

First, the lack of bank credit facilities / loans is one major problem to most construction companies. Currently, only large national projects can conveniently acquire bank loans. For other construction enterprises, only short-term financing facilities are sometimes available from the local banks, and even these often come at a high cost (Chen, 1998). As a result, most of the construction enterprises operate with little access to financing facilities and strive with their own funds.

Second, many clients do not pay their contractors timely and fully (Lu, 2003). It is estimated that the delayed payments from clients to contractors were about RMB 300 billion, or 18 percent of the total construction output, in 2001. These late payments were mainly due to the shortage of available funds for many construction projects even at the early stage of implementation. Another possible reason is high competitive pressure, which make contractors hesitate to press clients or take legal action even when serious late payments occur. The contractors are afraid that they would get nothing if they have offended their clients, or lose contracts and future opportunities. Therefore, to keep a project moving, a construction firm would typically have to use its

own funds. This introduces substantial liquidity issues. Furthermore, the contractual system of allocating advance payment to contractors is often not enforced. Usually, contractors receive inadequate advance payments or not at all.

Finally, low asset efficiency plagues the entire whole construction industry. Asset efficiency may be represented by asset turnover ratio, which is calculated as output value divided by total assets. From 1999 to 2003, the average asset turnover ratios of the Chinese construction industry are 0.85, 0.86, 0.87, 0.91 and 0.98 respectively (China Statistical Yearbook, 1999-2003). These figures are much lower than those of the developed countries, in which the ratios of many large international construction companies are greater than 1.0, with some even exceeding 3.0 (Cheah, 2002). This is an apparent signal of inefficient asset management.

It is logical to question whether the asset turnover of an average firm would have any impact on its return-on-asset (ROA), which is calculated as profits divided by total assets. A correlation analysis between asset turnover and ROA is of interest. The asset turnover and ROA of various regions in 2003 are listed in Appendix A-3. The Kolmogorov-Smirnov test results for these two variables are 0.111 and 0.20 respectively. Thus, the Spearman rank-order analysis will be used to test the correlation of these two variables. The results are summarized in Table 4.9. Since the computed correlation coefficient of 0.496 is statistically significant even at the 1% level, this confirms that in order to achieve a high ROA, a company should manage its assets efficiently.

Table 4.9 Correlation Analysis between Asset Turnover Ratio and ROA

		ROA
Asset Turnover Ratio	Spearman correlation	.496***
	Sig. (2-tailed)	.005

n=31

*P≤0.1; **P≤0.05; ***P≤0.01

In summary, the financial conditions in China are not ideal for most construction companies. Lack of bank credit facilities, serious late payments, and inefficient asset

management are all major hindrances. Thus, it is suggested that Chinese construction firms should strengthen their financial capabilities to manage their assets efficiently, maintain good Guanxi with different financial institutions to improve their access to financial resources, and build up good Guanxi with clients to reduce late payments.

4.4 Related Horizontal and Vertical Market Conditions

4.4.1 Market Segments of the Chinese Construction Industry

Construction is mainly a service industry. Market segmentation in this context can be measured by how many different types of projects that a construction firm is capable or targeting to take on. According to the Industrial Classification and Codes (ICC) for National Economic Activities published by the National Bureau of Technological Supervision of China in 1994, the Chinese construction industry can be divided into three major groups: (1) civil engineering construction; (2) installation of power-lines, pipelines, and facilities; and (3) decoration work. Civil engineering construction is further subdivided into several smaller groups, including: 1) buildings; 2) mines; 3) railways, highways, tunnels and bridges; 4) dams, power plants and ports, and 5) other remaining types of civil engineering construction.

It is acknowledged that the above classification method is not perfect. For example, different types of "product" may be included within the category of "buildings", such as residential apartments, commercial buildings, and institutional buildings (e.g. sport centers/museums). All these would belong to different market segments. In another case, special works such as electricity projects, petrochemical projects and metallurgical projects would all be classified under 'other civil engineering construction work' according to this classification method. The fact is these projects have their own specialties and cannot simply be grouped together. Nevertheless, this classification method at least provides a general guideline to divide the whole industry into different market segments. To present a rough picture of the market structure of each segment, the output share and concentration ratio of each group are listed in the following Table 4.10.

Table 4.10 Output Share and Concentration Ratio by Different Market Segments in 1997

Sector	Share of Total Output (%)	Concentration Ratio CR_4
Civil engineering construction	**86.91**	**0.79**
Buildings	68.23	0.43
Mines	1.03	N/A
Railways, highways, tunnels and bridges	10.93	**9.92**
Dams, power plants and ports	3.67	**13.41**
Other civil engineering construction	3.06	N/A
Installation of power-lines, pipelines and facilities	**9.96**	**2.21**
Installation of power-lines and pipeline	5.02	4.12
Installation of facilities	4.94	3.28
Decoration work	**3.13**	**N/A**

Source: Wang (2004)

The above table shows that building works have the largest output, accounting for 68.23% of total output value. Railways, highways, tunnels and bridges sector is the second largest sector, accounting for 10.93% of total output value.

As previously mentioned, the average concentration ratio of the Chinese construction industry is low – about 5% (See section 4.2.1). Nevertheless, Table 4.10 shows that some sectors contain larger ratios than the others, especially the sector of railways, highways, tunnels and bridges (9.92%) and the sector of dams, power plants and ports (13.41%). The relatively large ratios of these two sectors suggest that the differences in market shares between the leading companies and the average players are more significant. Consequently, the profit margin of the leading companies in these sectors may be higher than other sectors that have more even size/market share distributions. Thus, it is suggested that a large construction firm may consider pursuing a market/product diversification strategy into sectors that are perceived to provide more profitable opportunities.

The existence of higher concentration ratios in some sectors is indeed not a transient phenomenon. Projects in those sectors, such as tunnels and dams, are technically more complex and of larger size. This requires the contractor to have more advanced technology, higher capital investments, higher project management competency, relevant past experiences and strong reputation in the field. Other

infrastructure systems, such as highway, railway and power plants, are usually government owned and thus require Guanxi (connection) with the government in order to compete in the sector. All these elevate the entry barriers, preventing unqualified competitors from entering into these sectors, allowing greater room for differentiation and finally resulting in higher concentration ratios.

4.4.2 Regional Characteristics

Currently, there are 31 provincial administrative units in China. These include 4 municipalities (Beijing, Shanghai, Tianjin and Chongqing) which are directly administered by the central government; 5 autonomous districts (Inter Mogolia, Guangxi, Tibet, Ningxia and Xinjiang); and 22 ordinary provinces. From an economic development perspective, these 31 provincial units can be divided into eastern coastal region, central region and western region. The eastern coastal region has been more developed than the central and western regions. It should be noted that the central region is not restricted only to the central provinces in China – it may include some of the provinces located in the northeast of China, such as Jilin, and Heilongjiang.

Companies in different regions enjoy different average levels of profit margins. If part of these differences in profit margins is attributed to locational factors, a firm would want to evaluate the strategy of diversifying into regions that may earn them higher chances of profitability. When evaluating which regions that a company might want to enter, the impact of: (1) output growth; and (2) risk level; resulting on the profit margin (or its growth rate) need to be considered.

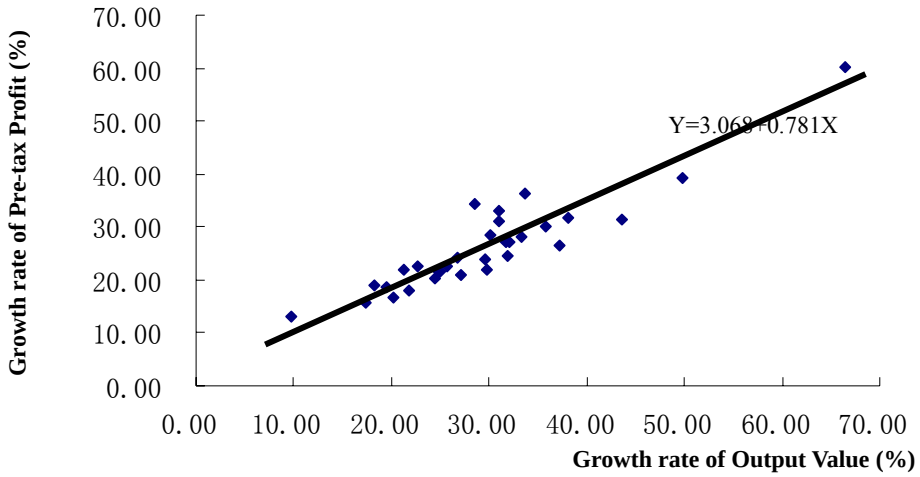

Figure 4.7 Correlations between Average Pre-tax Profit Growth Rate and Output Growth Rate of Different Regions from 1997 to 2003

Figure 4.7 shows a positive linear relationship between the average growth rate of pre-tax profit and the output value by different regions from 1997-2003 (data summarized in Appendix A-4). The Kolomogorov-Smirnov test suggests that these two variables belong to normal distributions (results for these two variables are significant at the 5% level). The outcome of a linear regression analysis produces a linear coefficient b=0.781 at the 1% level of significance. The positive relationship between the growth rate of output value and the growth rate of pre-tax profits implies that companies operating in a high-growth region would have more opportunities to excel in profitability.

When looking at the impact of risk on profit margin, the coefficient of variance (CV) of profit margin is employed to represent the risk level[1]. The classical Capital Asset Pricing Model (CAPM model) suggests that a positive relationship should exist between expected return and systematic risk (Brealey and Myers, 1996). The relationship between the risk level and the profit margin of different regions in this case is examined as follows.

[1] It should be noted that the definition of risk is very broad. Here, the definition of CV only looks at the variability or fluctuation but does not account for, say, business risks, bubbles, an overheated economy, etc. It is calculated as the ratio of standard deviation of profit margin to the mean of profit margin (Std.D/Mean). Thus, this allows for the comparison of the variation in profitability across various regions after normalization using the mean.

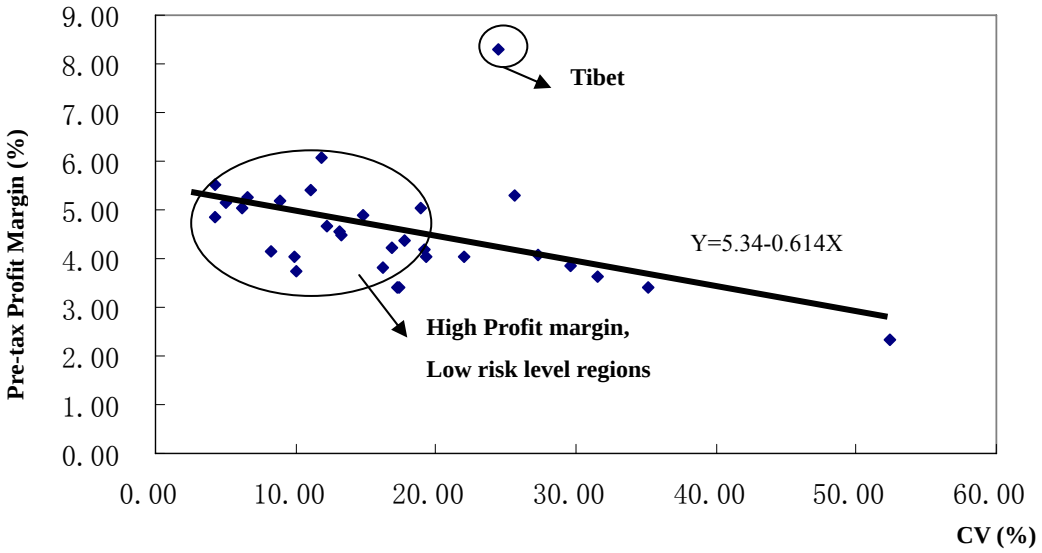

Figure 4.8 Relationship between Average Pre-tax Profit Margin and Risk Level by Different Regions From 1997-2003

Figure 4.8 illustrates the relationship between the average pre-tax profit margin and the CV of the different regions for the period 1997-2003 (data summarized in Appendix A-5). A significant negative relationship exists between these two variables, except for Tibet, which is clearly an outlying case[2]. The Kolomogorov- Smirnov suggests that these two variables belong to normal distributions (results for these two variables are significant at the 5% level). The outcome of a linear regression analysis produces a coefficient b= -0.614 at the 1% level of significance.

In the CAPM world, a positively sloped line would be expected, which justifies the saying that higher return always come with higher risk. Contrary to the CAPM, Figure 4.8 shows a negatively sloped line, which means that for the construction industry in China, some regions may enjoy higher return while at the same time are subjected to less volatility! One possible explanation for this phenomenon is the distortions introduced by the unique government policies. Those high risk, low profit margin regions, such as Xinjiang (risk level = 57.06%, average profit margin = 2.77%), Qinghai (risk level = 30.02%, average profit margin = 3.79%), Jinlin (risk level = 32.72%, average profit margin = 3.55%), are all in the western and central regions that

[2] When the output share of each region is studied in detail, it is found that Tibet only made up 0.12% share of total output value – thus the influence of Tibet could be neglected.

are less developed. The central government's policy encourages the eastern coastal region to develop first (Han and Ofori, 2001), causing regional disparity. The eastern coastal regions are able to demand more support from the government, attract greater investments, and hence enjoy more growth opportunities. Moreover, the local governments in these regions erect entry barriers to prevent other new entrants, by which preferential treatment is offered to selected local companies (particularly state-owned enterprises). These actions essentially lower their risk of operation and reduce the fluctuation of business profits.

The disparity of output growth, risk level and profitability among the different regions suggests that a geographical diversification strategy may be considered by the Chinese construction companies. A company should try to identify and enter into regions with higher output growth, higher profitability level or lower variability. Table 4.11 lists several potential provinces/municipalities, ranked according to the percentage of total output value.

Table 4.11 Percentage of Total Output Value, Pre-tax Profit Margin and Risk Level of Different Regions ranked by Percentage of Total Output Value

Rank	Regions	Percentage of Total Output Value (%) Year 2003	Pre-tax Profit margin(%) Year 2003	Risk level (CV of Profit Margin)
1	**Zhejiang**	13.55	5.68	6.56
2	**Jiangsu**	12.11	4.66	9.99
3	**Guangdong**	6.57	7.54	13.75
4	**Shandong**	6.42	5.92	4.76
5	**Beijing**	5.50	5.51	5.23
6	**Sichuan**	5.31	5.41	14.04
7	**Shanghai**	5.18	6.69	13.19
	SUM	54.64		

These 7 regions altogether contribute 54.64% of total output of the industry. At the same time, these regions enjoy slightly higher average pre-tax profit margin and lower risk level (in 2003, the average pre-tax profit margin of all Chinese construction companies has been reported as 5.4%). Among these 7 regions, 6 belong to the eastern coastal regions, including 2 municipalities (Beijing and Shanghai). Only Sichuan is located in the central region. These figures essentially support the argument that firms

should consider adopting regional/geographical diversification strategy into some of the above regions to increase the chances of securing a higher profit margin.

Before ending this section, the issue of taxation is discussed. Figure 4.9 indicates a very strong linear relationship between the pre-tax profit margin and the after-tax profit margin in 2003 (Appendix A-6). The Kolomogorov-Smirnov test suggests that these two variables belong to normal distributions (results for these two variables are significant at the 1% level). The outcome of a linear regression analysis produces a linear coefficient b=1.117 at the 1% level of significance.

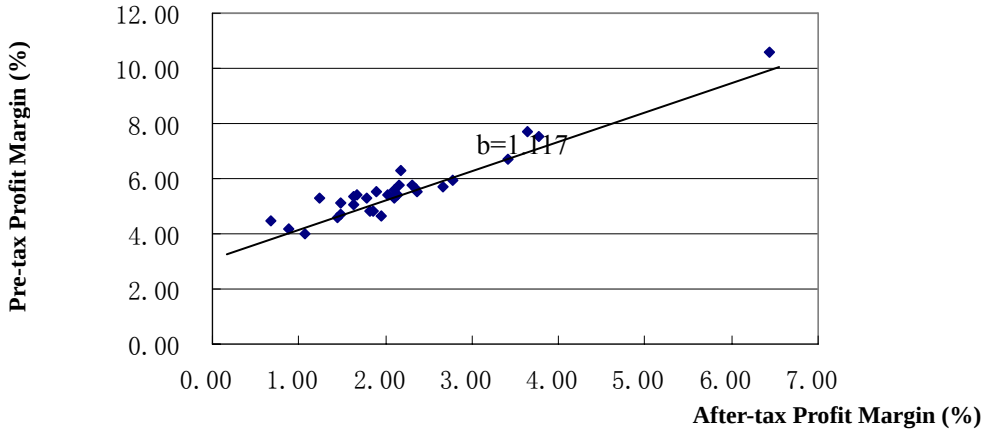

Figure 4.9 Relationship between Pre-tax Profit Margin and After-tax Profit Margin by Different Regions in 2003
Source: Chinese Statistical Yearbook (2004)

The strong relationship between pre-tax profit margin and after-tax profit margin indicates that on an average basis, the effects of taxes across different regions are in a way moderated. In other words, so long as a high pre-tax profit margin is achieved, the chances of achieving similar higher-than-average after-tax profit margin are high. Thus, differential tax rates do not seem to be an issue for strategic planning purposes.

4.4.3 Conditions of Related Sectors in the Value System

Figure 4.10 shows a typical value system of the construction industry, which was developed by Cheah and Chew (2005). This sub-section examines the market conditions of each sector and assesses whether large Chinese construction companies should pursue a functional/vertical integration strategy along the value system in order

to elevate their competitiveness.

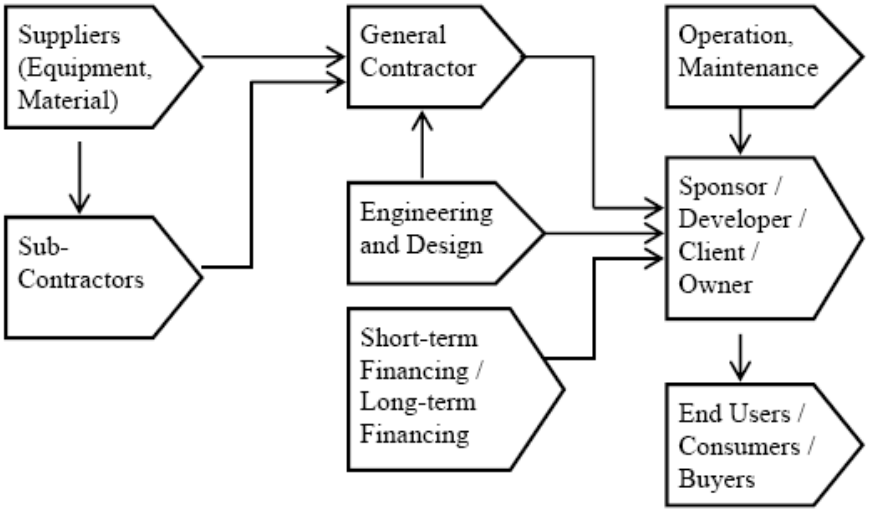

Figure 4.10 Related Sectors in the Construction Value System
Source: Cheah and Chew (2005)

(1) Subcontractor/Specialty contractor

It has been reported that there exists a low degree of specialization and an underdeveloped contracting system in the Chinese construction industry (Lan and Jackson, 2002). To a certain extent, the Chinese construction industry is still donning the legacy of the former centrally planned economic system. The similarity in size and services among firms results in an undesirable firm size distribution in the industry and a majority of the firms compete in the same general contracting market. Thus, many of the subcontracting and specialty works are performed in-house by the general contractors themselves. They only subcontract works or procure specialty services when they have no other alternatives (as in some projects, the client may require the services of nominated subcontractors). So, in China, there is less separation between subcontracting and general contracting as compared to the situation in other countries.

(2) Engineering/Design

Xu *et al* (2004) reported that the revenue growth rate of engineering/design sector was about 20.67% in 1999 and the net profit growth rate was 3.97%. Although these growth rates are not as high as the general contracting sector (which records an

average output growth rate and profit growth rate of 29.63% and 26.22% respectively from 1997 to 2003), many main contractors still opt to vertically integrate into this sector. This is because in project delivery systems such as the EPC and the Design-Build contracts, in-house design ability is a key to winning a contract.

(3) Construction Equipment/Materials

Most Chinese construction companies buy their own equipment rather than leasing or renting. It is also relatively rare for firms to vertically integrate into equipment manufacturing. As a result, construction equipment manufacturing has only a weak link to the mainstream construction industry in China (Chen, 1998). Compared to the equipment sector, it is a different situation for construction materials. In general, construction materials account for 60% of total construction costs. The average after-tax net profit margin of the construction materials sector was 3.2% in 2002 (Xiang, 2003), higher than the 1.94% average net profit margin of the overall construction industry (refer again to Figure 1.2). Attracted by a higher return and at the same time aiming to reduce their reliance on building material suppliers, some construction companies have chosen to backward integrate into construction materials manufacturing. Lan and Jackson (2002) reported that in Shanghai, 20% of ready-mixed concrete and 25% of plasterboard in the market are manufactured by the Shanghai Construction Group (SCG), which is a general contractor itself.

(4) Real Estate Development

The real estate sector has developed very rapidly in the past decade. In 2002, the growth rate of total revenue stood at 29.4%, the average pre-tax profit margin was 8.8% and the average net profit margin was about 3.6%. The corresponding figures for the construction industry for the same year were 21%, 5.36% and 1.94% in 2002 respectively. Again, spurred by the higher growth and profit prospects, some construction firms are exploring opportunities to expand into the real estate development sector, despite the fact that property prices in some areas, such as Shanghai, have reached worrisome levels that warrant government intervention.

Overall, the market conditions of the related sectors discussed above indicate that

large companies may adopt a vertical integration strategy to venture into upstream and/or downstream sectors in the value system to increase their revenue and profitability.

4.5 Project Procurement Systems of the Chinese Construction Industry

In China, there are mainly three kinds of bidding processes: (1) Opening Bidding, in which the client call for tender in different public media, and any contractor may ask for the bidding documents and submit its tender for the project; (2) Selective Bidding, in which the client develops a short list of contractors whom he considers qualified to undertake the work and each of these contractors is asked to submit its bid; (3) Negotiation, which is usually adopted when the documentation necessary for bidding is incomplete, or when the client wants the contractor's advice on certain aspects of the project.

Under the above procurement system, the first type – opening bidding, refer to price as the single most important factor and many contracts are awarded on the basis of lowest tender. Therefore, many Chinese construction companies have chosen to pursue the cost leadership strategy in order to match with the nature of this bidding system. Besides price, however, quality and credibility are increasingly becoming a client's major concerns. Wang (2004) points out that in China, a client may pre-qualify bidders by factors such as their past construction performance, technological capability, project management competencies and reputation. The client would then invite only qualified contractors to bid and this applies to the second and third type of bidding processes. In the bidding stage, those factors usually account for a certain percentage in the final bid evaluation. Therefore, the degree of product differentiation of construction firms has a certain impact on winning a contract, although the percentage of these non-price factors in bidding evaluation varies from project to project. Thus, other than the cost leadership strategy, a construction firm may also explore the differentiation strategy to cope with the bidding system. The differentiation strategies are often supported by quality

improvement, reduction of project delivery time, innovation and strong reputation.

The above discussions only address the formal procedures of selecting contractors by the clients. In China, some other procedures also exist, some of which may not be very transparent.

Lu (2003) highlighted a special phenomenon in the Chinese bidding system – 'tendering show'. When putting up a 'tendering show', the client of a public project has in fact already selected a contractor before following up with a tendering process just to show compliance with the *Tendering Law*. Very often, the reason for the client to do so is due to local protectionism and even corruption. Lu (2003) further states that the reason that tendering shows continue to exist is simply due to the lack of proper institutional arrangements in China.

The 'tendering show' in essence is an unfair and non-transparent procedure to select contractors illegally. Ironically, one way to cope with this phenomenon is to build 'Guanxi' with these government officers / clients to differentiate a firm from the other competitors. Many government officers / clients select contractors based on their Guanxi with the contractors; they would award projects to those who have maintained a close relationship with them. Thus, it may be said that Guanxi is one important resource to support construction firms to differentiate themselves from their competitors, although a clear line should also be drawn so that they do not engage in any unethical conduct.

In summary, in order to cope with the characteristics of these procurement systems, the Chinese construction companies may want to adopt the cost leadership strategy to win the contract based on their price. Besides, the companies also need to pursue the differentiation strategy to distinguish themselves from their competitors. Many clients evaluate the contractors according to their reputation, project management competency, technological and innovative capabilities and financing capability, some even consider their Guanxi with the contractors. Thus, these resources and competencies support the companies to differentiate themselves to win projects.

4.6 Impact of WTO on the Chinese Construction Industry

With China's accession to the WTO in 2001, the Chinese government is committed to open up the construction market to foreign companies. This has created a lot of impact to the Chinese construction industry.

On the positive side, the Chinese construction industry will benefit in many aspects after China's accession to the WTO. One major benefit is that with fewer trading limitations and industry barriers, more international enterprises would make direct investments and set up factories in China to utilize their resource superiority (Liu and Wu, 2000). This will increase the total market volume, making the total output value grow rapidly. Considering the significant positive relationship between the output growth rate and pre-tax profitability growth rate (discussed earlier in Section 4.4.2), a market that enjoys a rapid growth may spur the growth of profitability on average.

Another main benefit is the pressure on the Chinese government to make improvements and amendments to the laws and regulations to meet the requirements of the WTO (Steward and Jiang, 2004). This will diminish those problems mentioned in Section 4.1 that are related to the regulatory aspects.

On the negative side, the Chinese construction industry will face many challenges after the WTO accession. One of biggest challenges is the reduction of prohibitions and barriers for direct entry by foreign competitors. Therefore, the local Chinese construction companies have to confront strong competition from the foreign construction enterprises. Compared to the Chinese construction companies, the foreign companies possess stronger competitive advantage in terms of capital, technology, and project management capability (Liu and Wu, 2000). Therefore, in order to cope with the strong competition, the Chinese companies should cultivate their own capability in project management, technology, and financial management.

4.7 Summary

The Chinese construction industry has been growing rapidly since recent years. Nevertheless, the companies in the industry still suffer from a low degree of profitability. This chapter examines the degree of competition and possible problems in the Chinese construction industry at the macro level. From the analysis, it could be found that the industry is mainly affected by the following industry conditions: (1) High degree of government intervention and an under-developed regulatory and legal systems; (2) Excessive competition in the market; (3) Low ratio of high quality projects, lack of technological advancement and inefficient asset turnover; (4) Disparity of profitability and risk levels among different markets/regions/value systems; (5) Inefficiencies and irregularities of procurement systems; and (6) the impact of WTO.

With the discussions on the above industry conditions, the chapter provides some suggestions on the ways to cope with these unfavorable conditions. It is suggested that companies in the Chinese may explore some of the identified competitive strategies and build up some important resources and competencies (iRCs). These are now formally rephrased as a couple of hypotheses:

Hypothesis 1: Companies could achieve better performance by pursuing several types of competitive strategies. These potential strategies include cost leadership, differentiation, market/product diversification, geographical diversification and functional/vertical integration.

Hypothesis 2: Companies could achieve better performance by building up their strength in several important resources and competencies (iRCs). These iRC variables may include Guanxi resources, technological and innovative capabilities, financial capabilities, project management competencies, and reputation.

Chapter 5 Case Studies of Research Variables

5.1 Introduction

In Chapter 4 – Analysis of the Macro and Industrial Environment, five types competitive strategies and five iRC variables have been identified. It is proposed that companies can achieve better performance by pursuing these competitive strategies, cultivating and managing the development of these iRC variables. Nonetheless, there are still some issues that remain unsolved at this juncture:

(1) The analyses in Chapter 4 have not shown how the Chinese construction companies could implement these competitive strategies in order to attain competitive advantages;

(2) The ways that iRC variables function to support these competitive strategies would require further studies;

(3) It is logical to study the characteristics of these iRC variables as exemplated by some of the more successful Chinese construction companies, so that lessons can be learnt from these companies;

(4) It is also logical to suggest that most of the iRC variables cannot be cultivated spontaneously – they are indeed supported by some other variables. The relationships between the iRCs and these other variables need to be developed.

The objective of this chapter is to draw practical evidence from the case studies of 12 Chinese construction companies that have been identified as success cases in China. The tasks would include summarizing the potential relationships among the identified variables and constructing a series of hypotheses. These hypotheses will be verified using the survey results outlined in Chapter 6. In fact, the content of research questions in the survey comes from the understanding of the characteristics of variables gathered from the case studies in this chapter. Effectively, this chapter is an intermediate step to move from the external environmental analysis (Chapter 4) to the internal analysis before testing the hypotheses in Chapter 6.

A preliminary framework is presented in Figure 5.1 so as to guide the reader

through the various components that will be studied in this chapter. Specifically, the left-hand-side box has already been addressed in Chapter 4. The scope of this chapter continues toward the right in identifying specific variables that fall under the group of: (1) competitive strategies; (2) iRC variables; and (3) Strategy Organization (S&O) variables.

There are a great many strategic variables that have been proposed and studied in the management literature. In reality, this research cannot focus on all the variables in past literature. The basic ideas of competitive strategies and iRC variables were first mentioned in Chapter 2 and Chapter 4, and their details will be further elaborated in this chapter. The idea of S&O variables come from Cheah (2002)'s conceptual model (see Section 2.4.3). The purpose of introducing the S&O variables here is to examine whether some of these S&O variables might support the iRC components. In fact, not all the S&O variables (nine in total according to Cheah's model) would support the iRC variables. Later, it will be suggested that only four S&O variables, namely, Human Resource (HR) Strategy, IT Strategy, Organizational Structure and Organizational Culture would potentially support the iRC variables, which is depicted in Figure 5.1.

The discussion of the case companies is organized based on themes rather than centering upon each of the companies. This is because the amount of data and evidence gathered from each company varies. Some companies, for example, excel in the aspect of technological innovation and therefore much information can be gathered on their technological and innovative capabilities. On the other hand, for the same companies, it may not be possible to extract much information on other iRC variables. So, collectively as a whole, it is more meaningful to present the findings of the case analyses based on selected themes of strategic management.

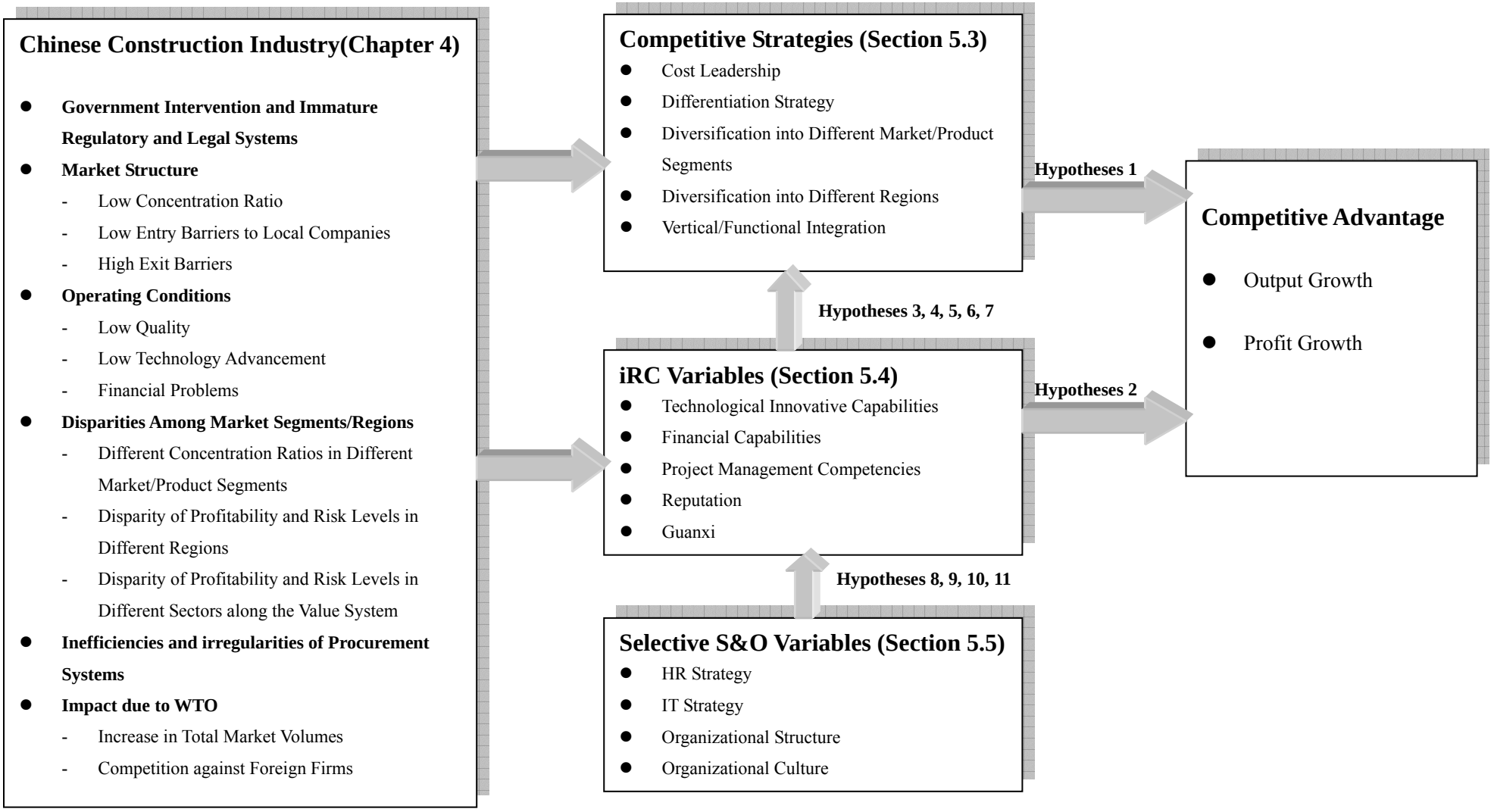

Figure 5.1 Preliminary Conceptual Model Based on the Analysis of Chinese Construction Industry and Case Studies

The structure of this chapter is also outlined in Table 5.1. In each section, the significance of each theme will first be explained according to its relevance to strategic management theories. These are then supplemented by evidence gathered from the case companies so that meaningful observations can be drawn. Then, potential relationships that exist among the variables are proposed based on these observations, which finally lead to the construction of Hypotheses 3-11.

Table 5.1 The Outline of Chapter Five

Section	Contents	Purpose
5.2	**Background of case companies**	Provides the outlook and some background information about the case companies
5.3	**Case Analyses of Competitive Strategies**	(1) Identify the case companies' activities in implementing each competitive strategy; (2) Identify how the iRC variables could support each competitive strategy based on the evidence of the case companies; (3) Construct hypotheses 3-7 that are related to the competitive strategies.
5.3.1	Cost Leadership	
5.3.2	Differentiation	
5.3.3	Competitive Scope ● Market/product Diversification ● Geographical Diversification ● Functional/Vertical Integration	
5.4	**Case Analyses of iRC Variables**	(1) Identify the characteristics of each iRC variable based on the observations drawn from the case companies; (2) Identify the relationships between each iRC variable and other supporting variables (which include other iRC variables and S&O variables); (3) Construct hypotheses 8-11 that are related to the iRC variables
5.4.1	Technological and innovative capabilities	
5.4.2	Financial capabilities	
5.4.3	Project management competencies	
5.4.4	Reputation	
5.4.5	Guanxi resources	
5.5	**Case Analyses of S&O Variables**	Identify the contents of these selected S&O variables based on the observations drawn from the case companies.
5.5.1	HR Strategy	
5.5.2	IT Strategy	
5.5.3	Organizational Structure	
5.5.4	Organizational Culture	
5.6	**Summary**	Presentation of the conceptual model

5.2 Outlook and Background Information of Case Companies

5.2.1 Firm Sample

A total of twelve large Chinese construction companies were selected based on their relatively strong performance and local reputation in China. All these companies belong to the First Class Qualification as defined in Chapter 1. These twelve companies are:

- China HuanQiu Contracting & Engineering Corporation (HQCEC)
- China Non-ferrous Metal Industry's Foreign Engineering & Construction Co. Ltd. (NFC)
- SINOPEC Engineering Inc. (SEI)
- Sinohydro Corporation (Sinohydro)
- China State Construction International Co. Ltd. (CSCIC)
- China Petroleum Engineering and Construction Corporation (CPECC)
- Tianjin Construction Engineering Main Contracting Co. Ltd. (TCEMC)
- China Harbour Engineering Company Tianjin Port Construction Corporation (CHEC-TPCC)
- Beijing Urban Construction Engineering Co. Ltd. (BUCEC)
- Shanghai Construction Group (SCG)
- China Railway Erju Co. Ltd (CREC)
- CITIC International Contracting Inc (CICI)

Among them, three are regional companies based in Shanghai, Beijing, and Tianjin; the others are national wide companies. The general background information of each company is compiled in Appendix B.

5.2.2 Data Collection

During the case study process, interviews were conducted with senior and middle-level managers and documentations were collected from these companies. The profile of the interviewees is listed in Table 5.2 on the next page.

The data collected from each company is recorded using an analytical template,

which is designed to organize all collected data in a systematic fashion. The analytical template is divided into four main components: (1) Financial information; (2) Observations on competitive strategies; (3) Observations on iRC variables; and (4) Observations on S&O variables. Appendix C presents the case of HQCEC as one example to show the structure of the analytical template.

Table 5.2 Profile of the Interviewees

	Company	**Designation**	**Years of Experience**	**Headquarter Location**
1	HQCEC	Business Department Manager	16 years	Beijing
2	NFC	Vice President	20+ years	Beijing
3	SEI	Project Manager	4 years	Beijing
4	SINOHYDRO	Senior Project Manager	6 years	Beijing
5	CSCIC	Project Manager	3 years	Beijing
6	CPECC	Deputy Manager in Strategy Department	12 years	Beijing
7	CHEC-TPCC	Manager in Business Department	20+ years	Tianjin
8	BUCEC	Financial Officer	14 years	Beijing
9	SCG	Project Manager	12 years	Shanghai
10	TCEMC	Financial Officer	20+ years	Tianjin
11	CREC	Project Manager	6 years	Sichuan
12	CICI	Project Manager	8 years	Beijing

5.2.3 Financial Outlook of Selected Case Companies

To give a general outlook of the financial performance of some of the case companies, the financial ratios of six case companies are presented in this section. These six case companies include: HQCEC, NFC, CREC, BUCEC, SCG, and CICI. The selected ratios include profitability ratio, leverage ratio, and liquidity ratio. The figures presented here are average values from 1999 to 2004. The details are shown in Table 5.3.

Table 5.3 Financial Ratios of Selected Case Companies

Year	HQCEC	NFC	CREC	BUCEC	SCG	CICI
Profitability Ratio						
Pre-tax Profit Margin	8.57%	24.43%	2.95%	7.35%	4.94%	N/A
Net Profit Margin	5.76%	10.53%	2.60%	5.75%	4.76%	5.88%
Return-on-Assets(ROA)	12.63%	5.97%	3.39%	7.35%	4.85%	N/A
Return-on-Equity(ROE)	9.21%	5.13%	6.66%	9.38%	6.42%	7.36%
Leverage Ratio						
Debt-to-Asset	0.08	0.38	0.54	0.70	0.27	0.47
Liquidity Ratio						
Current Ratios (Current Asset/Current Liabilities)	10.02	2.31	1.45	1.40	0.96	1.53
Efficiency Ratio						
Total Asset Turnover (Revenue/Total Assets)	1.52	0.23	1.16	0.77	0.99	0.93

From this table, some observations can be made:

(1) In general, almost all the companies have a higher pre-tax profit margin and after-tax net profit margin than the average Chinese companies (which are about 4.6% and 1.5% respectively, seeing Chapter 1). The only exception is CREC, whose pre-tax profit margin of 2.95% is lower than the average, but its net profit margin of 2.60% is still higher than the average. This supports the fact that the case companies selected here are generally the more successful ones.

(2) Companies with a higher pre-tax profit margin tend to have a higher net profit margin as well. This supports the conclusion from Figure 4.9 earlier. Among these 6 case companies, NFC has the highest pre-tax profit margin (24.43%) and after-tax net profit margin (10.53%)

(3) HQCEC has the highest ROA (12.63%), ROE (9.21%), and total asset turnover (1.52), which indicate good and efficient use of assets to generate high return.

(4) HQCEC has the lowest debt-to-asset ratio (just 0.08) and highest current ratio (10.02). This implies that the growth of HQCEC is supported more by equity rather than financial leverage.

This table indicates relatively good financial performance for these case companies. In particular, HQCEC stands out to be a particularly successful company to study in even more detail.

5.3 Analysis of Competitive Strategies

As part of the entire model, Figure 5.2 shows the components that will be discussed in this section. In general, competitive strategies include cost leadership, differentiation and also the scope of competition (Porter, 1985). These themes of competitive strategies will be examined together with their relevance to the case companies.

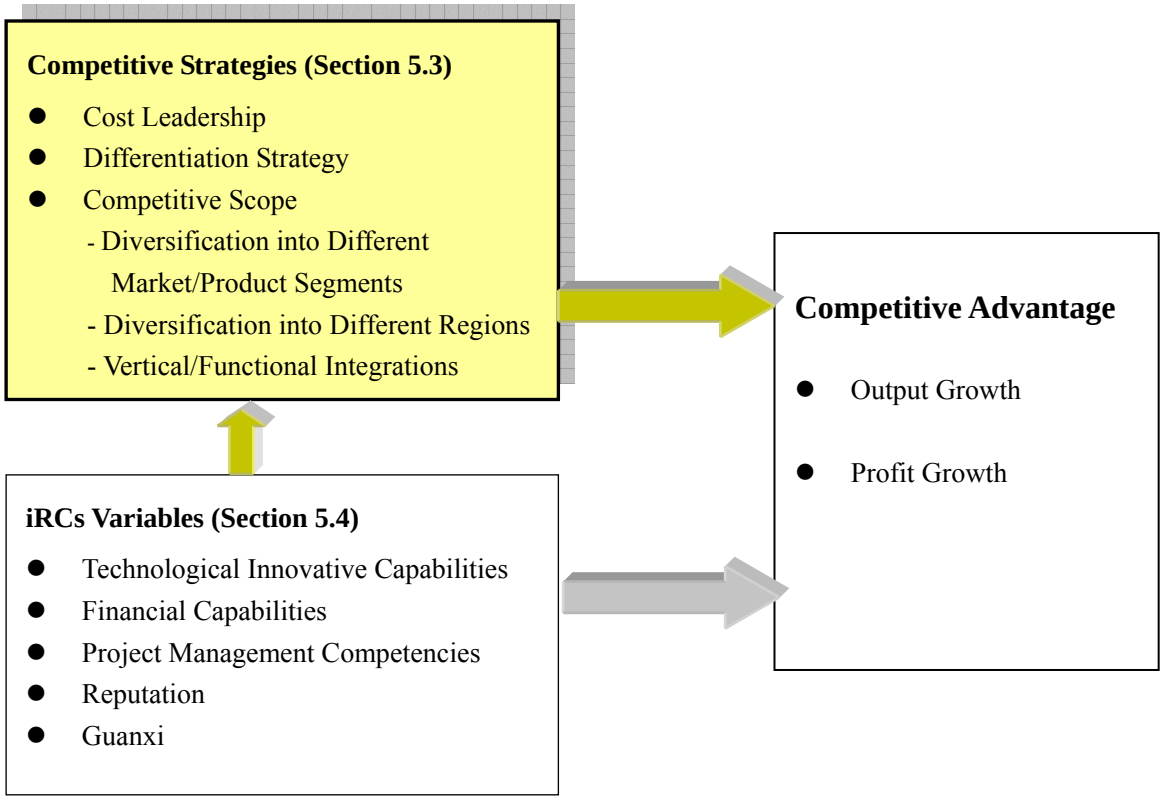

Figure 5.2 Components of Interest in Section 5.3

5.3.1 Cost Leadership Strategy

A cost leadership strategy requires management to focus its attention on competing on cost. This necessitates that systems and procedures are directed totally towards controlling cost (Male and Stock, 1991).

During the case study process, it is sometimes difficult to determine whether a particular case company is indeed having a cost advantage over its competitors. It is also difficult to know whether the bidding price of a company is greater than the project cost, since some companies intentionally bid at a very low price just to secure the

contract. Thus, in the context of this research, a firm is considered to be pursuing a cost leadership strategy when it possesses a proper system of cost control activities. Looking at the case companies, it is found that Sinohydro, CSCIC, CHEC-TPCC, BUCEC, SCG, TCEMC and CREC are the seven companies that particularly emphasize on cost control and try to pursue the cost leadership strategy.

The possible reason for the above mentioned companies pursuing a cost leadership strategy could be explained by their focus on traditional AEC projects, particularly building construction (except for Sinohydro). For most traditional AEC projects, design and construction are segmented during the procurement process, and many contracts are awarded on the basis of lowest price. Other types of projects, such as petrochemical plants, nonferrous metal exploration, environment engineering, highways, and power plants usually adopt the EPC or BOT contracting approaches. For these types of projects, price is not the most important factor to be considered when awarding the contracts. Thus, these companies that tender many of their projects in the traditional design-bid-build contracting mode would be inclined to pursue the cost leadership strategy.

When interviewing the above mentioned companies, it was found that most of the cost controlling activities can be categorized into 5 types: (1) Materials and equipment cost control; (2) Manpower cost control; (3) Cost control during the construction process; (4) Subcontracting cost control ; (5) Administrative cost control. Item (1) – (4) fall under the domain of *project management*. One example of the case companies that possesses a good system in controlling the cost of project management is CHEC-TPCC. CHEC-TPCC uses an 'objective cost control' method to control these four items. According to Yan (2004)'s definition, 'objective cost control' simply means that an enterprise should minimize every cost activities while maximizing the objective profit. CHEC-TPCC's cost controlling activities under the project management domain include: (1) allocating manpower to reduce the cost according to the characteristics of different projects stages throughout the construction process; (2) analyzing the price tendency of materials and equipment before the start of project, and maintain flexibility on allocating materials and equipment according to the projected schedule of each

project / a group of projects.

The reduction of administrative cost, which is mainly the overhead cost, is often achieved through proper financial management policies. In case of CHEC-TPCC, relevant activities include setting up a total budgeting system, enhancing internal auditing, and establishing measures that help to raise "red flags" in case of non-compliance in order to reduce financial risk.

From above discussions, it is suggested that the iRCs of *project management competencies* and *financial capabilities* would directly support the cost leadership strategy. In addition, some researchers in China also point out that *technological innovation* also plays a significant role in reducing project cost. Gao (2004) illustrated that through technological innovation, new materials and techniques are introduced into the construction industry. This helps to improve productivity while lowering the project cost. For example, Sinohydro invented 'PBM Concrete with Fibre Reinforced Polymer Reinforcement' and develop a proprietary technique of roughening concrete finishes to create a new texture. It is claimed that innovative efforts have helped the firm to reduce the cost of its projects in dam construction.

In summary, based on the observations in this subsection, Hypothesis 3 is deduced:

H3: The cost leadership strategy is supported by the iRC variables of project management competencies, financial capabilities and technological innovative capability.

5.3.2 Differentiation Strategy

Following Male and Stocks (1991)'s definition, Differentiation is concerned with creating something that is perceived by the buyers as unique. It implies that a firm offers something unique and unmatched by its competitors and valued by the industry that enables the firm to command higher prices than industry average (Kale, 1999).

Observations from the interviews suggest that the case companies may pursue the

differentiation strategy in the following aspects, as listed in Table 5.4:

Table 5.4 Observations of Differentiation by the Case Companies

	Company	Guanxi	Project management competencies	Technology and innovative capabilities	Financing capabilities	Reputation/ Brand Name
1	HQCEC	√	√	√	√	√
2	NFC	√	√		√	√
3	SEI	√	√		√	√
4	SINOHYDRO	√		√		√
5	CSCIC	√	√		√	√
6	CPECC	√			√	√
7	CHEC-TPCC	√		√		√
8	BUCEC	√		√	√	√
9	SCG	√	√	√	√	√
10	TCEMC	√		√		√
11	CREC	√	√	√	√	√
12	CICI	√	√		√	√

From Table 5.4, it can be deduced that:

(1) All the case companies possess the Guanxi resource. As stated in Section 4.5, many government officers / clients select contractors based on their Guanxi with these contractors. Evidence drawn from the case companies confirm this view and show that Guanxi is one important advantage to differentiate these companies from their competitors.

(2) Reputation / Brand name is another important resource possessed by all of the case companies to differentiate themselves from their competitors.

(3) In general, companies that have their core businesses in the traditional AEC contracting type of projects mostly develop their technological and innovative capabilities as a core competency to compete against their competitors. These companies include: Sinohydro, CHEC-TPCC, BUCEC, SCG, and TCEMC, and CREC.

(4) In general, companies that have their core businesses in projects of other contracting types, such as EPC and BOT projects, would develop their project management competencies as a key iRC. These firms include HQCEC, NFC, and SEI.

(5) Technological and innovative capabilities and project management competencies

are not mutually exclusive. Some companies such as HQCEC, SCG, and CREC possess these two iRCs at the same time.

(6) Most of the publicly listed companies have strong financing capabilities, such as NFC, BUCEC, SCG, and CREC. Beside publicly listed companies, other companies such as HQCEC, SEI, CPECC, and CICI, have established good Guanxi connection with financial institutions to enhance their capabilities in securing financing.

Based on the observations listed above, Hypothesis 4 can be deduced:

H4: The differentiation strategy is directly supported by the iRC variables of Guanxi resource, project management competencies, technological and innovative capabilities, financial capabilities and reputation.

5.3.3 Competitive Scope

5.3.3.1 Observations from the Case Companies

By and large, the *scope of competition* can vary along three dimensions: *market/product, geography* and *function* (Cheah, 2002).

Consider the case of China Railway Erju Co. Ltd (CREC). Its main market/product segments are railway construction and toll road construction, which account for 27% and 28% of CREC's total revenue respectively in 2003. CREC also diversifies into some other types of projects, such as building construction, hydraulic projects, municipal works, etc. The shares of different market segments in terms of CREC's revenue in 2003 are listed in Figure 5.3.

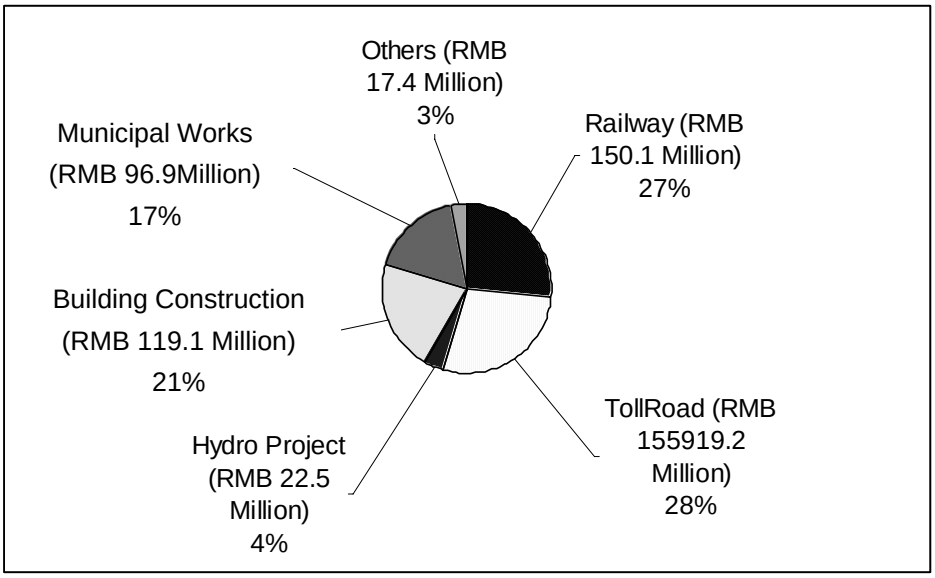

Figure 5.3 Market/Product Segments of CREC in 2003
Source: Chen (2003)

CREC also pursue vertical integration into different sectors or industries, which include backward integration into construction materials/equipment manufacturing, and forward integration into real estate development and the transportation industries. The main industries that CREC is involved and the shares of each market in 2003 are listed in Figure 5.4.

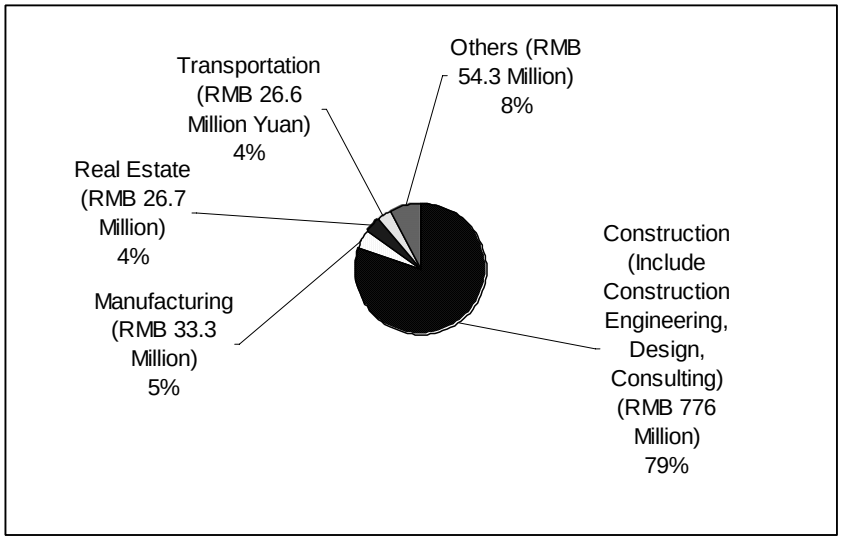

Figure 5.4 Vertical Integration of CREC in 2003
Source: Chen (2003)

Along the dimension of geography, CREC's main business covers the Sichuan Province, which is located in the southwest of China. Its local market revenues account for 44.56% of total revenues. As suggested in Chapter 4 (Section 4.4.2, Page 69), companies competing in the eastern coastal regions on average enjoy a higher growth rate of output value and higher profit margin. CREC has chosen to diversify into these regions, which account for 44.1% of its total revenues. The share of revenue by regions of CREC in 2003 is shown in Figure 5.5.

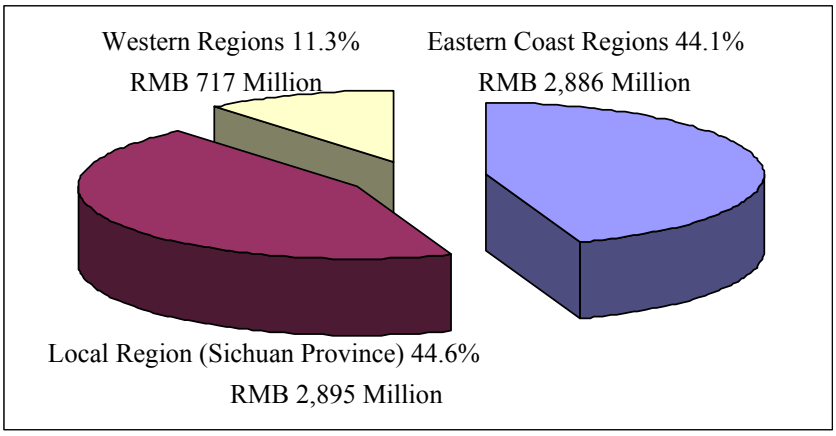

Figure 5.5 Revenues by Regions of CREC in 2003
Source: Chen (2003)

Besides CREC, many of the other case companies have also chosen to diversify into different markets/products, geographies and vertically integrate into different functions along the value systems. Table 5.5 summarizes the competitive scopes of these case companies. Some of the important observations are as follows:

(1) Most of the companies adopt a market/product diversification strategy to venture into different types of projects;

(2) Some companies, such as BUCEC, SCG, TCEMC, choose to compete mainly in their local markets. Conversely, other case companies are willing to diversify into various regions in China, especially the eastern coastal region, which has seemingly higher rates of output growth and profitability.

Table 5.5 Scope of Competition of Case Companies

	Company	Market/product	Geography	Function
1	HQCEC	Petrochemical; Chemical; Power Plant; Environment engineering; Infrastructure; Building	Thirty provinces, cities and autonomous regions, as well as southeastern Asia, Western Europe, America and Middle East.	Material Supply; Engineering Design and consultancy; Owner/Develop/Equity Investment
2	NFC	Nonferrous metal exploration; Building	Beijing, Middle East Asia, Mongolia,	Developer and supplier for nonferrous metal; Real Estate
3	SEI	Petrochemical; Environment engineering; Infrastructure; Building	Beijing, Fujian, Hubei, Heilongjiang, (Most eastern coast and central regions)	Design; Supervision; EPC contracting; Geotechnical investigation
4	Sinohydro	Hydropower projects; roads; airports; harbors; buildings environmental engineering	15 provinces, among them 6 in eastern coast regions, 7 in central regions, and 2 in western regions	Engineering Design and consultancy; Investment and Real Estate
5	CSCIC	Building; road and bridge; light rail works; dam and irrigation works; power plant and environment engineering	North China, East China, Southwest China, Northwest China, Northeast China and South China; Overseas: Singapore, Algeria, Botswana, US, Japan, Korea, Russia, Germany, Barbados and Ireland	Project financing and development; design; Technical development; Real Estate
6	CPECC	Petroleum and petrochemical projects; buildings; roads and bridges	Beijing, Qingdao, Zhuhai (All in eastern coast regions); more than 40 foreign countries	Consultancy; Design; Import and Export of technologies, equipment and materials
7	CHEC-TPCC	Shipyard; Harbor; Airport; Highway	Tianjin, Dalian, Qingdao, Qinhuangdao (All in eastern coast regions)	Supervision
8	BUCEC	All kinds of civil and industrial construction, municipal works, subway, highway, airport and real estate development, etc	Beijing	Real Estate; Financing; Manufacturing;
9	SCG	Civil Engineering; Commercial Building; Steel Structural Works	Shanghai; Overseas	Manufacturing of construction materials and equipment; supervision Real estate development
10	TCEMC	Civil Engineering; Commercial Building; M&E services	Tianjin	Steel component fabrication; Construction technology development and consultancy; Real estate development
11	CREC	Railways, Toll Roads, Water conservation projects, Power projects	19 different regions in China, most in eastern coast regions and central regions	Design; Transportation; Equipment Manufacturing, Real Estate
12	CICI	Energy supply, railways, subways, road and bridge, dams, buildings (include special buildings, such as gyms, golf courses.	Beijing, Xi'an, Tianjin ,Ningbo (Mainly eastern coast and central regions) and overseas (Hong Kong)	Technological Services;

(3) 10 out of 12 case companies choose to functionally integrate into project-related functions, such as supervision, engineering design, project consultancy, project financing, and construction-related technology service. Only 4 out of 12 case companies pursue a backward integration strategy into construction materials and equipments manufacturing. 9 out of 12 case companies forward integrate into real estate development or other types of development. Thus, this shows that the functional/vertical integration strategy is widely adopted by these case companies.

5.3.3.2 Motivation behind Expansion of Competitive Scope

In short, it is found that most of the case companies either pursue horizontal diversification into different markets/products and regions or vertical integration into different functions along a value system/vertical market.

One possible reason for construction companies pursuing a horizontal diversification strategy is that: there is a need for construction companies to spread risks and especially to reduce fluctuations in their revenue, which may be either seasonal or cyclical (Hillebrandt and Cannon, 1989). The portfolio theory of diversification suggests that horizontal diversification is undertaken to increase the stability of profits by spreading risks or reducing the proportion of high risk businesses in the portfolio of the company. Hillebrandt and Cannon also suggested two ways in which contractors can create a more stable situation. One way is by securing demand for a new product – in this context diversify into different markets/products; the other way is by spreading operations across different geographical regions. In this way, the ups and downs of different market/products and regional cycles do not necessarily synchronize.

Another possible reason for pursuing horizontal diversification is to fully create synergies among operating and management activities. Operating synergies utilize common facilities, personnel, overheads, learning curves or inputs. Management synergy refers to the transfer of management experience and skills across businesses.

The reasons for pursuing the vertical integration strategy, on the other hand, can be

explained by the following reasons:

(1) Reducing operational uncertainty.

Some of the case companies integrate functions of construction materials/equipment manufacturing or other construction-related services, such as engineering design and consultancy services. One major purpose of this strategy is to reduce operational uncertainty during the construction process. Vertical integration is more likely to happen when there is a high degree of uncertainty in the firm's environment and when transactions recur frequently so that transaction costs would be high. Thus, this strategy is often adopted to reduce the risks related to the construction process, such as long delivery time for construction materials, low quality design services, etc.

(2) Increasing profitability.

As discussed in Chapter 4 (Section 4.4.3, page 73), the average Net Profit Margin (NPM) of engineering/design, construction equipment/materials, and real estate are generally reported to be higher than the NPM of pure construction works. So, some companies may be pursuing the vertical integration strategy to seek for a higher return.

Overall, probably the most important reason for companies to adopt a diversification or integration strategy may be linked back to the objectives of the firm – pursuing growth, either in terms of profitability or total revenue.

5.3.3.3 Relationships between Competitive Scope and iRC Variables

(1) Competitive Scope and Guanxi (Relationship)

A client may be involved in different types of business activities in different regions. Thus, building a close relationship or Guanxi with clients helps to diversify into those markets/projects and regions in a natural, effective and less risky manner.

A case that illustrates Guanxi as a supporting iRC for the horizontal diversification strategy is CSCIC. CSCIC had formed long-term collaborations with many foreign clients, such as Aventis from France, ABB and Ericsson from Sweden, Bayer, Lufthansa and Siemens from Germany, Epson from Japan, Nokia from Finland, and

Hines from U.S.A. CSCIC managed to acquire different types of project and enter into different regions through these long-term relationships. For example, after building the pharmaceutical factory of Bayer in Beijing, CSCIC continue to carry on with other projects of Bayer, such as the Shanghai Chemical Industry Park Ⅱ and Ⅲ. After successfully completing the Embassy House project of Hines, CSCIC also secured another project from Hines - the Beijing Park Road project.

Besides having Guanxi with private sector clients, building up Guanxi with the local governments can also help to strengthen the geographical diversification strategy. As discussed in Chapter 4, some local governments raise up the entry barriers to discourage competent competitors coming from outside of their region. To overcome this barrier, Guanxi with the local governments becomes an important resource.

Guanxi with government is also related to the vertical integration strategy, especially forward integration into real estate development. Zhou (1994) suggested that real estate development in China would involve many different government authorities, such as city planning, land authority, electrical power authority, etc. Considering the political problems discussed in Chapter 4 (Section 4.1, page 45), in order to minimize the uncertainty in the development process, companies need to build Guanxi with various government authorities before entering into the real estate sector.

All in all, the case evidence suggests that Guanxi may provide a direct support to diversification and integration.

(2) Competitive Scope and Project Management Competencies

Obviously, all projects require strong project management competencies for execution. Naturally, most generic types of project management competencies would support a company to diversify into various markets/products segments. Also, with strong project management competencies, a company can undertake complex projects in regions where local companies have weaker competencies to execute the job. Thus, the iRC of project management competencies could also support a company to diversify into different regions.

(3) Competitive Scope and Technological and Innovative Capabilities

Technological and innovative capabilities can indeed help a company expand its businesses into different type of projects and regions. A good example would be SCG. SCG has strong technological and innovative capabilities in tall building, hydraulic projects, and steel structure works. It expanded its volume of businesses in these areas, including the construction of the Shanghai Lupu Bridge, which is the world's largest arch bridge with a span of 550 meters, and the construction of Jin Mao Building, which is China's tallest building as of this writing. Also, SCG was involved in the construction of the famous China National Grand Theater in Beijing. This again is mainly attributed to its technological capability in handling complex steel structure works.

(4) Financial Capabilities

Later, in Section 5.4.2 (Page 110), it will be discussed that long-term investment capabilities can also support diversification and integration strategies. Examples include NFC's '4-3-2-1' investment strategy and Sinohydro's investment in energy resources, highway projects, water and waste water projects, real estate development, etc. Thus, the iRC variable of financial capabilities can support a company's horizontal diversification and vertical integration strategies.

(5) Reputation/Brand Name

Almost all the case companies that have pursued a horizontal diversification strategy and a vertical integration strategy have strong reputations in their fields and regions. The reputation of completing high quality projects may be circulated within network of clients in different markets, regions and industries.

One example is CSCIC. CSCIC owns the brand name of "China Construction", which is highly recognized among clients from various sectors. By utilizing its brand name and reputation, CSCIC entered with relative ease into different market segments and various regions in China, including even some overseas markets. For instance, in Singapore, CSCIC secured a number of building and subway projects based on its reputation and brand name.

CSCIC also relies on this iRC for forward integration into the real estate industry. China Construction Overseas Property Co. Ltd is a subsidiary company of CSCIC, which has leveraged on the brand name of its parent company.

Based on the analysis of competitive scope for the entire Section 5.3.3, Hypotheses 5-7 can now be deduced:

Hypothesis 5: Market/product diversification is directly supported by all five iRC variables: Guanxi, project management competencies, technological and innovative capabilities, financial capabilities and reputation.

Hypothesis 6: Geographical diversification is directly supported by all five iRC variables: Guanxi, project management competencies, technological and innovative capabilities, financial capabilities and reputation.

Hypothesis 7: *Vertical integration is directly supported by three iRC variables: Guanxi, financial capabilities and reputation.*

It should be noted that, in Hypothesis 7, it is assumed that the two iRCs, project management competencies and technological and innovative capabilities, do not support the vertical integration strategy. The reason that these are not included is that project management is mostly related to the physical construction process, which is only part of the entire value chain. It is less applicable to engineering design, construction equipment and materials manufacturing. So, it does not really support a vertical integration strategy. On the other hand, technological and innovative capabilities are usually specific or unique to one part of the value chain. For example, a technology developed for steel erection does not necessarily apply to an upstream segment of the value chain, such as the production/manufacturing of steel.

5.4 Analysis of iRC Variables

As part of the whole model, Figure 5.6 outlines the components that will be studied in this section. The content of the five iRC variables, namely, technological and innovative capabilities, financial capabilities, project management competencies, Guanxi resource, and reputation, will be elaborated. The objective of this section is to identify the characteristics of each iRC variable based on the observations drawn from the case companies and also to identify the supporting variables of each iRCs.

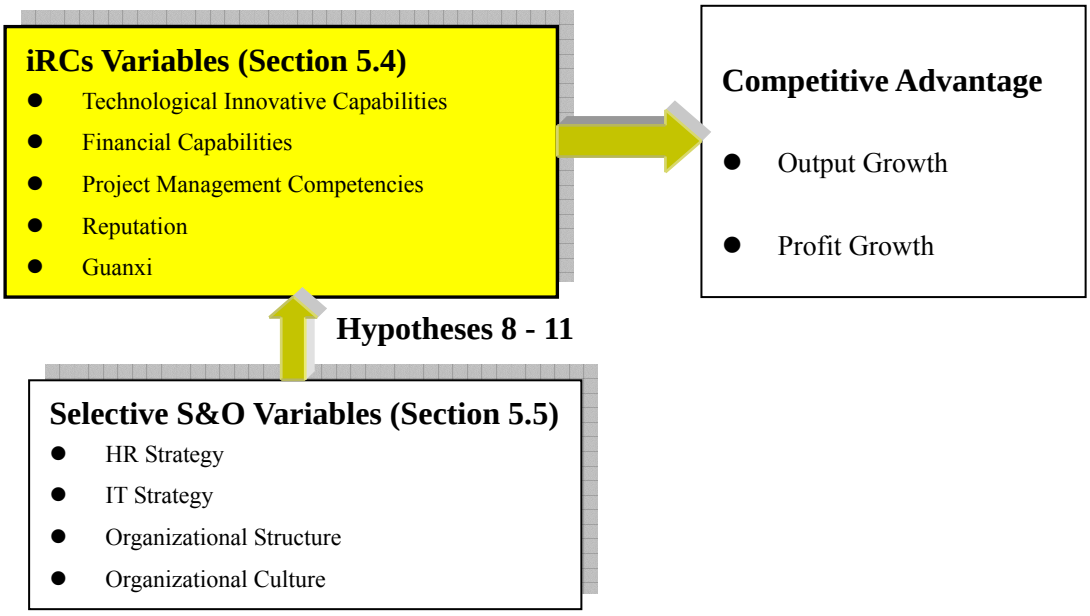

Figure 5.6 Components of Interest in Section 5.4

The structure of each sub-section of Section 5.4 is organized as follows. First, the scope covered by each of these iRC variables is discussed. Next, case evidence that helps to illustrate the features of each iRC variable is presented. It was found that each of the iRC variables is in fact supported by other iRCs or S&O variables. Evidence gathered on such linkages will also be mentioned. All these finally lead to the construction of Hypotheses 8 – 11.

It is also noticed that for each of the iRC variables, not all iRC and S&O variables would play a role in supporting that particular iRC. Therefore, only those iRCs and S&Os that play a supporting role are included in the discussion of each section.

5.4.1 Technological and Innovative Capabilities

The first iRC that will be discussed is the technological and innovative capabilities of construction firms. The aspects covered by this iRC include the types of innovation, the modes of innovation, funding amount, and others. All these are elaborated in the following sub-sections.

5.4.1.1 Benefits and Rewards related to Technological and Innovative Capabilities

Many researchers in China have confirmed the significance and benefits that can be derived from having strong technological and innovative capabilities in the Chinese construction industry (Wang and Guo, 2003; Li and Jin, 2002). Following their findings, they pointed out that by developing new technologies, techniques, materials, and equipment, which are the main elements of technological and innovative capabilities, the company would achieve the following benefits: (1) forming a strong source of competitive advantage; (2) improving productivity; (3) improving project quality, while reducing project cost; and (4) executing different types of projects.

The achievement of strong technological and innovative capabilities can be represented by the awards won by some companies. Upon studying the 12 case companies, it is found that most of them had indeed received many awards in technological innovation. Here, the awards won by SCG are listed in Table 5.6 as an example to illustrate this aspect:

Table 5.6 Evidence of Technological Advancement of SCG

Award	**Details**
National Technology Advancement Award	1 Pudong International Airport-building construction technology research
Shanghai Technology Advancement Award	1 JiangYin Changjiang River – construction techniques research on bridge installation across thousands meters
	2 Subway Ⅱ HeNanZhongLu station-tunnel protection technique
	3 3500m^3 steel natural gas tank – technical research on joints
	4 Shanghai stadium – overall construction management techniques
	5 Underground tunnel technical research
	6 Φ2700 concrete pipe manufacturing technique
	7 Research on tall building scaffold system
	8 Shanghai Yan'an Viaduct – construction of middle length
	9 Aluminum-titanium alloy structure – technical research
	10 Shanghai construction industrial standards – Pre-stressing

5.4.1.2 Types and Modes of Innovation

The types of innovation can be divided into process innovation and product innovation, as depicted in Figure 5.7.

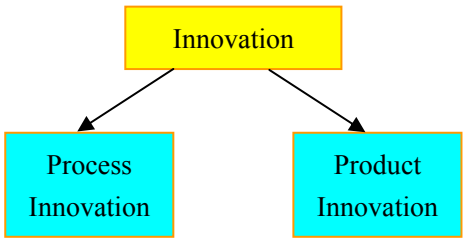

Figure 5.7 The Types of Innovation

Process Innovation is an improvement in construction methods designed to accomplish usual construction operations or to improve the efficiency of a standard operation (Tatum, 1987). It can also reduce cost and increase efficiency (Rosenberg, 1982). On the other hand, *Product Innovation* is an innovation that produces a qualitatively superior product. Research confirms that product innovation is one important advantage for creating a higher quality product (Slaughter, 1998). It can also produce qualitatively superior output (Rosenberg, 1982). The case company of HQCEC provides a good illustration of the scope of process and product innovations, as summarized in Table 5.7.

Table 5.7 The Types of Innovation of HQCEC

Type of innovation	Activities of HQCEC	Scope of Each Activity in HQCEC
Process Innovation	Optimizing and reengineering the current technical processes	Encourage employees of related tasks to use methods such as process simulation and collaboration to optimize and reengineer relevant techniques processes. Such optimization and reengineering initiatives apply to both the whole process and also specific parts of the process. The ultimate aim is to form more patents and proprietary techniques.
	Improvement on design techniques and software innovation	Encourages related departments and employees to develop computerized and standardized work for design computation. Improve externally procured software to create its own version that suits in-house needs. The purpose of these activities is to form the company's proprietary design programs and software systems.
	Development and optimization of management program and software	Encourages related departments and employees to continually improve on the current management program and software to elevate management capability and efficiency.
Product Innovation	Adding flexible modes in exploring new techniques, new products and new technologies	Encourages related department and employees, either individually or collaboratively, to develop new techniques and new products.
	Equipments and materials design and innovation	Encourages related departments and employees to explore and innovate in the areas such as the structure of facilities and equipment, development of special materials, design computation and machining techniques, ultimately leading to the company's proprietary equipment and technology
	Development and optimization of the automation control system	Encourages related department and employees to explore various control schemes, metrics, and control software. By fully utilizing commercial software and hardware platforms, company manages to form proprietary, efficient and low-cost control systems

Other than the types of innovation that a company decides to pursue, the mode of innovation selected would also affect its technological and innovative capabilities.

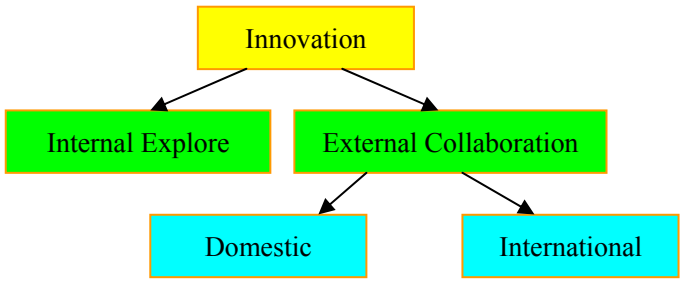

Figure 5.8 The Modes of Innovation

As Figure 5.8 suggests, the modes of innovation may include: (1) internal exploration, which means that the innovation process occurs internally within the company; and (2) external collaboration, which include two sources: domestic and international. These are discussed in more detail.

(1) Exploring new techniques and technologies internally

HQCEC relies on its design and project experience accumulated in the petroleum and chemical industry domains and couples with further studies and integration to form proprietary patents and technologies. This type of innovation would fully take advantage of the core expertise of HQCEC in technology, management and also its reputation to find the right partners. The company also emphasizes on the soft side using the policy of encouragement and incentives to motivate employees.

The selection of innovation projects is based on three conditions: 1) what the company is good at; 2) what the market needs; 3) which technology could be in the leading position in the domestic market as well as having strong competitive potential internationally.

(2) External collaboration

Similar to the Japanese's strategic alliance's strategy (Kangari, 1997), HQCEC forms external collaboration with both domestic and international partners.

Driven by increasing international competition at home, rising costs of technology development, the need to leverage scarce scientific and technical talent, and the desire to share the risks associated with the generation and commercialization of construction technology, HQCEC has begun to collaborate with high technology and manufacturing firms in cooperative technology development. HQCEC keeps close Guanxi with international licensors and engineering companies in patent cooperation as well as collaborate with domestic and overseas institutes and universities to develop advanced technology.

Collaboration efforts may be pursued either *domestically* or *internationally*. In HQCEC's context, its domestic collaboration is to explore together new techniques and technology and share the intellectual property rights. This type of collaboration would fully utilize the advantage of the engineering design and information channel of HQCEC. At the same time, HQCEC utilizes the expertise of collaborating institutes in the area of key techniques, equipment research and their abundant research capital. This helps to explore complementary strengths, resource sharing and profit sharing.

The key point of domestic collaboration, from the macro viewpoint, is to achieve the final innovation objective and also attempt to exert control over the whole innovation process. Based on this, HQCEC selectively choose suitable research institutes and collaborative parties to achieve the objectives of solving practical problems, reducing risk and getting enough research capitals in the process of innovation.

As for international collaboration, HQCEC aims to establish long-term rather than short-term relationships with foreign companies. Being relatively familiar with international engineering norms as compared to many of its Chinese counterparts, HQCEC collaborates with international companies, urging them to transfer advanced technologies and techniques into China while helping foreign companies to secure property rights and market information. A couple of these collaboration companies include DIC (Japan) and Crompton (US). This type of collaboration is a win-win situation for both parties. Foreign companies could provide HQCEC's the much needed technology and techniques, while HQCEC could provide market resources to these foreign companies (Figure 5.9).

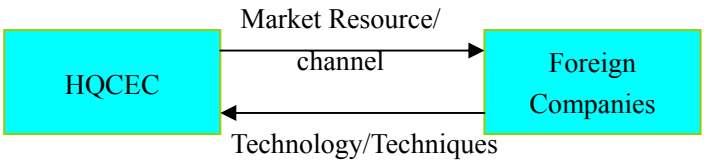

Figure 5.9 Collaboration with Foreign Companies

Besides HQCEC, other case companies have also established strong collaborations with research and higher learning institutions. Some of them include:

Companies	Partners
CHEC-TPCC	Tianjin University
CRCCG	Beijing Jiaotong University
NFC	Metallurgy Engineering Institute

5.4.1.3 Research and Development Spending

Similar to other countries, a system that develops innovative products needs to be continuously funded in China (Wang and Guo, 2003). In the case of CHEC-TPCC, the R&D expenses amount to 1% of total revenue. This figure is quite significant compared with even some foreign countries. In Japan, which is well-known for its generous investments in R&D, the ratio of R&D expenditure to value added was approximately 1%, while the ratio is generally less than 0.1% in UK (Gann, 1998). The figures for some other case companies are as follows:

Companies	R&D expenses to Revenue ratio
SINOHYDRO	0.5%
CREC	0.5%
TCEMC	1.0%

5.4.1.4 Structure of Technology and Innovation Centers

Li and Jin (2002) pointed out that medium and large Chinese construction companies often set up a special department dealing with innovation activities. The observations of the case companies confirm this view. In the case of CHEC-TPCC, the responsibility of a technology center is as follow:

(1) Gather information on the latest international harbor engineering technology

This concurs with Kangari (1997), who stated that one important factor for developing innovative construction technology in Japan is a firm's capability in gathering effective, valuable, and timely information. The purpose of this is obviously to collect a broad range of technological information from outside the company to review and evaluate new ideas.

(2) Formulate direction, objective and planning for technological innovation: Absorb, introduce, develop, spread and evaluate the new technologies.

As Slaughter (2000) has indicated, the effective use of construction innovations can be planned through a cycle of implementation stages and activities. The six stages

that are often identified in the theoretical literature and empirical studies are: 1) identification; 2) evaluation; 3) commitment; 4) detailed preparation; 5) actual use; 6) post-use evaluation. The function of technology and innovation center in CHEC-TPCC mainly follows these six stages. Its organizational structure related to technology and innovation is shown in the following figure:

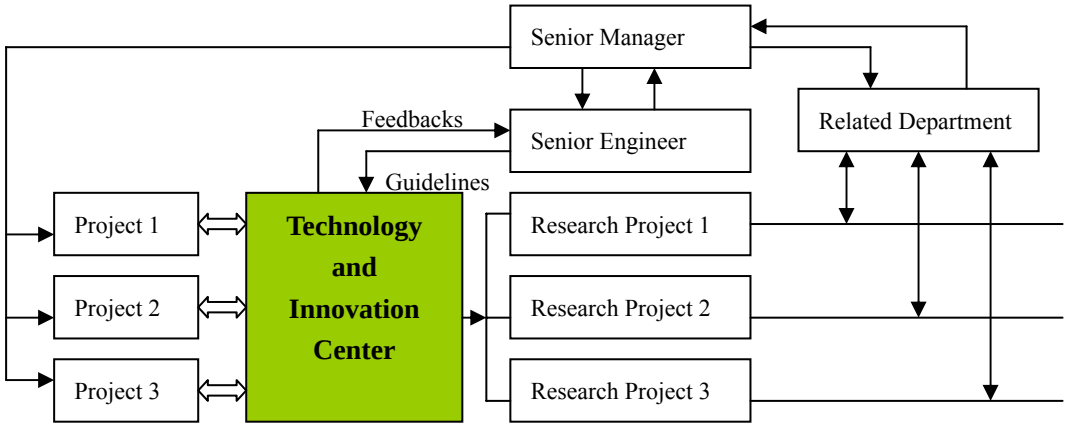

Figure 5.10 Innovation System of CHEC-TPCC

From this figure, it can be seen that technology and innovation center is the crux of the whole innovation system. The center directly receives directions from and provides feedbacks to the senior engineer. It also received specific technical requests from projects, and controlled the scope of the research projects which are supported by other related departments. Although the research projects are directly controlled by the technology and innovation center, other departments, such as engineering department, equipment department, construction and supervision department etc., are all involved in the innovation process. All these departments possess some power to determine the progress of related research projects. In some ways, the organizational structure of innovation system appears to be decentralized in nature.

As an innovation process is usually full of uncertainty, the center can only set up some general rules or directions to control the process – there are no detailed rules or handbooks. Thus, the organizational structure related to innovation also appears to be informative in nature.

5.4.1.5 Relationship between HR Strategy and Technological and Innovative Capabilities

Seaden (2003) proposed that HR strategy can influence innovation. Wang and Guo (2003) also identified that in China, optimizing human resource, enhancing training and education, and stimulating the performance of the employees are the main HR strategies to support the development of technological and innovative capabilities.

In the case of HQCEC, the firm encourages all employees in the company to take part in innovation and adopts the following HR strategies:

1) Introduce various incentives to encourage the employees' special contribution beyond the job description: innovation bonus, performance bonus, special achievement bonus.
2) By methods of sourcing, recruit professionals and graduates to make the percentage of employees with Masters and Ph.D degrees up to 20%.
3) Setting up post doctoral working stations to carry out innovation exercises and develop an innovative culture. This not only enhances training for the employees, but also maintains a strong network with universities, which serve as important sources of new recruits.

Similar methods are developed in CHEC-TPCC, especially with an incentive system to motivate the innovative enthusiasm of employees.

In the case of CSCIC, its technology center holds regular technical seminars for different trades and provides technical exchanges among various project teams so as to improve the overall technical competencies of the staff. The technology center has, both at home and abroad, carried out a program known as "The Science and Technology Promotion Model Projects", which is used as a capstone event promote technical strength within the company.

5.4.1.6 Relationship between IT Strategy and Technological and Innovative Capabilities

Some researchers in China had illustrated the importance of IT strategy to innovation (Chen, 2002). In the case of CSCIC, it establishes a database system to aid

the innovation process. In order to expedite informative progress in the courses of bidding and compilation of technical proposals, the technology center is responsible for setting up a technical database to collect useful data from various sources. The data include: technical proposals for bidding; working plan of various trades in project execution; photos at different stages; summary of construction or award-application data upon project completion; new technology, new products, new material and new workmanship promoted by the state and relevant institutions; building codes and working methods, as well as information from periodicals and institutions. All data are stored either in electronic editions or in print editions. Data like codes, working methods as well as the abstracts and contents from periodicals and institutions are stored in electronic editions that can be accessed through the company's intranet system.

5.4.1.7 Relationship between Culture and Technological and Innovative Capabilities

In the Chinese construction industry, it is important to cultivate a culture of innovation, which includes innovation spirits, involvement of all employees to innovate, and team-work spirit (Wang and Guo, 2003). This would encourage employees to participate in innovation and therefore enhance the technological and innovative capabilities of the firm. Although not substantial, anecdotal evidence drawn from the case companies show that their culture might have included the innovation aspect. For example, the content of HQCEC's visions include: 'continuous improvement in innovation, adoption and application of new technology', and that of NFC include 'long-standing commitment to innovation'.

Thus, in the context of China, organizational culture may have a role to play in supporting technological and innovative capabilities.

5.4.1.8 Summary of Potential Variables Supporting the iRC of Technological and Innovative Capabilities

Based on the discussions in the preceding sections, the iRC and S&O variables that potentially support technological and innovative capabilities are: Guanxi with research institutes and collaboration companies, financial capabilities, HR strategy, IT strategy, organizational structure and culture. This is summarized in Figure 5.11.

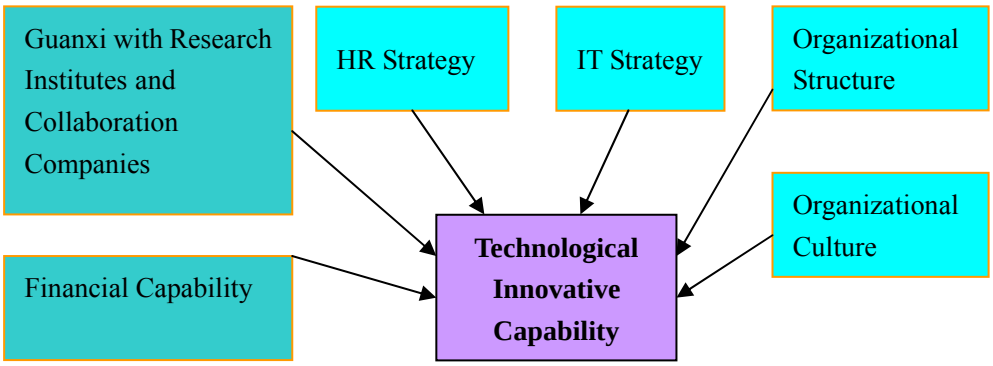

Figure 5.11 The Relationship of Innovation and Other Variables in the Framework

It also follows that Hypothesis 8 can be deduced:

Hypothesis 8: Technological and innovative capabilities is directly supported by: Guanxi resource with research institutes and collaboration companies, financial capabilities, HR strategy, IT strategy, organizational structure and culture.

5.4.2 Financial Capabilities

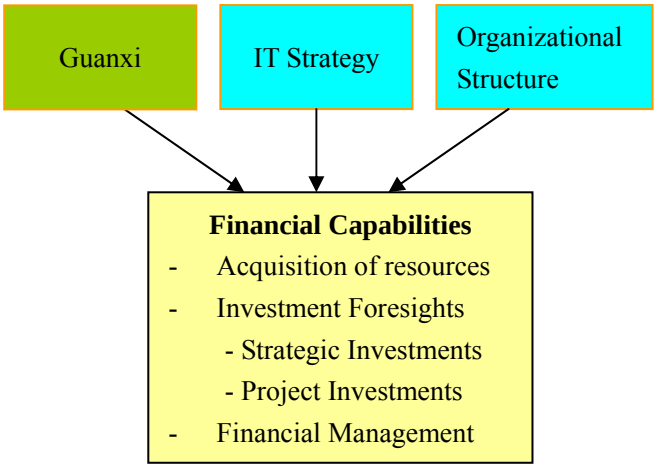

Figure 5.12 The Components of Financial Capabilities

Figure 5.12 suggests that strong financial capabilities can be developed in three areas: acquisition of financial resources, strategic and project investment foresights, and financial management. In turn, in order to develop these financial capabilities, support is required from some of the S&O and iRC variables. The three relevant variables identified from the observations of case companies are Guanxi, IT strategy and organizational structure. The basis of narrowing down to these three components and their connections to developing financial capabilities will be the focus of this section.

5.4.2.1 Acquisition of financial resources

In China, as the capital market is not matured and alternative financing modes is limited for construction companies, the major source of acquiring financial resources is through bank loans. As Eyiah (2001) suggested, one solution is to develop good business relationships with the banks. This holds true for the case companies studied, as many of them have formed Guanxi with major Chinese banks as summarized in Table 5.8. Therefore, Guanxi with banks represents an integral part of the companies' overall financial capacity.

Table 5.8 Summary of Guanxi with Chinese banks

Companies	**Banks**
HQCEC	Bank of China, China Export-Import Bank
CHEC-TPCC	'AAA' level customer of China Construction Bank, China Merchant Bank
NFC	'AAA' level customer of Bank of China, China Construction Bank
SEI	Bank of China, China Export-Import Bank
CPECC	Bank of China, China Export-Import Bank
CICI	China Investment and Trust Industrial Bank, China Export-Import Bank
CREC	China Industry Bank, China Construction Bank, China Agriculture Bank

Other than forming Guanxi with banks, some companies invest in financial institutions to become their main shareholders. This resembles the Japanese type of an interwoven structure. One example is NFC, which is the main shareholder of China Minsheng Bank, Minshenglife Insurance Company and Guoyuan Fund Management Company. Another example is SEI: SEI invests in the Zhong You Financing Company,

and in turn obtains financing from this company. The relationship between companies and financial institutions is shown in Figure 5.13. Obviously, SEI's model would make sense only if the lending that it obtains from such arrangement exceeds what has been invested to set up the link with the financial institutions.

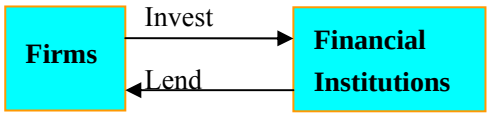

Figure 5.13 Relationship with Financial Institutions

Other than bank loans, some publicly listed companies secure financing through the stock market. This includes BUCEC, NFC, SCG, and CREC.

5.4.2.2 Investment Foresights

(1) Strategic investments

The scope of strategic investments includes investments in both related and unrelated industries in order to support a company's diversification strategy. This helps to diversify business risk and spur growth in those areas that may lead to unexpected synergies.

In the case of HQCEC, the company adopts the following activities:

1) Assist to organize and strengthen the management of invested companies so as to pursue a higher return-on-investment (ROI). In effect, this is akin to what private equity firms do in the western world.
2) Adopt appropriate mergers and acquisitions strategies for engineering design institutions and construction firms that function in related business areas, while at the same time cultivate their design and project management competencies.
3) Invest in countries which have great influence over HQCEC operations in order to promote market development and expansion. One example of these countries is Sri Lanka, in which HQCEC has undertaken quite a number of projects and decided to invest further in this country to explore more project opportunities, given the foundation that has been laid in their previous projects.

In the case of NFC, the company adopts a '4-3-2-1' strategy, which means: 40% of capital invested in its main business (nonferrous metal development and construction); 30% invested in real estate (e.g. Beijing Guang Cai International Center, Beijing Peng Run mansion); 20% invested in financial institutions (e.g. as shareholders of China Minsheng Bank, Minsheng Insurance Company and Guo Yuan Fund Company); and 10% invested in other areas.

In the case of Sinohydro, investment activities mainly include four aspects: (1) energy sources development projects such as electric power and coalfield development; (2) highway market; (3) water and waste water market; and (4) real estate industry. One example of Sinohydro's investment is the purchase of Sichuan Aaba Water and Electricity Corporation. By investing in this company, Sinohydro acquires 40% share of the Sichuan Taipingyi Hydro project.

In the case of CHEC-TPCC, investment activities include RMB 337 million spending in shipping equipment upgrading, such as pile drivers, high power towboats, 2000-3000T large barges and dredgers that are suitable for overseas marine engineering and construction. Such investments help to elevate its technological competency.

In the case of SCG, it acquired the Hong Kong Construction Co. Ltd. from China Everbright International Limited with a sum of 230 million Hong Kong dollars. This helps SCG diversify its business into Hong Kong market.

Based on these examples, it can be suggested that most companies adopt strategic investments to support themselves entering into real estate, equipment manufacturing and other related industries in order to pursue a diversification strategy.

(2) Project investments

Project investments imply injecting capital into projects in order to get a higher return. Comparing with strategic investments, project investments may be of shorter term in nature, although not in all cases.

In the case of CREC, the firm has:

1) Invested RMB 3.65 billion into Shanghai Subway 2 project;
2) By adopting the BOT mode, invested in the Hu Zhun railway project, of which

the total length is 121 km;

3) By adopting the BOT mode, invested in the Xian Yang Bridge;
4) By adopting the BOT mode, invested RMB 3.9 billion into the Jing Cheng Highway, of which the total length is 46.7 km.

SCG's project investments are similarly listed in the following table.

Table5.9 Project Investments by SCG

Projects investment	Investment amount (million RMB)	Return (IRR)
HuQingPing Highway	125	9.27%
TongSan national road	659	8.55%
Yan'an Viaduct bridge	550	9.5%
Shanghai Subway	60	10.1%

As for CICI, the company invested RMB 500 Million in the HuiZhou Highway, which again adopted the BOT mode. The company also adopted a so-called "F+EPC" mode (financing plus engineering, procurement and construction) to construct the Tianjin Haihe River Bridge. CICI was responsible for 85% of total project financing and the other 15% was the responsibility of the owner, who is the local government in Tianjin.

Because most Chinese construction companies are lack of financial resources, those that have sufficient funds to invest in large projects can achieve a strong competitive advantage (differentiation) over their competitors. Therefore, this also illustrates that financial capabilities has a strong link to the competitive strategy of *differentiation*.

5.4.2.3 Financial Management

For HQCEC, accounting and financial management is the center of corporate management, and "total budgeting" forms the core of accounting and financial management. "Total budgeting" means that each expenditure in the company should follow the following rule: budget before the activity, control during the activity and audit and verify after the activity. This sequence would help to reduce unplanned expenditures and monitor and track closely any variations that arise.

For the case of CHEC-TPCC, relevant activities include:

1) Managing account receivables by setting up special team and utilizing legal

agencies to deal with these unreceived accounts.

2) Setting up an internal center to form unified accounts that are more convenient to manage.
3) Setting up a total budgeting system
4) Facilitating the communication of financial information by setting up an IT system for that purpose
5) Enhancing internal auditing, establishing measures that helps to raise "red flags" in case of non-compliance in order to reduce financial risks.

In short, proper financial management is likely to require the support of a good IT system and strategy. The proper implementation and management of financial activities could lead to cost leadership – another type of generic strategies. This is because if one has a strong financial management system, it can keep track of the components of cost more closely and create more accountability.

5.4.2.4 Relationship between Financial Capabilities and Organizational Structure

As one dimension of organizational structure, *formalization* can strengthen capital control. Many companies have developed comprehensive documentation systems to formalize and control financing, investments and accounting activities. For example, Sinohydro emends the document of <The Actualization Compendium of Asset Management Responsibility> and <The Actualization Compendium of Division and Sub-Company Management Objective Responsibility> to formalize the relationship between parent and subsidiary companies so as to enhance the financial control of company assets.

Besides formalization, *centralization* can also influence financial capabilities. Most of the case companies have shown that centralization occurs in most of the financial decisions. Essentially, most of these companies set up main financial departments in their headquarters. Therefore the headquarters would reserve the decision-making power for acquiring financial resources, investment and financial management.

5.4.2.5 Summary of Relationships between Financial Capabilities and Related iRC/S&O Variables

From the case observations and discussion in this section, effectively only three iRC/S&O variables can be identified as supporting or having an impact on the development of financial capabilities. This leads to Hypothesis 9:

Hypothesis 9: Financial capabilities is directly supported by Guanxi resource, IT strategy, and organizational structure.

5.4.3 Project Management Competencies

Put simply, project management competencies are structured to ensure that a project is completed on time, within budget and with a desirable level of quality (Cheah and Chew, 2005). The entrenched project management tradition (Chinowsky, 2000) in the civil engineering profession signifies an abundance of models and theories associated with ways to improve on cost, scheduling and quality measures. Many researchers asserted that project management is one useful way to cope with competitive pressure and gain competitive advantage. Wheatley (1992) said competitive pressures would force companies to seriously consider developing strong project management techniques. Projects are "the basic building blocks in the strategic management of products and services" and help companies survive in the global marketplace (Cleland, 1991). The growth of project management is attributed to its ability to help organizations do work more efficiently, effectively, and productively (Kerzner, 1987).

5.4.3.1 Basic Building Blocks of Project Management Competencies

In most case companies, project management remains as a key function, and the activities would include schedule management, cost management, quality management, contract management and procurement management. As most of these activities are widely discussed in most construction management texts and journals, it is not the focus here to elaborate on those details. Rather, Table 5.10 simply lists the general

content of each activity that can be found in the routine operations of the case companies. The content of procurement management is used here as an example to illustrate how one case company implement this function.

Table 5.10 Some Common Components of Project Management Activities

Main Activities	**Content of each activity**
Schedule Management	Schedule Planning, CPM or Grantt Chart Plan execution, e.g., resource allocation, analyzing parameter of workload Schedule Control
Cost Management	Cost planning, setting responsibilities and objectives Cost Auditing and Analysis Cost Control
Quality Management	Quality Planning, defects prevention Quality Control, defects detection
Contract Management	Evaluating client's credibility and past contractual performance Process management during contract implementation Archival of records, legal and claims evaluation
Procurement Management	Setting up of procurement centers Procurement of materials and machineries

One purpose of procurement management is to reduce the procurement cost (Luo, 2003). An equally important objective is to ensure reliable delivery of required materials to the construction sites. Incidentally, for all the 12 case companies, the procurement activities are mainly controlled by their headquarters. The procurement process of CSCIC is listed in the Figure 5.14.

The procurement information of different projects is sent back to the procurement center in the headquarters. According to the regions within which the projects are located, the headquarters send out the information to the regional sub-procurement centers. In turn, the regional centers issue orders to the regional suppliers, who would deliver the materials to the companies' logistic centers. Finally, the logistic centers would coordinate the delivery according to the needs of each of the project sites.

One major benefit of setting up a main procurement center in the headquarters is to strengthen the company's bargaining power against the suppliers. Considering the factor of economies of scale, large quantity of the procurement makes it easier to lower the price. The other major benefit is to lower administrative costs and reduce the chances of corruption if procurement is instead managed by local project teams.

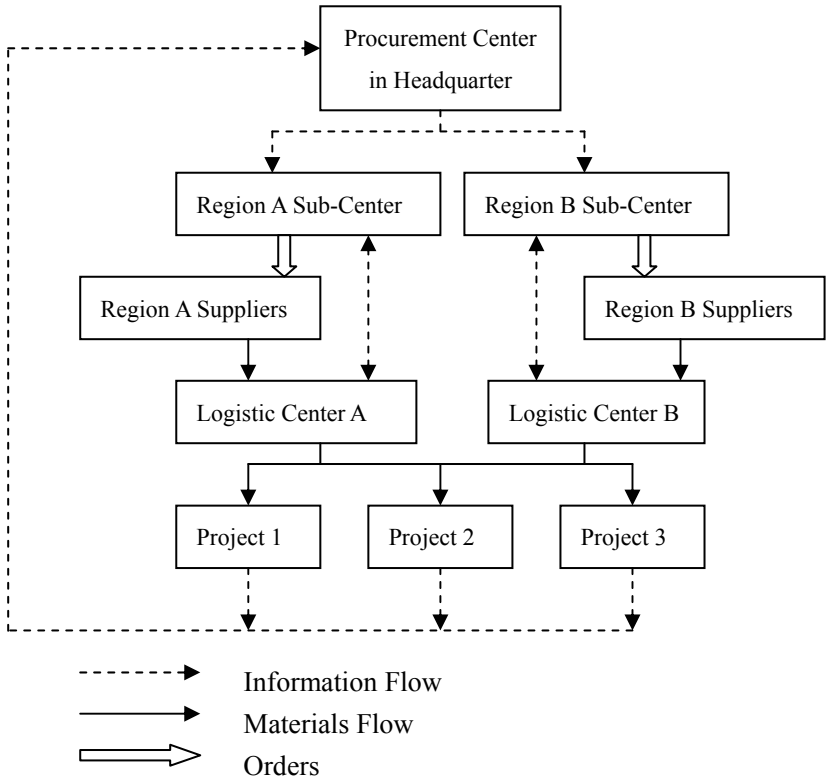

Figure 5.14 Procurement System of CSCIC

Lastly, since most procurement activities are controlled by the headquarters, it can be said that the organizational structure for this function appears to be highly centralized in nature.

5.4.3.2 iRCs and S&O Variables Related to Project Management Competencies

(1) IT Strategy and Project Management Competencies

Today, the use of IT systems for effective and efficient project management becomes a common phenomenon. In a later Section 5.5.2 (page 127) on IT strategy, it will be shown that many companies have integrated their bidding supporting system, project management system, contract management system, and procurement management system under an overall IT architecture to facilitate the multiple aspects of project management.

(2) HR Strategy and Project Management Competencies

Belout (1998) and Belout and Gauvreau (2004) both confirm that human resource management also has some influence on project management. Maloney (1997) states that by adopting strong policies in matters of compensation, recruitment and education and training, HRM can indeed promote the success of a project. Many case companies had done well in this aspect. Instead of trying to save cost, many of them invest in providing various training programs to different levels of their employees to enhance their ability and knowledge in project management.

(3) Financial Capabilities and Project Management Competencies

As previously discussed in Section 5.4.2, one important aspect of financial capabilities is financial management, which involves budget estimation and budget control. This ties in with the cost control system under project management.

(4) Organizational Structure and Project Management Competencies

In Lin and Germain's (2003) study, formal control (formalization) and centralization are two important measures of organizational structure. Observations of 12 case companies suggest that their project management processes are highly formalized and centralized.

Most of the companies have formulated rules and procedures to handle project management. These rules and procedures covered most of the activities, including quality management, cost management, contract management, and technology management. Some of the examples of these rules and procedures in CHEC-TPCC are: <Project management planning outline>, <CHEC-TPCC Construction Cost Management Handbook>, <GB/T 19001---2000 idt ISO 9001:2000 Quality Management System Handbook>.

Besides formalization, centralization is also evident in Table 5.19 (refer to page 139, Section 5.5.3), which shows that most of case companies control their project management activities from the headquarters. Some of these activities include: bidding decisions, material procurement, contract management, and project cost control.

(5) Organizational Culture and Project Management Competencies

A culture in quality management can help the company achieve its quality goals by encouraging all employees, especially at the project level, to change their attitudes, mindsets and skills to meet the quality requirements. The espoused value (Schein, 1992) culture of HQCEC has included 'Continuous improvement in quality', whereas the espoused value of CHEC-TPCC states that 'Quality is the life of the firm, and high quality is the employee's key objective'. Thus, corporate culture may in a way enhance the development of certain aspects of competencies.

(6) Guanxi and Project Management Competencies

Although not obvious initially, Guanxi with various parties can indeed contribute to strengthening project management competencies. For example, Guanxi with owners helps to mitigate disputes in the contract, while Guanxi with suppliers helps to enhance supply chain management and logistics issues.

5.4.3.3 Summary of Project Management Competencies

In summary, the iRC and S&O variables that may support the development of project management competencies have been identified as: Guanxi resource, financial capabilities, IT strategy, HR strategy, organizational structure and organizational culture (Figure 5.15).

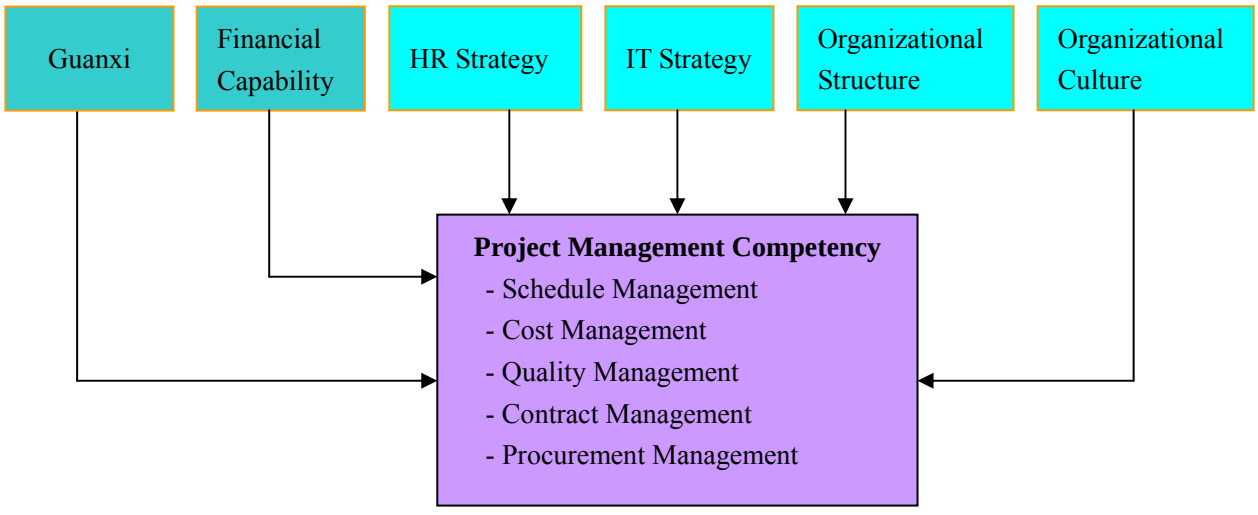

Figure 5.15 Summary of Analysis of Project Management

Another hypothesis – Hypothesis 10 can be deduced:

Hypothesis 10: Project management competencies is directly supported by Guanxi, financial capabilities, HR strategy, IT strategy, organizational structure and organizational culture.

5.4.4 Reputation

Although the reputation of a firm is usually seen as an intangible asset, Fombrun (1996) suggests that it produces significant long-term competitive advantage. According to Gray and Balmer (1998), corporate reputation creates shareholder's value by improving the competitive position of an organization. Corporate reputation can impede rivalry, enhances the license to operate and is a protective shield against downturns and crisis. It is the reputation of a company that influences stakeholders to provide or withhold support. It could result in premium prices for their products and leverage in negotiations with suppliers, creditors and distributors (Fombrun, 1996).

On the theme of corporate reputation, SCG presents a particularly successful case. Projects done by SCG have some common characteristics: either high-tech and complex in nature, or of high quality. Successful completion of these projects had rewarded SCG with a good reputation in the industry over time. Table 5.11 lists some of the awards received by SCG. These awards illustrate the good reputation that SCG has built up.

Table 5.11 Awards Achieved by SCG

Awards	**Number of projects**	**Name of Project**
National Construction "Lu Ban" Award	4	● Shanghai Pudong International Airport Building ● Shanghai Urban Planning Exhibition Center ● 909 manufacturing factory ● RiCaZe Shanghai Square
National Golden Medal Award	1	● New Shanghai Library Building
National Silver Medal Award	2	● RuiAn Square ● Shanghai JinYuLan Square D2 Building
Shanghai construction "BaiYulan" Award	24	…
Shanghai High-quality structure Award	11	…

Upon analyzing HQCEC, NFC, Sinohydro, CRCCG, and SCG, it is found that the reputation of these companies is mainly derived from the concept of high quality and high technology. High quality can be achieved by having strong project management competencies – not simply quality management. Activities such as cost management would also help to complete a high quality project by selecting the right materials, techniques or technology within a budget constraint. Thus, the reputation of a company is directly promoted by both the iRCs of project management competencies and technological and innovative capabilities. This is illustrated in Figure 5.16 and summarized by Hypothesis 11. Perhaps due to the limitation of data related to this aspect, concrete evidence of other iRC/S&O variables promoting reputation cannot be found.

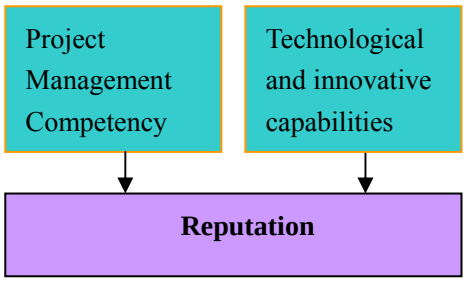

Figure 5.16 Summary of the Case Analysis of Reputation

Hypothesis 11: Reputation is supported by the iRCs of project management competencies and technological and innovative capabilities

5.4.5 Guanxi Resource in the Framework

Guanxi is one important resource that needs to be cultivated by the Chinese construction companies. It has become more important in managing uncertainties and external dependency (Park and Luo, 2000). Tsang (1998) used the resource-based theory to analyze the Guanxi phenomenon, and found that organizational relationships indeed meet the same special characteristics as a core competency: valuable, rareness, imitability and non-substitutability. Therefore, the Guanxi resource helps to establish a sustainable competitive advantage. Park and Luo (2000) also tested the Guanxi resource along two dimensions: horizontal connections with the task environment of

suppliers, buyers, and competitors; and vertical connections with various levels of government and regulatory agencies.

In the Chinese construction industry, Guanxi is often used to mitigate unfavorable conditions. The development of Guanxi with various levels of government, regulatory bodies, financial institutions and clients are also observed for the case companies and confirmed by the interviews, in which the interviewees were asked to evaluate their relationships with these bodies. These are summarized in Table 5.12. It confirms that most of the companies had build up relationships with various parties – government/regulatory body, clients, research institutes, financial institutes, and subcontractors/suppliers.

Table 5.12 Summary of Guanxi of Chinese Companies

	Government/ Regulatory Bodies	Clients	Research Institutes	Financial Institutions	Subcontractors/ Suppliers
HQCEC	√	√	√	√	√
NFC	√	√		√	
SEI	√	√	√	√	
SINOHYHRO	√	√		√	√
CSCIC	√	√	√	√	√
CPECC	√	√	√	√	
TCEMC	√	√		√	√
CHEC-TPCC	√	√	√	√	√
BUCEC	√	√	√	√	√
SCG	√	√	√	√	√
CREC	√	√	√	√	√
CICI	√	√	√	√	√

Unlike the other four iRCs that are studied in the previous sections, Guanxi cannot be directly supported by other iRC/S&O variables. Most of the interviewees suggest that Guanxi is normally groomed along the way in the long history of growth of the company and consciously cultivated by the top managers. For example, HQCEC started developing Guanxi with the Ministry of Chemical Industry of China (MOCIC) since it established in 1953, and keeping close relationship with MOCIC is always a major initiative faced by its top managers. Thus, it can be said that Guanxi is an iRC that develops by itself over time, rather than something that could be derived from or supported by other iRCs.

5.5 Analysis of Selected S&O variables

Throughout the discussions in Section 5.4, there are four S&O variables that are consistently mentioned and that primarily support the iRC variables. These S&O variables include: HR strategy, IT strategy, organizational structure and organizational culture. This section will study the nature and features of each of these S&O variables in more detail based on the observations drawn from the case companies. Figure 5.17 shows the relevance of this section to the entire model.

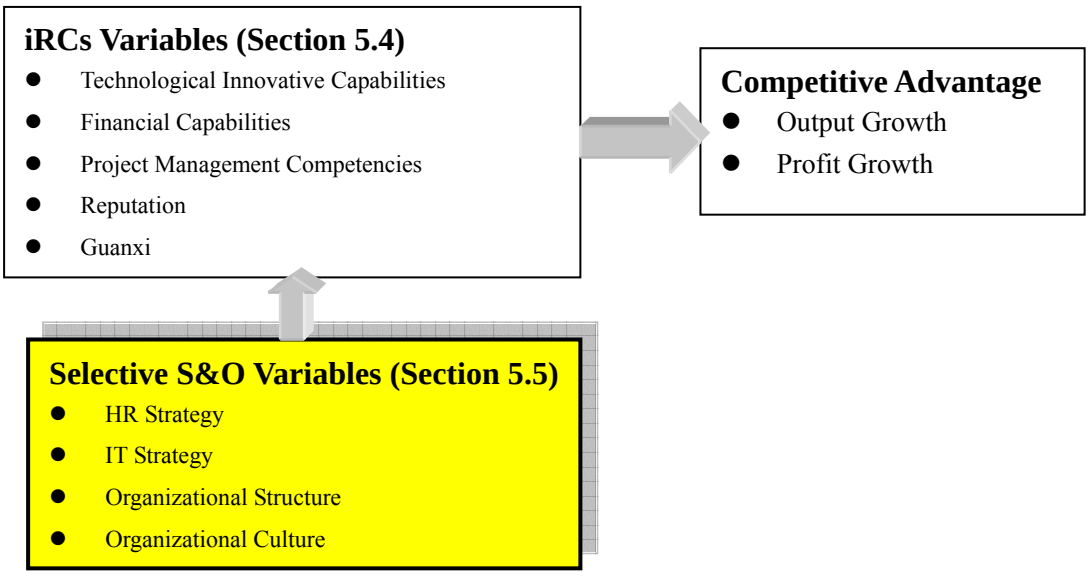

Figure 5.17 The Focus of Section 5.5 – Selected S&O Variables

5.5.1 Human Resource (HR) Strategy

Human resource is one of the most important company assets that can help to form sustainable competitive advantage (Delaney and Huselid, 1996). Barney and Wright (1998) outlined the way that human resources provide competitive advantage using what they called a VRIO (value, rareness, imitability, and organization) framework. Rareness comes from the identification of unique characteristics of the employees that can be exploited to meet the special needs of the company. Human resources can be inimitable due to the nature of socially complex factors such as company history, culture and the organizational systems within which the human resources are used (Barney, 1995). In order to develop assets of human resources, companies should lay out a clear set of initiatives under the field of Human Resource Strategy.

The field of HR Strategy has two broad approaches, namely 'hard' HRM and 'soft' HRM (Druker and White, 1996). The 'hard' approach treats human resources like any other factor of production whereby the main focus is on cost minimization. In fact, it is plausible to suggest that 'hard' HRM really belongs to the regime of project management. The 'soft' approach is reflected in statements to the effect that *'employees are our greatest asset'* and hence the key to organizational success. Human resource therefore need to be managed very carefully to ensure that only the best people are selected, that they are given high quality and appropriate training and development, that they are suitably rewarded to reflect their value, and their commitment to the organization is recognized. With respect to value and commitment, it is also directly related to *organizational culture* (Druker and White, 1996) – one of the other S&O variables in this research. In this section, the discussion on HR Strategy will focus more on the 'soft' issues.

As Loosemore and Dainty (2002) had identified, HR strategy in construction has three aspects: *employee resourcing*, *human resource development* and *reward management.* Table 5.13 lists the key features of these three aspects of HR strategy.

Table 5.13 Key Features of HR Strategy

Aspects	**Key Features**
Employee resourcing	Ensuring an organization has a ready supply of appropriately skilled people; encompasses the human resource planning function, deployment decisions, recruitment and selection process, and succession planning
Human resource development (HRD)	Including training and development programmes; performance management, management development, career management and performance appraisal systems
Reward management	Deciding upon rates of pay, pay structures and how performance will be rewarded; classifying into two aspects: extrinsic rewards (tangible rewards such as salary, bonuses, commission payments, working conditions) and intrinsic rewards (satisfy other goals such as lifestyle, comfort, a sense of achievement, challenge, etc)

Source: Loosemore and Dainty (2002)

These three aspects identified by Loosemore and Dainty are particularly reflected in the case of HQCEC and NFC.

First, in terms of employee resourcing, both companies attempt to recruit

postgraduate researchers (Master and Ph.D degree holders) to make up a proportion of 20%. This is achieved either by self-cultivating or by recruiting human resources from their contact with the universities or the general market. Both companies also adjust their organizational structures and specify job positions in detail, including the responsibilities of the job positions, the process of work, the expected relationships and norms between superiors and subordinates, and the technical content of every job.

Second, in terms of human resource development, both companies set up training and educational mechanism by adopting the following modes in parallel:

Part-time <--------> Full-time training;

Internal <--------> External;

Face-to-face training <--------> Using intranet;

Traditional education mode <--------> Case discussion mode

Besides training and education system, the human resource development of both companies also includes the setting up of a performance management system. First, the performance objectives of the company are established. After that, these corporate level objectives are broken down into working objectives of every department. Each employee in turn has to determine his own job objectives in line with the department level targets. When it comes to appraisal, based on these established objectives, managers at each level would use the data or facts to evaluate subordinates' performance and feedback the evaluation results to the employees. Then, the managers and the employees would make up a performance improvement plan together in order to close the gap between actual performance and the objectives in the next round. The entire process can be summarized in the following figure:

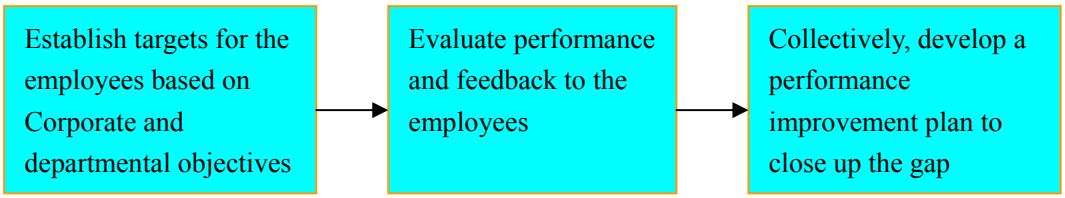

Figure 5.18 Employee's Performance Management System

The third aspect of Loosemore and Dainty's framework – the reward system of both companies, includes the following mechanisms:

1) *"Spiritual" incentive mechanism*, which includes: creating a favorable working atmosphere, harmonious human relations and corporate culture respecting employees' personality; allowing employees to take part in the decision making process; helping employees to set up self development objectives in line with the corporate and departmental objectives.

2) *Career development incentive mechanism*, which includes: career development plans for the employees; providing career development opportunities; allowing employees to dictate their development directions according to their own specialties and the requirements of the corporation; encouraging younger employees to participate in important missions; deliberately arranging important training opportunities for outstanding employees.

3) *Payment incentive mechanism*, which means setting up a wage system commensurate with the employees' performance, which would include a basic wage, bonuses and welfare. For the outstanding employees, the companies dynamically add the basic wage. The companies also set up different bonuses such as team work performance bonus, project performance bonus, marketing performance bonus and technological innovation bonus. Lastly, flexible welfare such as social insurance is provided.

The reward system discussed here is quite different from the Chinese traditional reward system as found in most stated-owned enterprises. Although it also includes a basic wage, a bonus and some welfare, the traditional SOE reward system is not tied to the employee's performance, and everyone in the company gets a similar payment. Therefore, the traditional reward system often fails to motivate employees to work hard.

5.5.2 IT Strategy

Rivard (2000) defined IT as the use of electronic machines and programs for the processing, storage, transfer and presentation of information. Earl (1989) advocated four reasons for using IT as a strategic weapon: to gain competitive advantage, to improve productivity and performance, to enable new ways of managing and organizing, and to develop new business. Mitropoulos and Tatum (1999) identified similar forces that motivate contractors to adopt IT: competitive advantage, process problems (e.g., the use of CAD to overcome the increased costs of detailing), technological opportunity (e.g., decision to use a certain software in a project simply because it is already available in-house), and external requirements (e.g., owner requirements).

Advances in technology are widely regarded as major sources of improvement in establishing the competitive position of firms and industries. Researchers also agree on IT as a helpful response to competitive threats. Porter (1985) noted that competitive pressures often drive firms to adopt new technologies to differentiate themselves from their competitors or to gain a cost advantage. There are three ways in which IT could bear impact on performance: (1) increase speed and accuracy that improve decision outcomes, (2) facilitate coordination and responsiveness, and (3) induce learning and innovative behaviors (Andersen, 2001).

When considering the Chinese construction companies, IT Strategy is primarily referred to applying various IT systems in the company to facilitate the functional processes. Figure 5.19, Table 5.14 and Table 5.15 illustrate the IT systems of three companies – CICI, HQCEC and CHEC-TPCC respectively. These systems are highly-integrated in nature to assist and support decision-making.

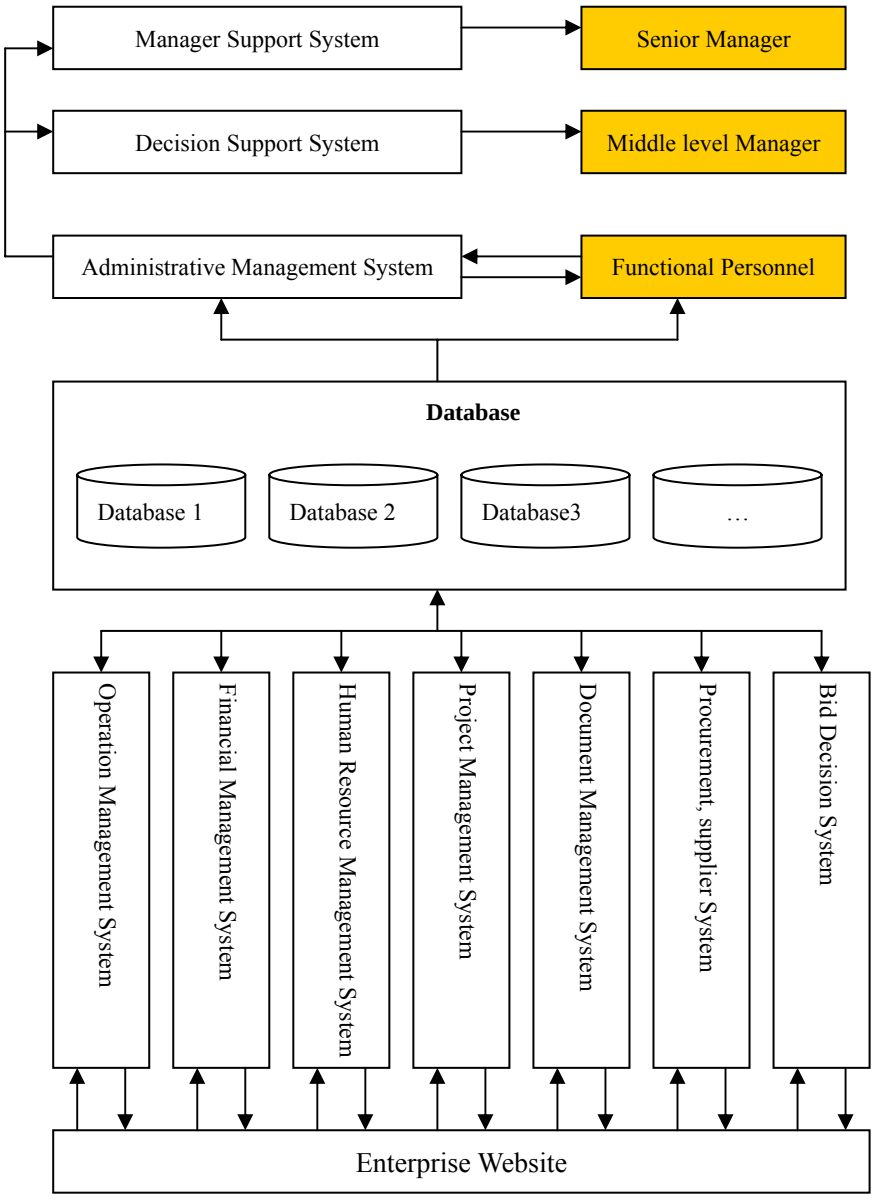

Figure 5.19 IT System Structure of CICI

Table 5.14 Components of IT System of HQCEC

Components	Function	Benefits
HR Management	(1)Assist Decision-making (2)Recruitment (3)Wage auditing (4) Man-hour Record (5) Document Management	Improve HR management
Knowledge Management	(1)Experience and Lessons learnt (2) Project Completion Report (3) ShareNet Project e-document (4) Expert System	Help to codify knowledge for use in next project
Asset Management	(1)Fix-asset Management (2)Intangible Asset Management	Enhance Financial Management
Financial Management	(1)Accountant Auditing (2)Financial Control of subsidiaries	Enhance Financial Management
Contract Management	(1)Payment System (2)Billing Record (3)Management of variation orders (4) Claims Management (5) Penalties	Enhance Project Management Capacity
Supplier Management and Procurement System	(1)Issue the Enquiry (2)Suppliers data enquire (3)Supplier quotation (4) Supplier Document Management (5)Material Price Analysis (6) Qualified Supplier Management	Improve procurement system and Supply chain Management and productivity
Decision Support System	(1) Data Collection (2) Data Analysis, comparing and forecasting (3) Solution Scheme	Improve decision-making process

Table 5.15 Components of IT System of CHEC-TPCC

Components	Function	Benefits
Office Automation System	Intranet Document Management	Improve productivity and efficiency
Management Information System (MIS)	（1） Document Search （2） Financial Management （3） Human Resource Management （4） Planning and Statistics （5） Project Management （6） Marketing Information （7） Bidding Decision Supporting （8） Equipment Management （9） Fixed Assets Management （10） Quality Management	Support management activity, improve the activities more efficient
Database System	（1） Standard Code Database （2） Project Database （3） Equipment Database （4） Fix Assets Database （5） Human Resource Database （6） Planning and Statistical Database （7） Financial Database （8） Marketing Information Database	Support the MIS

5.5.2.2 Summary of Relationships between IT Strategy and Other S&O and iRCs Variables

From the above three cases, it is verified that IT is effective in supporting most management activities, such as human resource management, project management, financial management, and improve the efficiency and productivity of these activities. By supporting these activities, IT strategy supports most of the S&O and iRC variables to ultimately establish a competitive advantage. The linkages between various IT

systems and the other variables in the framework are compiled below:

Table 5.16 Relationship between IT Strategy and Other S&O and iRC Variables

IT systems:	**Linkages with other S&O and iRCs variables**
	S&Os
Office automation System	Organizational structure: control, formalization
HR Management	HR Strategy
	iRCs
Knowledge Management	Technological and innovative capabilities
Quality Management	Project management competencies
Asset Management, Financial Management	Financial capabilities
Bidding Decision Supporting, Project Management, Contract Management, Supplier Management and Procurement System	Project management competencies

5.5.3 Organizational Structure

5.5.3.1 Theoretical Configurations of an Organizational Structure

Mintzberg (1979) suggested five structural configurations, namely, simple structure, machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy (Table 5.17). He proposed that firms exist in one of these forms of structural configurations and adopt a matching primary coordinating mechanism. Firms also choose ways to delegate decision making authority to some levels, resulting in the distribution of power within certain parts of an organization.

Table 5.17 Mintzberg's Structural Configuration

Structural Configuration	**Prime Coordinating Mechanism**	**Key Components of Organization**	**Type of Decentralization**
Simple Structure	Direct supervision	Strategic apex	Vertical and horizontal centralization
Machine Bureaucracy	Standardization of work processes	Technostructure	Limited horizontal decentralization
Professional Bureaucracy	Standardization of skills	Operating core	Vertical and horizontal decentralization
Divisionalized Form	Standardization of outputs	Middle line	Limited vertical decentralization
Adhocracy	Mutual adjustment	Support staff	Selective decentralization

Source: Mintzberg (1979)

5.5.3.2 Organizational Structure of Case Companies

In the author's opinion, it is inappropriate to insist that the structure of the case companies can only fit into one of the above listed five structural configurations. For example, most of the case companies adopt a *machine bureaucracy* and a *divisionalized form* at the same time. Discussions with the interviewees confirm that many of the organizational structures of the case companies are indeed quite similar, at least in terms of their basic structure.

Figure 5.20 shows the organizational structure of CHEC-TPCC. It mainly consists of three levels: headquarters, divisions and projects.

(1) The Power of Headquarters

In Figure 5.20, the departments in the headquarter include: corporate management department; business department; engineering department; technological and innovation department; financial department; auditing department; and procurement department. These departments are mainly responsible for: setting corporate objectives, strategic planning, determination of basic policies, finance, accounting systems, basic research, approval of capital expenditures over prescribed limits, setting of executive salaries and bonuses above certain levels, and selection of individuals for positions down to specific echelons in the organization.

The first type of power retained by the headquarters, analogous to the managerial role of an entrepreneur, is the formation of the organization's overall product-market strategy. Whereas the divisions determine the implementation strategies for a given product and regional market, the headquarters decide which ones should be pursued. In effect, the headquarters manage the strategic business portfolio, while establishing, acquiring, selling, and closing down divisions in order to change its mix of products and markets wherever it is warranted. This function is done by the Corporate Management and the Business Management departments in the headquarters.

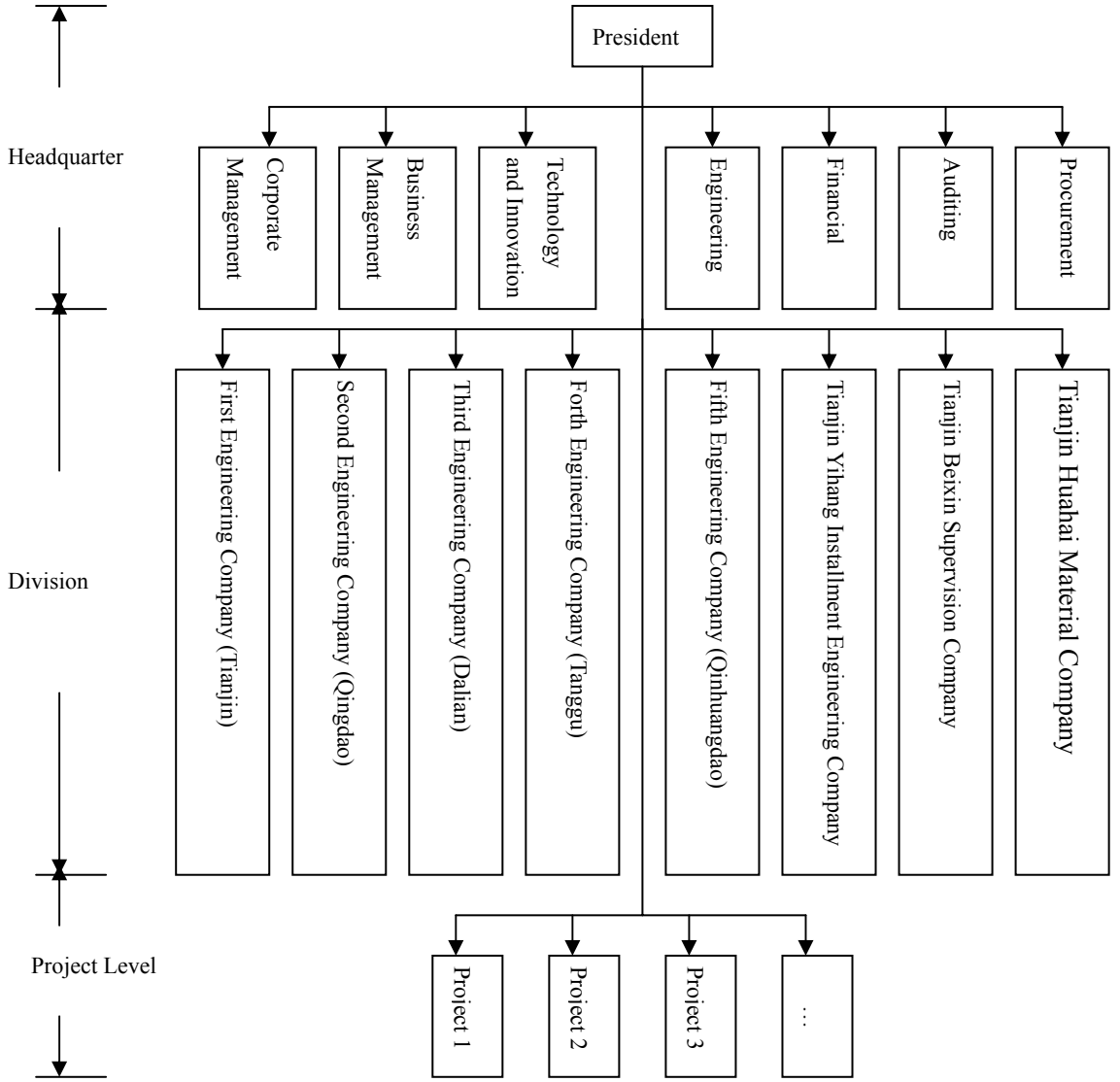

Figure 5.20 Organizational Structure of CHEC-TPCC

The second type of power that the headquarters retained concerns the allocation of the overall financial resources. The divisions share the common financial resources. It is clear that the aim of the headquarters in managing these financial resources is to: draw excess funds from divisions that do not need them; raise additional funds in the capital markets when necessary, and allocate available funds among the divisions that do need them. This function is mainly done by the Financial Department and the Auditing Department.

The headquarters also provide certain support services to the divisions through the Engineering Department, Procurement Department and Technological and Innovation Department. Moreover, the Technology and Innovation Department is responsible for

new technological innovation for all the divisions.

The headquarters is also the resource center, budget center, business center, and profit center, whereas the project level mostly makes up the cost centers. This means that the headquarters control almost all the resources, profits, budget, and the types of projects that they should pursue. The project level is only responsible for controlling cost. Thus, this illustrates that project management in China is centralized in nature and the headquarters exert a great control.

(2) The Structure of the Divisions

Cheah (2002) identified that large international construction companies mainly structure their organizations along three dimensions: market/product, geography and function. Specifically, 14 out of 24 large international construction companies he surveyed choose the market/product dimension as their primary organizational structure. Contrary to the outlook of these international large construction companies, CHEC-TPCC structures its organization mainly along geography and function. As Figure 5.20 shows, the sub-companies (divisions) of CHEC-TPCC mainly include:

(1) First Engineering Company: Focus on Tianjin Market (Geography)

(2) Second Engineering Company: Focus on Qingdao Market (Geography)

(3) Third Engineering Company: Focus on Dalian Market (Geography)

(4) Forth Engineering Company: Focus on Tanggu Market (Geography)

(5) Fifth Engineering Company: Focus on Qinhuangdao Market (Geography)

(6) Tianjin Yihang Installment Engineering Company: Focus on Installment projects (Market/product)

(7) Tianjin Beixin Supervision Company: Focus on Project Supervision (Function)

(8) Tianjin Huahai Material Company: Focus on Construction Material and Equipment (Function)

In total, there are eight sub-companies in CHEC-TPCC. Among them, five are structured along the geographical dimension, two along the functional dimension, and only one along the market/product dimension. Thus, the primary structures of

CHEC-TPCC are geographical and functional in nature. Incidentally, most of the other case companies also share a similar structure. The fact that the geographical or functional dimension, instead of the market/product dimension, is chosen as the main structure may be due to couple of reasons:

(1) Different regions have different characteristics, such as local suppliers, labors, and Guanxi with local government and clients. Companies cannot control all these factors from the headquarters. Thus, they would structure along the geographical dimension, and decentralize some of the power to these sub-companies.

(2) Another factor is simply the norm that the Chinese construction companies seldom structure their sub-companies along market/product dimension. In the context of construction, market/product means different types of projects. The case interviews confirm that most of these case companies arrange different types of projects directly under the control of the headquarters or regional sub-companies. Again, this signifies the relatively centralized structure at the top level as discussed earlier.

5.5.3.3 Formalization and Centralization of Organizational Structure

It is realized that an organizational structure can be characterized by features other than market/product, geography, and function (Ford and Slocum, 1977; Frederickson, 1985). Lin and Germain (2003) highlighted two main dimensions of organizational structure: formalization and centralization.

(1) *Formalization* may be defined as the degree to which rules and procedures within a system are specified and/or adhered to (Ford and Slocum, 1976). Rules and procedures can be implicit as well as explicit, and can be used either to prescribe what should be done or what is forbidden. Explicit rules are usually set down in writing. It can be measured by the presence of written rules, norms and procedures that control the behavior of organizational members (Suzen, 1985).

(2) *Centralization* refers to the diffusion of decision making power, or the locus of decision making in an organization (Mintzberg, 1979). It includes such factors as the locus of decision-making authority, hierarchy of authority, autonomy,

and participative decision making. Theoretically, a maximum degree of centralization would exist if all decisions are made by a single individual; a minimum degree would exist if authority to make these decisions were exercised equally by all members, regardless of their level or rank (Marsh, 1992). In a centralized organization, final choices are made almost exclusively at high levels and unquestioning acceptance of top management decisions is expected. Such organizations are characterized with minimum level of participation from lower level members of the organization.

Figure 5.21 below presents a 2x2 classification base upon the interaction between formalization and centralization. This figure combines formalization and centralization into four main types. Type 1 (Fief) is informalized and centralized; this represents the principal organizational form in pre-reform China (Boisot and Child, 1996). Type 2 (Bureaucracy) is formalized and centralized, which provide an institutional order for many firms, but may lead to congested hierarchies and inadaptability. Type 3 (Ideal) organizations are typical of those in the western economies wherein a large number of autonomous units transact through impersonal relationships. The effectiveness of decentralization rests upon formalization and management competence. Type 4 (Anarchy) is informalized and decentralized. In this type, firms are not necessarily dysfunctional if informal coordination through negotiation and value sharing compensates for the lack of impersonal bureaucratic control (Boisot and Child, 1996). However, without the necessary mechanisms required for informal coordination, such decentralization would only settle into anarchy.

Centralization

Formalization	High (Centralized)	Low (Decentralized)
High (Formalized)	**Bureaucracy (Type2)**	**Ideal (Type3)**
Low (Informalized)	**Fief (Type 1)**	**Anarchy (Type 4)**

Figure 5.21 Interaction between Formalization and Centralization

Source: Lin & Germain, 2003; Boisot & Child, 1996

It would be interesting to examine the degree of formalization and centralization of the case companies using the above framework. The situation of formalization of the twelve case companies is summarized in Table 5.18. In this table, nine aspects were evaluated qualitatively based on the extent that these construction companies have formalized rules, documents and procedures. These nine aspects includes: Project Management, Quality Management, Contract Management, Cost Management, Technology Management, Responsibility of Department, Human Resource Management, Financial Management and Marketing Management. It is found that formalization is a common feature in most of the companies, except for the case of Sinohydro and SEI, which are only slightly less formalized.

Table 5.18 Formalization of the Case Companies

	Project Management	Quality Management	Contract Management	Cost Management	Technology Management	Responsibility of Department	HR Management	Financial Management	Marketing Management
HQCEC	√	√	√	√	√	√	√	√	√
NFC	√	√	√	√	√	√	√	√	
SEI	√	√			√	√	√	√	√
CPECC	√	√	√	√	√	√	√	√	√
Sinohydro	√	√	√			√	√	√	
CSCIC	√	√	√	√	√	√	√	√	√
CHEC-TPCC	√	√	√	√	√	√	√	√	√
TCEMC	√	√	√	√	√	√	√	√	
BUCEC	√	√	√	√	√	√	√	√	√
SCG	√	√	√	√	√	√	√	√	√
CICI	√	√	√	√	√	√	√	√	
CREC	√	√	√	√	√	√	√	√	√

Table 5.19 Centralization of the Case Companies

	Bidding Decision	Material Procurement	Contact Management	Subcontractor Selection	Construction Design	Preparation of Technical Schemes	Project Cost Control	Capital Control	HR Management
HQCEC	√	√	√	√	√	√	√	√	√
NFC	√	√	√			√		√	√
SEI	√	√		√				√	
CPECC	√	√	√	√				√	√
Sinohydro	√	√	√	√	√	√	√	√	√
CSCIC	√	√	√	√				√	
CHEC-TPCC	√	√	√			√		√	
TCEMC	√	√	√	√			√		√
BUCEC	√	√	√	√	√	√			√
SCG	√	√	√	√			√	√	√
CICI	√	√	√	√				√	
CREC	√	√	√	√	√	√	√	√	√

Table 5.19 shows the situation of centralization of the case study companies. In this table, nine management activities are evaluated based on whether the locus of decision making is at the headquarters level or at the project level. It is found that some activities, such as construction design, preparation of technical schemes and project cost control, are not centralized in some companies. One possible reason is that the decision-making of these activities require great amount of project level information. The headquarters cannot process these information quickly and efficiently since most of these information are very detailed in nature. Thus, the decision concerning these activities should naturally be made by personals at the project level other than the headquarters. However, as a whole, centralization is a common feature in most of the case companies, although some activities are not centralized.

In conclusion, it is found that the structure of many of these large Chinese companies are formalized and centralized, and would fall into the Type 2 – Bureaucracy according to Figure 5.21 above.

5.5.4 Organizational Culture

5.5.4.1 Introduction

Schein (1992) defined organizational culture as the "pattern of basic assumptions – invented, discovered or developed by a given group as it learns to cope with its problems of external adaptation and internal integration – that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems". Corporate culture is a set of shared values/assumptions believed by all the organizational members to be valid for solving problems.

Schein also described corporate culture as the values that create success and are taught to newcomers. According to Denison (1997), culture refers to the underlying values, beliefs, and principles that serve as a foundation for an organization's management system as well as the set of management practices and behaviors that both

exemplify and reinforce those basic principles.

Kotter and Heskett (1992) found that corporate culture can have a significant impact on a firm's long-term economic performance. In their findings, they contend that culture has a significant impact on an organization's long-term performance and is indeed performance enhancing.

5.5.4.2 Key Characteristics of Culture of the Case Companies

Table 5.20 summarizes some of the extracts taken from the case companies' documentations and claims made by their management during the interview. From this table, one could draw some conclusions on the culture of these case companies:

(1) Different companies adopt different combination of sources of value (i.e. innovation, quality, customers, human resource, reputation) to form an integral corporate culture as a whole.

(2) These different cultural values are closely related to the iRCs and S&O variables in the framework (e.g. innovation related to technological and innovative capabilities, customers related to Guanxi resources, human resource related to HR strategy, etc.).

(3) Sometimes companies look at a source of value from slightly different angles. For example, on the cultural value of customer's role and importance, the starting point of NFC and CHEC-TPCC is ethical in nature – "we should act in good faith to our clients". In contrast, the starting point of HQCEC and SEI is more pragmatic in nature – "to protect our interest, we must first protect our clients".

Table 5.20 Contents of Culture of Selected Case Companies

	Innovation	**Quality**	**Customer**	**Human Resource**	**Reputation**
HQCEC	Continuous improvement in innovation, adoption and application of new technology	Continuous improvement in quality,	Employees' success arises as the consequence of HQCEC's success, which is totally dependent on the success of clients	Human Resource as foundation assets; work as a group; continuous development and training	
NFC	Long-standing commitment to innovation	Honest belief in quality as a perennial theme to pursue	Long-standing commitment to good faith		
SEI	Innovation is the drive of the development of SEI as a whole	High quality based on advanced technology, scientific management, full service, commitment and customer's satisfaction	Customers' benefit is what SEI targets to offer; to protect Customers' interests and benefit is to protect SEI itself.	Human assets are essential, and it is believed that every single position in the firm from top through bottom has an influential role to play in the company's success	
CSCIC	Innovation is to be conducted on trivia; To advocate innovative spirit and tolerate mistake and failure in the course of innovation; To foster the atmosphere of lifelong learning and practicing		The trade of construction is the trade of service means to provide the society with specialized, professional and internationalized service and to provide clients and customers with value-added service; "Those who win the trust of people will win in market" indicates the importance of obtaining understanding and support from the client and customer as well as collaboration from staff and cooperative partners	To respect, trust and understand staff; To provide every staff member with opportunities for challenging their mission, receiving training, course, developing individual professional career and building up their own value; To ensure that each staff member enjoys the feeling of their personal achievements and benefit from the development of company.	
CHEC-TPCC	Advocate pursuit of innovation and science	Quality is the life of the firm, and high quality is the employee's key objective	Customer comes first; fulfill promise to our clients		Encourage to compete, build reputation
CREC	Focus on scientific management and technology innovation	Building high quality project		Build high capacity working team	Develop "high-profile" project

5.6 Summary and Presentation of the Conceptual Model

This chapter discussed in detail all the components of competitive strategies, iRC variables and selected S&O variables based on the observations gathered from the twelve case companies. The case evidence confirms what have been proposed at the beginning of this chapter:

(1) There are five main competitive strategies that are adopted by the case companies, namely cost leadership, differentiation, market/product diversification, geographical diversification and vertical integration. These strategies could potentially contribute to establishing competitive advantage and good performance.

(2) There are five main iRC variables which are possessed by the case companies, namely technological and innovative capabilities, financial capabilities, project management competencies, reputation and Guanxi.

(3) Each competitive strategy can be supported by some or all of these five iRC variables.

(4) Each iRC variable could be supported by other related iRC and S&O variables.

(5) Not all of the S&O variables defined in Cheah (2002)'s model are relevant to the Chinese construction context – at least as far as the case companies are concerned. Indeed, based on the observations from case companies, it is found that only four S&O variables, namely, HR strategy, IT strategy, Organizational Structure and Culture may be meaningful.

Finally, based on the discussions in Chapter 4 and Chapter 5, a conceptual model is constructed. This was earlier presented as Figure 5.1 to guide the readers. The next chapter will proceed to verify the eleven hypotheses constructed and the relationships among the components in the conceptual model using survey data.

Chapter 6 Questionnaire Analysis

In this chapter, the Hypotheses 1-11 identified in the last two chapters will be verified by the use of a questionnaire survey. The structure of this chapter is organized as follows: First, the sampling procedure is described. The content of the questionnaire is outlined in the second section in detail. Obviously, each question is designed with a certain rationale behind. Armed with the feedback results, the third section presents the descriptive statistics for the measurement of each variable. Finally, linear regression analysis and binary logistic regression analysis are conducted to verify Hypothesis 1 to11, and the research findings are discussed in the last section. It should be noted that the findings in this chapter are not intended to apply to the Chinese construction industry as a whole; as mentioned at the beginning of this thesis the focus is mainly on larger-sized companies. Optimally, these would be companies that possess sufficient resources to adopt some of the recommended strategies in the findings.

6.1 Sampling Process

The questionnaire was meant to target First Class Qualification and larger and more influential construction companies in China, which is in line with the objective of this research. It was to be completed in by middle or higher level managers of these companies. The sample was selected based on the local reputation of the companies or their ranking in the Engineering News Record's "Top 225 International Contractors" listing. Clearly, the procedure did not target for a simple random sample, since random sampling usually gets a very low response rate in China (many managers in the Chinese companies are not willing to reveal certain information unless they have reasonably good "Guanxi" (relationship) with the researcher). Instead, 300 questionnaires were sent out by the authors' contacts in China who have close relationships with the targeted companies. After sending out, further contacts – through e-mail, telephone, and face to face interview, were also made if the respondents expressed their willingness to discuss further in the returned questionnaire. In total, 85 questionnaires were returned. Among them, 67 respondents

belong to large companies (In this research, the definition of a large company is similar to that adopted by Amboise (1991), of which the number of employees is mainly greater than 500). The other 18 respondents' organizations employed less than 500 people, but they have a strong reputation and influence in their local construction markets and are deemed to be meaningful targets as far as the research objectives are concerned. Thus, all these 85 respondents are considered to be relevant for the analysis described in this chapter. It follows that the effective rate of return for this research study reported here is 28.3% (85/300).

Table 6.1 shows the respondents' profile in this survey.

Table 6.1 Profiles of Respondents of the Survey

Position of the respondent in the company	**Number**
Engineers	23
Project Managers	25
Department Managers	32
Vice-presidents	5
Total	85

6.2 Design of the Questionnaire

The questionnaire is composed of five main parts. The questionnaire is actually written in Chinese. Appendix D provides a translated version of the questionnaire. The first part includes questions that provide background information about the responding organization. The second part includes questions that measure the dependent variables of the analyses adopted in this chapter: performance of the construction companies, which reflects their competitive advantage. The third part includes questions on business strategies. The fourth part includes questions evaluating the iRC variables, and the fifth part is related to the S&O variables.

The **first part** of the questionnaire extracts some background information in order to identify whether the respondents are suitable targets. As stated before, the questionnaire targeted mainly large and influential construction companies, therefore, Question 1 was designed to determine the total number of the employees in the company. The answer was structured along a 5-point scale (A= <100, B=100-200,

C=200-500, D=500-1000, E= >1000). Also, since the questionnaire was expected to be completed by middle or higher level managers, Question 2 asked the respondents to fill in the job position in their companies. They could choose from one of the following items: engineering, project manager, department manager, vice-president of the company, president of the company and others, if any.

The **second part** of the questionnaire gathers information about *performance*. The term performance refers to the achievement of an enterprise with respect to some criteria (Lenz, 1980). In this research, performance is measured by the growth rates of sales and net profit, which are widely used in past studies of Chinese businesses and the construction industry (Park and Luo, 1998; Kale, 1999). Instead of adopting subjective measurement approaches used by some researchers (e.g., Kale, 1999; Wagner and Digman, 1997), this research adopts Park and Luo (1998)'s measurement approach. Two questions (Question 3 and 4) were designed to ask, in the most recent 3 years, what the growth rates of sales and net profit of the company are. The answers are again structured along a five-point scale (1= <5%, 2= 5%-10%, 3= 10%-15%, 4= 15%-20%, 5= >20%). As the respondents are mostly middle level and higher level managers who would have access to these financial information, this measurement approach is more reliable than a subjective approach, in which questions were just posed about how well their company did as compared to their competitors.

The **third part** of the questionnaire gathers information about the *competitive strategy* of the company. The purpose of this part is to test the strategic choices of these companies, which include cost leadership, differentiation and scope of competition (which is in turn divided into product/market diversification, geographical diversification, and functional/vertical integration). These strategic choices are discussed individually below.

Question 5 tests the *cost leadership strategy*. The cost leadership strategy requires management to focus its attention on competing on cost, and necessitates that systems and procedures are directed totally towards controlling cost. The case analysis in

Section 5.3.1 shows that most of the cost controlling activities include: (1) Cost of material and equipment control; (2) Manpower cost control; (3) Cost control during the construction process; (4) Subcontracting cost control; (5) Administrative cost control. Thus, this question was designed according to these 5 items.

Here, the respondents were asked to choose one or more items listed above in terms of which their organizations have advantages over their competitors. If the respondents have some other advantages which are not included in these 5 items, they would choose the last option that states: "others, if any". In this way, the results are measured on a scale of 0-6, in which '0' means none of the items is chosen and a cost leadership strategy is obviously absent, '1' means any one of the items is chosen, and so on.

Question 6 tests the *differentiation strategy*. A differentiation strategy is concerned with creating the perception in the industry that something is seen by clients as being unique. Considering the Chinese construction context and the case analysis discussed in Section 5.3.2, the five main aspects in which companies may want to pursue under the differentiation strategy include: (1) Guanxi, (2) project management competencies; (3) technological and innovative capabilities; (4) financing capabilities; and (5) reputation/brand name. In this research, the respondents were asked to choose one or more items listed above for which their organizations have an advantage over their competitors. Similar to the question on cost leadership strategy, the results are measured on a scale of 0-6.

Question 7, 8 and 9 examine the competitive scope. The *scope of competition* can vary in three dimensions: *market/product, geography* and *function.*

Question 7 tests the extent of *geographical diversification*, which implies the act of diversification into different domestic, regional and international markets. The respondents were asked the number of provinces in which the projects of the company were located. The answers are structured along a five-point scale (i.e. 1, 2->3, 4->6, 7->10, >10).

Question 8 evaluates the extent of *market/product diversification*. Market/product

diversification mainly refers to diversification into different types of projects and market segments. Here, the respondents were asked to choose one or more items listed below that belong to the company's existing business portfolio: (1) Road/tunnel/bridge; (2) Subway/airport/railway; (3) Harbor/dock; (4) Hydraulic/dam project; (5) Electricity project; (6)Environmental Engineering; (7) Residential apartment/commercial building/industrial plant; (7) Special building(sport center/museum); (8) Petrochemical project; (9) Metallurgy project; and (10) others, if any. The results are therefore measured on a scale of 0-10.

Question 9 tests the extent of *vertical integration* (or functional integration). Vertical integration includes forward integration and backward integration (Male and Stocks, 1991). For example, forward integration would take the contractor into property development/ownership, while backward integration would involve undertaking engineering, material and equipment supply. The respondents were asked to choose one or more items list below which belongs to the company's existing business scope: (1) Engineering design; (2) Supervision; (3) Project consulting; (4) Real estate development; (5) Construction plant and materials; (6) others, if any. The results are similarly measured on a scale of 0-6. It should be noted that items designed in Question 8 and 9 are extracted from the observations listed in Table 5.5 (Page 94).

The **fourth part** of the questionnaire extracts information about the *iRC variables* that may exist in the company. The purpose of this part is to examine how well the company develops and nurtures its iRCs. The iRCs of interest, as identified in Chapter 4 and 5, include: Guanxi; technological and innovative capabilities; reputation; project management competencies; and financial capabilities.

Question 10 examines the iRC of *Guanxi* of the company. In Park and Luo (2000)'s paper, they designed questions to test Guanxi along two dimensions: horizontal connections with the task environment of suppliers, clients, and competitors; and vertical connections with various levels of government and regulatory agencies. In Section 5.4.5, it was found that among these Guanxi resources, Guanxi with competitors does not seem to be very common in the Chinese construction industry.

Instead, Guanxi with financial institutions and research institutes are more common to large Chinese construction companies. Therefore, the questionnaire examines Guanxi resources with five types of entities: government/regulatory bodies; clients; research institutes; financial institutions; and subcontractors/suppliers. The respondents were asked to indicate the overall quality of their Guanxi with the above stated key parties on a five-point scale, ranging from [1= no Guanxi at all] to [5= excellent].

Question 11 tests whether a company possesses strong *technological and innovative capabilities*. When studying the case companies in Section 5.4.1, it was found that many companies with high technological and innovative capability often have the following characteristics: (1) setting up technology innovation centers to organize innovative processes; (2) investing sufficient funds into R&D every year; (3) winning technological innovation awards/patents; (4) building long-term relationships with research institutes. Therefore, this question was designed by adopting these four characteristics as the choice items.

Question 12 examines the *reputation* of the company. Respondents were asked to evaluate their companies' reputation on a five point scale ranging from [1= poor] to [5= excellent].

Question 13 evaluates the *project management competencies* of the company. As identified in Section 5.4.3, the activities of the case companies for this aspect mainly include: (1) Schedule management; (2) Cost management; (3) Quality management; (4) Contract management; and (5) Procurement management. Therefore, the respondents were asked to evaluate the firm's project management competency along these five dimensions on a five point scale ranging from [1= poor] to [5= excellent].

Question 14 evaluates the *financial capabilities*. To recapitulate, the analysis in Chapter 5 confirms that the financial capabilities of the case companies are composed of three aspects: (1) Acquisition of financial resources; (2) Investment strategies; and (3) Accounting and financial management. Therefore, the respondents were asked to evaluate the financial capabilities of their firms along these three dimensions on a five-point scale.

The **fifth part** of the questionnaire gathers information about the role and

importance of the *S&O variables* in a company. The S&O variables that are of particular interest include two strategic fields (Human Resource Strategy and IT Strategy) and two organizational mechanisms (structure and culture).

Question 15 evaluates the *Human Resource Strategy.* The HR strategy mainly includes employee resourcing, human resource development and reward management. Therefore, this question examines each of these three aspects.

Respondents were asked to evaluate the firm's human resource management based on four sub-questions on a five-point scale. These sub-questions are: (1) Detailed prescriptions for the employee's job responsibility; (2) Training; (3) Performance appraisal system; (4) Reward system. The first sub-question is related to employee resourcing; the second and the third sub-questions are related to human resource development; and the fourth sub-question is related to reward management.

Question 16 tests the *IT strategy*. The IT strategy mainly focuses on the use of technology to leverage information to a firm's advantage. From the observations of case companies in Section 5.5.2, it can be found most of the case companies pursue IT strategy by building up the following IT systems: (1) Office automation system; (2) Bidding system; (3) Project management information system; (4) Financial management information system; (5) Human resource management system; (6) Engineering technology development system. The existence of these IT systems in a company may be used as a proxy for the extent of IT strategy, so the respondents were asked to choose one or more IT systems listed above which exist in their company.

Question 17 and 18 evaluate the *organizational structure*, which can be characterized by formalization and centralization.

Question 17 tests the extent of *formalization*. In Section 5.5.3, formalization was defined as the degree to which rules, regulations, policies and procedures are explicitly specified and adhered to in an organization. The areas within which rules, regulations, policies and procedures are commonly found in the management processes of large Chinese construction companies have been identified and listed in Table 5.18 (Page 138). Following these observations, this question is designed to ask the respondents to

choose one or more items listed below which have formalized procedures, rules, and regulations: (1) Project management; (2) Quality management; (3) Contract management; (4) Cost management; (5) Technology management; (6) Responsibility of the department; (7) Human resource management; (8) Financial management; (9) Marketing management; and (10) others, if any. The results are measured on a scale of 0-10.

Question 18 tests the extent of *centralization*. Centralization refers to the extent of participation by organizational members in decision-making. In a centralized organization, final choices are made almost exclusively at high levels and unquestioning acceptance of top management decisions is expected. Such organizations are characterized with minimum level of participation from lower level members of the organization. Therefore, in order to test whether an organization is centralized, some decision-making items are listed to see whether these items are actually controlled by the headquarters. These items were earlier identified and listed in Table 5.19 (Page 139). Here, the respondents were asked to choose one or more decision-making items listed below which are controlled by the headquarters: (1) Bidding decision; (2) Material procurement; (3) Setting of contractual terms; (4) Subcontractor selection; (5) Structure of project team；(6) Selection and development of technological scheme; (7) Project costing; (8) Capital budget control; (9) Allocation of manpower; and (10) others, if any. The results are similarly measured on a scale of 0-10.

Question 19 studies the *organizational culture* of the responding organization. This question lists the values/norms that may be found in a typical firm to see whether the target company has a broad culture or only focuses on one or two aspects. In Section 5.5.4, it is illustrated that the culture of most case companies emphasize on quality, reputation, human resource, customer satisfaction and innovation. Therefore, the respondents were asked to choose one or more items listed below which may represent an influential theme in their corporate culture: (1) Emphasis on project quality; (2) Emphasis on reputation and brand name; (3) Emphasis on human development of

capital; (4) organizational learning; (5) Customer satisfaction; (6) Pursuing innovation; and (7) others, if any. The results are measured on a scale of 0-7.

6.3 Measurements of Variables

This section describes the procedures that have been followed to convert the responses gathered for each survey question into quantitative measures that are suitable for further analysis. The variables include four main parts, which correspond to the components of the questionnaire as described previously, namely, performance, competitive strategies, iRC variables and S&O variables. The mean and standard deviation of these variables are presented in the following sub-sections.

6.3.1 Performance Measurement

Performance is measured by the sales growth rate, the net profit growth rate, and the overall performance, which simply averages the sales growth rate and the net profit growth rate. However, as explained in the questionnaire design, these rates are not measured on an absolute basis. Rather, the respondents would select the range indicated by a 5-point scale. The mean and standard deviation of these measures are summarized in Table 6.2.

Table 6.2 Mean and Standard Deviation of Performance

Performance Indicator	Scale of Measurement	Mean	Std. Deviation	Median
Sales growth rate	1-5	3.15	1.418	3.0
Net profit growth rate	1-5	2.46	1.323	2.0
Overall performance	1-5	2.86	1.272	2.15

n=85

The median values of these performance indicators imply that:

(1) The average sales growth rate of the target sample falls within the range of 10-15%.

(2) The average net profit growth rate of the target sample falls within the range of 5-10%.

(3) The average overall performance of the target sample falls within the range of 5-10%.

6.3.2 Measurement of the Variables of Competitive Strategies

Competitive strategy variables include cost leadership, differentiation, market/product diversification, geographical diversification, and functional/vertical integration. The scale of measurement, mean, standard deviation, and median of these variables are listed in Table 6.3.

Table 6.3 Scale of Measurement, Mean, Standard Deviation and Median of Strategy Variables

Competitive Strategies	Scale of Measurement	Mean	Std. Deviation	Median
Cost leadership	0-6	2.14	1.048	2.00
Differentiation Strategy	0-6	2.72	1.191	3.00
Geographical Diversification	1-5	3.41	1.383	3.00
Market/Product Diversification	0-10	3.71	2.262	3.00
Functional/Vertical Integration	0-6	1.84	1.413	2.00

n=85

At first glance, the descriptive statistics of these variables may imply that:

(1) Among the five variables, the only one that stands out is the higher degree of geographical diversification strategy. On a scale of 1-5, the mean value is 3.41 and the median is 3.0. This indicates that on average, companies in China may want to diversify into 4-6 different regions or provinces.

(2) On average, companies in China only have limited functional/vertical integration. On a scale of 0-6, the mean value is only 1.84 while the median value is only 2.0.

Still, in order to determine whether a responding company has indeed implemented some of these strategies, these variables need to be transformed into dummy variables (0, 1). The transformation process is largely judgmental and based on the study of the whole sample. This is because whether a strategy is implemented or not is a relative concept – it should be referred to the situation of other companies in the industry. For instance, if one company has a value of 2 for the differentiation strategy, and all the other companies in this industry have the value of 1, then it would be reasonable to suggest that this company has indeed pursued the differentiation strategy relative to the others. Conversely, if this company has a value of 2, while all the other

companies have a value of 5, then it would be concluded that this company has not pursued the differentiation strategy. Therefore, to detect the presence of competitive strategies within each company, the mean and median values of each variable is used as a benchmark. As a precaution, it has been verified that for this particular survey, there are no differences in the resulting conclusions when either the mean or the median is used to transform the variables. Here, the mean is used to transform the variables into dummy variables. Effectively, values greater than the mean would be designated as "1", while values less than the mean would be assigned as "0". These transformed values will also be used in the subsequent regression analyses.

After the transformation, the mean and standard deviation of the variables are listed as follows:

Table 6.4 Mean and Standard Deviation of Transformed Strategy Variables

Competitive Strategies	**Transformed Measures**	
	Mean	**Std. Deviation**
Cost leadership	.46	.484
Differentiation Strategy	.56	.499
Geographical Diversification	.48	.503
Market/Product Diversification	.47	.502
Functional/Vertical Integration	.54	.501

From Table 6.4, it can be seen that the respective mean and standard deviation for each competitive strategies are quite close. Since the scale of all these variables ranges from 0 to 1, a standard deviation of 0.5 can be considered as quite substantial. This implies that many of the surveyed companies adopt varying strategies. There is no single strategy that has a similar or narrow outlook that fits all companies (otherwise the standard deviation of this strategy would be very small).

6.3.3 Measurement of the iRC Variables

The iRC variables include: Guanxi resource; technological and innovative capabilities; reputation; project management competencies; and financial capabilities. The scale of measurement, mean and standard deviation of these variables are summarized in Table 6.5.

Table 6.5 Scale of Measurement, Mean and Standard Deviation of iRCs Variables

iRCs Variables	Scale of Measurement	Mean	Std. Deviation	Median
Guanxi	1-5	3.633	0.746	3.8
Technological Innovation	0-5	1.690	1.235	2.0
Project Competencies	1-5	3.188	0.721	3.2
Financial Capabilities	1-5	3.016	0.916	3.0
Reputation	1-5	3.610	1.103	4.0

n=85

The mean values of these iRC variables would imply that:

(1) On average, Guanxi and Reputation are more extensively developed as compared with other iRC variables.

(2) On average, it may be suggested that the degree of technological and innovative capabilities is still not extensively developed in the Chinese construction industry – at least as far as the survey results are concerned.

6.3.4 Measurement of the S&O Variables

The scale of measurement, mean, standard deviation and median of the four S&O variables are shown in Table 6.6.

Table 6.6 Scale of Measurement, Mean and Standard Deviation of S&O Variables

iRCs Variables	Scale of Measurement	Mean	Std. Deviation	Median
HR strategy	1-5	3.09	0.880	3.0
IT strategy	0-7	2.99	1.708	3.0
Organizational Structure				
Formalization	0-10	6.53	2.818	8.0
Centralization	0-10	5.60	2.431	6.0
Culture	0-7	3.60	1.552	3.0

n=85

In Table 6.6, it is difficult to draw obvious conclusions for HR strategy and culture since the mean and median values are close to the mid-point of the respective scales. However, the mean value of formalization is 6.53 (on a scale of 0-10) and the median value is 8.0. This indicates that on average, large companies in China are more likely to design formalized rules and procedures to govern some of their operational activities. Similarly, the mean value of centralization is 5.60 (on a scale of 0-10), and the median value is 6.0, this indicates that on average, the structure of large companies in China are more likely to be centralized in nature. These results are indeed consistent with Table

5.18 and Table 5.19.

On the other hand, the mean value for IT strategy is lower than the mid-point of the scale, which may suggest a relatively weak degree of adoption of IT strategy by the Chinese construction companies.

6.3.5 Internal Consistency of the Scales

The internal consistency of a scale is one of the most important issues in any social science research study (Kale, 1999). The internal consistency of scales is usually assessed by the Cronbach Alpha method. The Cronbach Alpha coefficient (α) has a value that ranges from 0 to 1, where higher values indicate higher internal consistency of scales. These values can be compared to Van de Ven's (1979) criteria for measuring reliability of organizational attributes: 0.7-0.9 for a narrow construct, 0.55-0.7 for a moderately broad construct, and 0.35-0.55 for a very broad construct. Therefore, the items which have lower values of reliability of a scale should be deleted (in this case, values that are less than 0.55).

Table 6.7 shows the Cronbach Alpha coefficients of the research variables. From this table, it is observed that all the α values are greater than 0.55, with most above 0.70 – indicating that the constructs are meaningful. It should be noted that the Cronbach Alpha test is not applicable to some of the questions because of the structure of those questions. These are simply indicated as "NA" in Table 6.7.

Table 6.7 Cronbach Alpha Coefficients of Research Variables

Variables	**Cronbach Alpha Coefficients**	**Variables**	**Cronbach Alpha Coefficients**
Performance	**.8339**	**iRCs variables**	**.8118**
Sales growth rate	NA	Guanxi Resource	.7405
Profit growth rate	NA	Project Management	.8332
Competitive Strategies	**.7126**	Financial Capability	.7855
Cost leadership	NA	Technological innovation	NA
Differentiation	NA	Reputation	NA
Geographical Diversification	NA	**S&O variables**	**.6818**
Product/Market Diversification	NA	HR Strategy	.8555
Functional Integration	NA	IT Strategy	NA
		Organizational structure: Formalization	NA
		Organizational structure: Centralization	NA
		Organizational culture	NA

n=85

6.4 Results of Regression Analyses and Discussion

The results of further analyses using regressions will be presented in four sections. These analyses will verify the eleven hypotheses of Figure 5.1. The first sub-section presents the analysis of data for testing research Hypothesis 1, which proposes that the five competitive strategies are the primary sources of establishing competitive advantage. The second sub-section presents the analysis of data for testing research Hypothesis 2, which proposes that the iRC variables are the direct sources of establishing competitive advantage. The third sub-section presents the analysis of data for testing research Hypothesis 3-7, which examine the relationships between the iRC variables and the five competitive strategies. Finally, the fourth sub-section presents the analysis of data for testing research Hypothesis 8-11, which consider the interaction among iRC and S&O variables.

6.4.1 Analytical Results and Discussion of Hypothesis 1

Hypothesis 1 proposes that the five competitive strategies are the primary sources of competitive advantage. In order to test the hypothesis, a linear regression analysis is conducted based on three related models: Model 1a, 1b, and 1c. The independent variables in Model 1a, 1b and 1c are the same – with all three models including Cost leadership, Differentiation, Geographical Diversification, Market/Product Diversification and Functional/Vertical Integration. These independent variables are measured and transformed in the manner as described in Section 6.3.2. However, the dependent variable for each model is different: Sales growth (Model 1a), Profit growth (Model 1b) and Overall Performance (Model 1c). The analytical results are shown in the Table 6.8.

Table 6.8 Results of Regression Analysis of Competitive Strategies and Firm Performance

Competitive Strategies	**Sales Growth (Model 1a)**	**Profit Growth (Model 1b)**	**Overall Performance (Model 1c)**
Cost Leadership	.149	.013	.062
Differentiation	**.346*****	**.384*****	**.358*****
Geographical Diversification	.129	.159	.130
Market/Product Diversification	**.227****	**.217****	**.229****
Functional/Vertical Integration	.019	.044	.004
Adjusted R^2	**.205**	**.227**	**.212**
F-Value	**5.331*****	**5.703*****	**5.166*****

n=85

*P≤0.1; **P≤0.05; ***P≤0.01

The adjusted R^2 of Model 1a, 1b and 1c are 0.205, 0.227, and 0.212 respectively. In some of the other researchers' work (e.g. Kale, 1999; Park and Luo, 2001), they accept regression models even when most of the results of adjusted R^2 are below 0.3, sometimes as low as 0.11. In a relative sense, the values of R^2 in this case could also be deemed acceptable for evaluating Model 1a, 1b and 1c. It can be deduced from this table that only 2 independent variables – differentiation and market/product diversification, are statistically significant at the 5% level.

The results suggest that among the five types of competitive strategies, only the differentiation strategy and market/product diversification could contribute directly to the performance of a firm in term of sales growth and profit growth. As Porter (1980, 1985) points out, a firm cannot pursue cost leadership and differentiation at the same time, for it would face the risk of being 'stuck in the middle'. The research results confirm this view for the Chinese construction context (since the independent variables "differentiation strategy" and "cost leadership" are not concurrently significant). The reason that the differentiation strategy, instead of cost leadership, has a stronger relationship with performance is due to the excessive competition that exists in the Chinese construction industry. Many under-performing companies still remain in the industry because of high exit barriers (Shanghai Jinxin Security Research Institute, 2002). These companies, especially small and medium-sized enterprises among the under-performing group, often lower their price to acquire new projects. In some of the

projects, the price could even be lower than the project cost in order to prolong their survival in the industry. On the contrary, large and influential companies have more resources and competencies to support them to distinguish from their competitors. Therefore, they can acquire more projects and a higher level of profit by adopting a differentiation strategy instead of a cost leadership strategy.

Other than differentiation, the findings in Table 6.8 also confirm that market/product diversification can contribute to a strong firm performance. As mentioned previously, market/product diversification implies that companies are competing in different types of projects, such as road, tunnel, bridge, subway, airport, railway, and dam, etc. The reason behind this finding is that market/product diversification can often reduce risks, which may be faced by a focus strategy that targets only one type of market segments. Furthermore, market/product diversification fully utilizes the experiences, resources (such as manpower, equipment, etc.) and competencies (such as project management competencies) developed in one type of projects and synergize these resources and competencies with applications to other types of projects.

The results do not support the notion that geographical diversification could influence performance. One possible factor is the protectionist policy of the local and regional government in China. In order to protect benefits, secure short-term profits and lighten the pressure of unemployment and fiscal problems, many local government and authorities have chosen to lower the entry barriers to their local construction companies (see Section 4.2.3). This would aggravate the level of competition within the local industry. At the same time, the local government might elevate the entry barriers to companies from other regions, thus making it difficult for them to secure new projects in the region.

This result also does not support the notion that vertical or functional integration could influence performance. This means that vertical or functional integration may not be a viable strategy for the larger construction companies in China (although it should be mentioned that many firms have successfully applied this strategy in other countries – see Cheah (2002)). One possible explanation is that although vertical integration

could reduce operational risk and transaction costs (such as backward integration into the manufacturing of equipment and materials and forward integration into real estate development), it cannot utilize resources and competencies developed in the existing construction business to venture into other similar projects. For example, a few categories of iRCs – Guanxi resource with original clients, project management competencies and technological and innovative capabilities, have limited "expansion value" into the upstream and downstream businesses.

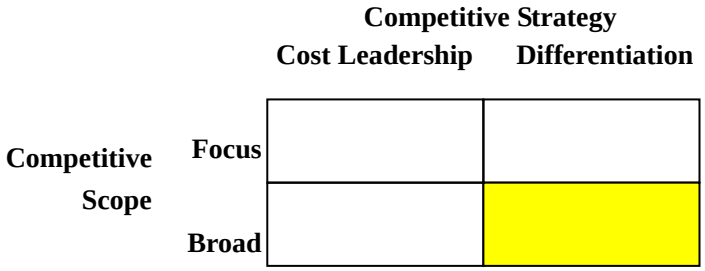

Figure 6.1 Competitive Strategy Adopted by Larger Chinese Construction Companies

Figure 6.1 is adopted from Porter (1980, 1985)'s notion of generic strategy. From the findings of Model 1a-1c, it can be concluded that First Class Qualification companies would choose to adopt the differentiation strategy and the market/product diversification strategy concurrently to improve their firm performance. This combined strategy belongs to the shaded box in the figure.

6.4.2 Analytical Results and Discussion of Hypothesis 2

Hypothesis 2 postulates that the five iRC variables are the primary sources of competitive advantage. In order to test Hypothesis 2, a linear regression analysis was conducted for three related models: Model 2a, 2b, and 2c. The independent variables in Model 2a, 2b and 2c include: Guanxi Resource, Project Management Competencies, Financial Capabilities, Technological and Innovative Capabilities and Reputation. These independent variables are measured in the manner as described in Section 6.3. The dependent variables are separately Sales growth (Model 2a), Profit growth (Model

2b) and Overall Performance (Model 2c). The analytical results are shown in Table 6.9.

Table 6.9 Results of Regression Analysis of iRCs Variables and Firm Performance

iRCs variables	**Sales growth (Model 2a)**	**Profit growth (Model 2b)**	**Overall performance (Model 1c)**
Technological and Innovative capabilities	**.256*****	.09	**.203****
Financial Capabilities	**.264****	**.374*****	**.347*****
Project Management Competencies	.038	.081	.044
Reputation	.011	.062	.013
Guanxi	**.291*****	.113	**.231****
Adjusted R^2	**.413**	**.314**	**.402**
F-Value	**12.811*****	**8.679*****	**11.657*****

n=85

*P≤0.1; **P≤0.05; ***P≤0.01

The results show that the adjusted R^2 for model 2a, 2b and 2c are 0.413, 0.314, and 0.402 respectively. Specifically, at a 5% level of significance, it is found that Guanxi, technological and innovative capabilities and financial capabilities can directly influence a firm's performance. It should be noted that Guanxi resource and technological and innovative capabilities can only contribute to sales growth but not profit growth.

The existence of a direct relation between Guanxi and sales growth is not surprising. Guanxi with government may increase new orders in public projects. In Section 4.5, it has been discussed that 'tendering shows' exist in the Chinese construction procurement system, and this encourages companies to build Guanxi with government to acquire public projects. In addition, Guanxi with clients may spur customer loyalty and minimize transaction costs and business uncertainty. However, cultivating and sustaining Guanxi can be costly in terms of the reciprocal and utilitarian demands (Park and Luo, 2001). As such, this to some extent offsets the benefits derived from Guanxi. This may explain why Guanxi could only contribute to sales growth and not profit growth.

The possible reason for the iRC of technological and innovative capabilities contributing to sales growth is its role in expanding the business scope of a firm with more chances to get involved in high technology projects. Consider the case of SCG. It was able to construct the famous China National Grand Theater mainly because of its

strong technological capability in handling complex steel structure works. This high-tech project segment is difficult for lower level firms to enter. Another reason can be traced to the theory of economies of scale. Technology with generic applications or functions can be used multiple times in similar types of projects and enlarge the turnover of a firm. Therefore, technological and innovative capabilities could directly contribute to sales growth, especially if it helps to build up a track record and good reputation in complex and high-tech projects. On the other hand, innovation could be costly, since every year the company has to invest a lot of money into this area (as has been discussed in Section 5.4.1.5). This would then offset the benefits derived from a higher level of sales, thus minimizing the bottom line impact on profit growth.

The research findings also confirm that financial capabilities is one important factor which can directly contribute to both sales growth and profit growth. Some of the possible explanations are:

(1) As discussed in Section 4.3.3, the financing conditions in Chinese construction industry are problematic, such as the lack of access to bank loans to many construction companies, untimely payment by clients, etc. Thus, the ability to acquire more financial resources can help companies undertake more projects as compared to those who have less financial resources and in turn increase the sales volume.

(2) Sound investment strategies can also help companies involved in rapidly growing and more profitable industries, such as real estate. This partly explains the contribution of financial capabilities to positive sales and profit growth.

It is interesting to note that although financial investment is a form of integration, integration does not turn out to be a significant variable when testing Hypothesis 1. This is due to the fact that the strategy of integration is very broad in meaning and scope. It not only involves real estate investment – which is only one part of forward integration, but also involves backward integration into other market segments. Thus, although financial investment *per se* is significantly related to performance, integration strategy as a whole may not be the same.

(3) Strong financial management capabilities can help companies utilize their assets more efficiently, diminish unreceived accounts, and reduce financial risks. All these would help to enhance profitability.

Interestingly, the research findings indicate that project management competencies may not directly contribute to the performance of a firm – neither in terms of sales growth nor profit growth. This may be due to the unfavorable conditions that exist at the project level environment in China. For example, excessive administrative regulations and procedures would introduce unnecessary uncertainties to the project operating environment. This hinders project management competencies from directly contributing significantly to the performance of a firm.

Finally, the analytical results found that strong reputation does not always directly lead to higher performance. This may be unexpected to many researchers, such as Fombrun (1996), who suggested that reputation can produce significant long-term competitive advantage. The possible reason in China could be that reputation is always seen as an intangible asset and needs to be built in the long-run. This would take the companies much time, effort and cost. The benefits from reputation may not be obvious in the short-term, as seen by the respondents in the survey.

It should be noted that although reputation does not directly contribute to the performance of a company, it could indeed *indirectly* affect performance by supporting the differentiation strategy of a company. The contribution of the reputation to the differentiation strategy is discussed in the next section (Table 6.10, Page 164).

6.4.3 Analyses and Discussions of Hypothesis 3-7: Influence of iRC Variables on Each Competitive Strategy

Hypothesis 3-7 concerns the influence of iRC variables on each of the five competitive strategies. As stated in Section 6.3.2, the survey data of these five competitive strategies have been transformed into dummy variables. Hence, a binary logistic regression model has to be used in each of the analytical processes. The independent variables are the related iRC variables, which have been stipulated in

Hypothesis 3-7, and each competitive strategy variable would serve as the dependent variable separately in Model 3 to Model 7. The analytical results are summarized in Table 6.10.

It should be noted that the previous results in Table 6.10 suggest that differentiation and market/product diversification can directly influence the performance of a company. For the analysis here, it is therefore logical to suggest that the iRCs variables that support these two competitive strategies would also indirectly influence the performance of a company.

Table 6.10 Results of Binary Logistic Analysis for Hypothesis 3-7

iRCs variables	**Cost Leadership (Model 3)**	**Differentiation (Model 4)**	**Market/ Product Diversification (Model 5)**	**Geographical Diversification (Model 6)**	**Functional/ Vertical Integration (Model 8)**
Technological and Innovative Capabilities	.420	-.104	1.686	**.612****	
Financial Capabilities	**.728***	-.331	2.367	1.011	**1.012*****
Project Management Competencies	**1.490*****	**1.594****	**1.568*****	**1.209*****	
Reputation		**.990****	.117	1.032	**.514****
Guanxi		**2.490*****	.405	.877	-.022
Nagelkerke R^2	**.258**	**.658**	**.269**	**.375**	**.317**
Chi-square	**12.586*****	**57.378*****	**19.139*****	**28.095*****	**23.037*****

n=85

*P≤0.1; **P≤0.05; ***P≤0.01

In Table 6.10, the Nagelkerke R^2 values of Model 3, 4, 5, 6, and 7 are 0.258, 0.658, 0.269, 0.375 and 0.317 respectively. The Chi-square tests of these five models are all statistically significant at 1% level. In a binary logistic regression model, the meaning of Nagelkerke R^2 is similar to the adjusted R^2 of a simple regression model (Chen and Huang, 2002). Therefore, the results imply that Model 3 could explain 25.8% of the variation in the dependent variable – cost leadership strategy, at a 1% level of significance. The results for Model 4, 5, 6, and 7 carry similar explanations.

(1) Discussions related to cost leadership strategy

The research findings in Table 6.10 confirm that project management competencies can support the cost leadership strategy at a 1% level of significance. This confirms that activities, such as cost management in controlling the cost of

manpower and the construction process, procurement management in controlling materials and equipments cost and contract management in controlling subcontracting costs, would all help companies to pursue a cost leadership strategy.

The weaker support of financial capabilities to the cost leadership strategy (only at 10% level of significance) may suggest that although the aspect of financial management may be effective in reducing administrative costs, the other two areas under this iRC (acquisition of financial resources and investment strategies) do not seem to have direct relationships with the cost leadership strategy.

The research findings also show that technological and innovative capabilities does not support cost leadership strategy. This implies that the main benefits of technological innovation in Chinese construction companies may not be reflected in the reduction of project cost. Alternatively, the invention of new low-cost construction materials or new processes to elevate labor productivity may not bear a similar level of impact as the development of new technologies and techniques to meet the business requirements of more complex projects.

(2) Discussions related to differentiation strategy

The research findings in Table 6.10 show that at a 5% level of significance, Guanxi, project management competencies and reputation can all support the differentiation strategy.

Taking the results of Table 6.9 and 6.10 together, the research finding show that Guanxi not only directly promotes the sales growth of a firm, but also influences the differentiation strategy and indirectly contributes to the performance of the company. The influence of Guanxi on the differentiation strategy can be seen in many aspects. Guanxi is often perceived by clients as unique and unmatched by competitors. It also serves as a useful channel to overcome unfavorable operational environment, such as political, regulatory and financing environment (as discussed in Chapter 4). Guanxi with government can smooth project operating environment and reduce uncertainties. Furthermore, Guanxi with financial institutions would help a firm in acquiring financial resources with a more advantageous position as compared to their competitors. Lastly,

Guanxi with suppliers would ensure better access to quality construction materials, receive good service and timely deliveries.

According to the previous results in Table 6.9, although project management competencies was not identified as a significant factor directly contributing to the performance of a firm, it can indirectly influence performance by supporting the differentiation strategy. One possible explanation for this is that: strong project management competencies help to project a good image of project execution, such as completing a project within budget and schedule. This image would differentiate a firm from its competitors, although it may not have direct implication on sales and profit growth.

In Table 6.10, the iRC of reputation is also found to be supporting the differentiation strategy. This confirms that reputation helps to form a unique brand and clients can distinguish a company from their competitors according to their reputation. Although the findings in Table 6.9 show that reputation does not have any effect on performance, it indeed needs to be emphasized and cultivated by the Chinese companies for the long run.

In the research findings of Table 6.10, technological innovative capabilities do not support the differentiation strategy, although in Table 6.9 technological innovative capabilities could directly contribute to performance. One possible explanation is that the Chinese construction industry is not mainly driven by technology. Although there are some projects that are particularly complex, most of the larger construction companies have the capability to utilize a reasonable level of technology to assist construction in these projects. The clients could not perceive differences in technology and innovation capabilities as the most important factor when it comes to the category of large companies. Likewise, many of the larger Chinese construction companies have similar level of financial capabilities, which could not be easily differentiated by the clients. For example, most of the larger companies have similar financial channels – they all establish relationships or strategic alliances with major Chinese banks or other financial institutions. These resources could help the company to attain high performance but may not be able to support the differentiation strategy.

(3) Discussions related to market/product diversification strategy

The research findings in Table 6.10 show that project management competencies support the market/product diversification strategy at 5% level of significance. This indicates that the experience and competencies of project management gained in one type of projects may also be applied to other types of projects. Thus, project management competencies would contribute indirectly (although not directly, according to the results of Table 6.9) to the performance of a firm by supporting the market/product diversification strategy.

The research results in Tables 6.10 indicate that other iRC variables do not support the market diversification strategy. This may be due to the reason that the resources and competencies built up for one market would be difficult to be transferred to another new market segment. For example, if a company strives in the hydraulics sector for a long time, it accumulates its resources and competencies in technological and innovation, Guanxi, reputation, etc. specific to this sector. However, when this company intends to enter into the highway construction sector that is totally new to this company, the already accumulated resources and competencies may not immediately show their effects in the short term (although in the long run these iRCs may still help to support the overall diversification strategy).

(4) Discussions related to geographical diversification strategy

The results of Table 6.10 show that project management competencies and technological and innovative capabilities would support geographical diversification at a 5% level of significance. These results are indeed logical. As discussed in Chapter 4, local protectionism policies in various regions hinder the entry of competitors from other regions. Only certain complex and high-tech projects, which local companies are less capable of executing, offer opportunities to be undertaken by competitors from other regions. Thus, if one company wants to diversify into different regions, it must possess high competencies and capabilities in project management and technological innovation.

Logically, one would expect that Guanxi would also support a geographical diversification strategy in securing contracts in other regions. However, the results in Table 6.10 do not support this argument. In a way, this represents a "chicken-and-egg" problem. Without first penetrating the local market and setting up a physical presence, it would be difficult for a firm to establish Guanxi with the local clients and government agencies and promote its chances of securing orders as a "new comer".

(5) Discussions related to the functional/vertical integration strategy

The results of Table 6.10 show that financial capabilities and reputation would support functional/vertical integration at a 5% level of significance. The results suggest that backward integration into construction equipment/materials manufacturing and forward integration into real estate development requires that the company has sufficient financial resources to pursue these strategies. At the same time, sound investment strategies are also needed to ensure that such integration indeed makes sense and would lead to a favorable return. Furthermore, reputation can transfer the good image built in one segment of the value chain to the new upstream/downstream segments. This is especially true considering the success of some large companies in EPC and BOT projects that combined a few upstream and downstream activities.

6.4.3 Analyses and Discussions of Hypotheses 8-11

Hypotheses 8-11 examine the relationships between each iRC variable (except Guanxi, which is largely cultivated by the top managers in a longer time horizon and independent of other variables) and related supporting variables (including other iRC and S&O variables). In order to test these hypotheses, linear regression analyses were conducted by adopting Model 8 to Model 11, which are listed in Table 6.11.

Table 6.11 Results of Regression Analysis for Hypothesis 8-11

iRCs variables	**Technological and Innovative Capabilities (Model 8)**	**Financial Capabilities (Model 9)**	**Project Management Competencies (Model 10)**	**Reputation (Model 11)**
iRC variables				
Technological and Innovative Capabilities				**.337*****
Financial Capabilities	.025		**.385*****	
Project Management Competencies				**.023****
Guanxi	**.248*****	**.433*****	.018	
S&O Variables				
HR strategy	.078		**.269*****	
IT strategy	**.210****	**.296*****	.019	
Structure: Formalization	.149	.119	**.252*****	
Structure: Centralization	.129	-.025	.043	
Culture	**.398*****		.173	
Adjusted R^2	**.481**	**.450**	**.522**	**.268**
F-Value	**12.134*****	**18.156*****	**14.110*****	**16.382*****

n=85

*P≤0.1; **P≤0.05; ***P≤0.01

In these models, the dependent variables are, separately, technological and innovative capabilities (Model 8), financial capabilities (Model 9), project management competencies (Model 10) and reputation (Model 11). The independent variables are the supporting iRC and S&O variables stipulated in each hypothesis in Chapter 5.

From this table, it could be found that adjusted R^2 in Model 8, 9 and 10 are 11 are 0.481, 0.450, 0.522 and 0.268 respectively. The F-values for these models are all at a 1% level of significance. Thus, Model 8, 9, 10 and 11 are all deemed acceptable (although Model 11 is arguably weaker). Based on the results listed in this table, some discussions will be given in the following section.

(1) Discussions related to technological and innovative capabilities

The results in Table 6.11 show that HR strategy is not a significant component in supporting the development of technological and innovative capabilities, whereas culture, on the contrary, is a significant component (at 1% level of significance). As explained in Section 5.4.1, technological innovation requires all the employees in related departments to get involved in the innovation process. In fact, this requires

employees to collaborate with each other not just within the companies, but also with external parties, either domestic or international. All these require the company to cultivate a culture of innovation, communication and learning from each other and to enhance the spirit of teamwork. Instead, the HR strategy emphasizes on optimizing human resource, enhancing training and education of the employees in a more generic sense. HR strategy focuses more on the development of capabilities of individual employees instead of the entire team. It places less emphasis on encouraging collaboration among employees that can only be achieved by promoting a conducive environment and culture. Also, as a great number of uncertainties exist during the innovation journey, the work done by each employee is difficult to evaluate. This hinders the application of certain incentive mechanisms that are central to the HR strategy. Thus, culture, instead of HR strategy, stands out as a stronger component in supporting technological and innovative capabilities.

The results in Table 6.11 show that IT strategy can directly support technological and innovative capabilities at a 5% level of significance. The studies in Section 5.5.2 show that the IT systems of case companies may include: (a) a database system, which is used to collect technical data from various sources; (b) technical software for design and innovation, and (c) knowledge-based systems. These IT systems naturally facilitate the development of technological and innovative capabilities.

The research findings show that the two dimensions of organizational structure – formalization and centralization, do not support technological and innovative capabilities. Technological innovation would require the organizational structure to be decentralized and informal (Slaughter, 2000; Fry, 1982). This is because activities of innovation require willingness, self initiative and collaboration among related employees, which cannot be stipulated in a formal manner. This argument largely agrees with the findings.

The results in Table 6.11 show that Guanxi is an important iRC in supporting the development of technological and innovative capabilities. External collaboration with domestic and international research institutes is a major mode adopted by some companies. Such collaboration would enhance the innovative capability of a firm. In

order to build a strong collaboration with external parties, Guanxi with these parties would be important.

Finally, the results in Table 6.11 show that financial capabilities do not support technological and innovative capabilities. Usually, company with sufficient financial resources could spend more money in research and development, which would enhance its technological and innovative capabilities. However, the research finding indicates that this is not always the case. One possible reason is the effectiveness of capital spending in R&D – this may be low for some Chinese companies if they do not know the best way to use the funds, e.g., resources may be channeled to a weak direction of research. Although the company has invested a lot of funds into R&D, the actual output may not be very productive. This weakens the relationship between financial capabilities and technological and innovative capabilities.

(2) Discussions related to project management competencies

The research findings show that project management competencies are supported by HR strategy instead of culture. Unlike an innovation process, the objectives and activities within the regime of project management can be broken down into very detail. The performance of each employee can be evaluated according to the extent that their works have achieved the targets. Thus, the incentive mechanisms in HR strategy, such as career development and remuneration, are all useful in motivating employees and promoting excellence in project management competencies. Furthermore, a proper design of training and education system could enhance the competencies of individual employees.

The results show that IT strategy does not support the development of project management competencies. This result may be unexpected since in general, there is plenty of software in the market that is related to project management activities. Examples of these kinds of software include Project 2000 (Microsoft) and Primavera 3. Furthermore, there is also customized management software developed by the construction company itself or by other IT companies. The possible explanation for the current finding is that: many Chinese construction companies are still not sophisticated

enough to fully utilize the potential of such software. Real time data, such as cost assumptions, are not input into programs promptly and accurately. This restricts the usefulness of the project management software. Observations drawn from the case companies confirm that many companies mainly use the basic and fundamental functions of these software. Thus, the main benefit of adopting those project management software is limited to enhancing the efficiency of work, not establishing other general types of project management competencies.

The results show that project management competencies are related only to formalization but not centralization. The studies in Section 5.4.3 and 5.5.3 indicate that most of the case companies have formulated rules and procedures to handle project management activities. The purpose of formulating these rules and procedures is to codify the experience and knowledge accumulated in various projects and to enhance management capabilities. On the other hand, although the case studies confirm that most case companies are highly centralized in terms of overall structure, by nature it is impossible to centralize all the project-level functions since they are geographically dispersed.

Although Guanxi to some extent can be used to overcome the uncertainty of project environment, the research findings show that Guanxi is not an important variable in supporting the variable of project management competencies. Unlike technological and innovative capabilities and financial capabilities, in which there is a need to collaborate with external parties, project management competencies must be cultivated, improved and optimized internally over time. The development of competencies in cost, schedule and quality management do not require the same extent of collaboration with external parties. Thus, based on this view point, Guanxi is relatively less important in cultivating project management competencies.

Lastly, the research findings show that strong financial capabilities indeed have an impact on project management competencies. This is because activities of financial management, such as budget estimation and budget control, are closely related to certain project management functions, such as cost management and procurement.

(3) Discussions related to financial capabilities and reputation

The research findings in Table 6.11 show that Guanxi can support the financial capabilities at 1% level of significance. As stated in Section 5.4.2, in order to acquire financial resources, many Chinese construction companies need to cultivate Guanxi with relevant financial institutes. Also, as many financial institutes in China are owned by the government, Guanxi with government is another aspect that needs to be cultivated to acquire the financial resources. The research findings also show that IT strategy can support the financial capabilities at 1% level of significance. This indicates that IT systems related to asset management, financial management, and total budgeting, all help to enhance the financial management capabilities.

Finally, the research findings confirm that in China, strong reputation would be gained by having strong technological and innovative capabilities and project management competencies. Obviously, most clients really care about whether their contractors have the ability to manage the complexity of their projects and meet their requirements in quality and schedule.

6.5 Summary

As a whole, the research findings in this chapter can be summarized in the following three tables:

Table 6.12 Summary the Research Findings for Hypothesis 1 and 2

	Sales Growth	**Profit Growth**	**Overall Performance**
Competitive Strategies (H1)			
Cost Leadership			
Differentiation	●	●	●
Market/Product Diversification	●	●	●
Geographical Diversification			
Functional/Vertical Integration			
iRCs variables (H2)			
Technological and Innovative Capabilities	●		●
Financial Capabilities	●	●	●
Project Management Competencies			
Reputation			
Guanxi	●		●

Table 6.13 Summary the Research Findings for Hypothesis 3-7

	Cost Leadership	Differentiation	Market/ Product Diversification	Geographical Diversification	Vertical Integration
	(H3)	(H4)	(H5)	(H6)	(H7)
Technological and Innovative Capabilities				●	
Financial Capabilities	●				●
Project Management Competencies	●	●	●	●	
Reputation		●			●
Guanxi		●			

Table 6.14 Summary the Research Findings for Hypothesis 8-11

	Technological and Innovative Capabilities	Financial Capabilities	Project Management Competencies	Reputation
	(H8)	(H9)	(H10)	(H11)
iRC variables				
Technological and Innovative Capabilities				●
Financial Capabilities			●	
Project Management Competencies				●
Guanxi	●	●		
S&O Variables				
HR strategy			●	
IT strategy	●	●		
Formalization			●	
Centralization				
Culture	●			

Table 6.12 indicates that a company can improve its performance by focusing on a differentiation strategy and adopting market/product diversification. The company should also emphasize on cultivating a few iRC variables, namely, technological and innovative capabilities, financial capabilities and Guanxi.

Table 6.13 indicates that each competitive strategy is supported by a few iRC variables. Furthermore, the iRC variables which support the differentiation and market/product diversification strategies would indirectly contribute to the competitive advantage of a firm.

Table 6.14 indicates that each iRC variable, except Guanxi, is supported by other

related iRC and S&O variables. In a way, this table provides suggestions on how to build up some of these iRC variables. Take for example, the cultivation of technological and innovative capabilities should consider the influence of Guanxi, IT strategy and organizational culture and focus on their interactions at a more detailed level.

Overall, it should be noted that these findings are only based on the current outlook and survey feedback. In Table 6.12, although geographical diversification has not been confirmed as contributing to firm performance currently, it may become a significant strategy when the economic situation changes. If this were to be the case, Table 6.13 and 6.14 would be useful in providing guidance as to how geographical diversification may be developed from the supporting iRCs and S&O variables and studying the associated implications on corporate strategy carefully.

Chapter 7 Conclusions

The western theories of strategic management have not been widely applied to the construction industry. Cases of applications to the Chinese construction industrial context are even more limited. The Chinese construction companies have not been able to gain sufficient insights and contributions from the academic world to help build their competitive advantage. This research project embarks with the aim to fill this gap. Starting with the environmental analysis, relevant types of competitive strategies and important resources and competencies (iRCs) are identified as critical research variables that potentially contribute to the development of a company's competitive advantage and ability to cope with the industrial environment in China. Further case studies examine the characteristics of each of these critical variables and study the relationships between the competitive strategies and iRCs. In turn, following the fundamental bases of Resource-based View (RBV) and the Competence-based View (CBV) theories, it is postulated that each iRC variable must also be developed over time – in this case nurtured and supported by other iRC and S&O variables. Based on the environmental analysis and case study findings, a conceptual model is developed. Finally, using the feedback gathered from a questionnaire survey, the relationships among the various components within the conceptual model are verified.

As a whole, a few major conclusions and implications stand out.

7.1 Summary of Conclusions and Implications

This research is founded on the thinking that the competitive advantage of a firm can be traced to two sources: competitive strategies (originated from the industrial organizational economics theories) and iRC variables (derived from the RBV and CBV theories). Although the standpoints of these two fields of theories are significantly different – with industrial organization economics belonging to the Classical approach and the RBV and CBV theories belonging to the Processual school, the model developed in this research confirms that these are essentially complementary. The RBV and CBV theories broaden the horizon of establishing competitive advantage and the

model shows that the formation of competitive strategies is not only related to industrial organizational economics, but also relies on a firm's internal resources and competencies. Moreover, selected Strategy & Organization (S&O) variables in Cheah (2002)'s model are also proved to be relevant in supporting the development of the iRC variables.

Although past theories and models contribute in parts to the understanding of the operations of construction companies, the output of this research streamlines the generality and applicability of these theories and models into finer layers of details. Essentially, the research output illustrates the intrinsic relationships that exist along the chain of "S&O –> iRC –> Competitive Strategies –> Competitive Advantage". These linkages are now summarized in Figure 7.1, which is the ultimate contribution of this research.

The figure is essentially a recapitulation of the statistically significant and key relationships that have been identified in this research. However, it should be noted that since the operating environment in China is ever changing, this figure would serve as a good reference framework to discuss the sequence of developing competitive advantage as circumstances change – an aspect that was not addressed explicitly in the earlier chapters. Subsequently, the author will also make use of Figure 7.1 to express his opinion of future changes to the outlook of Chinese construction enterprises that are deemed plausible.

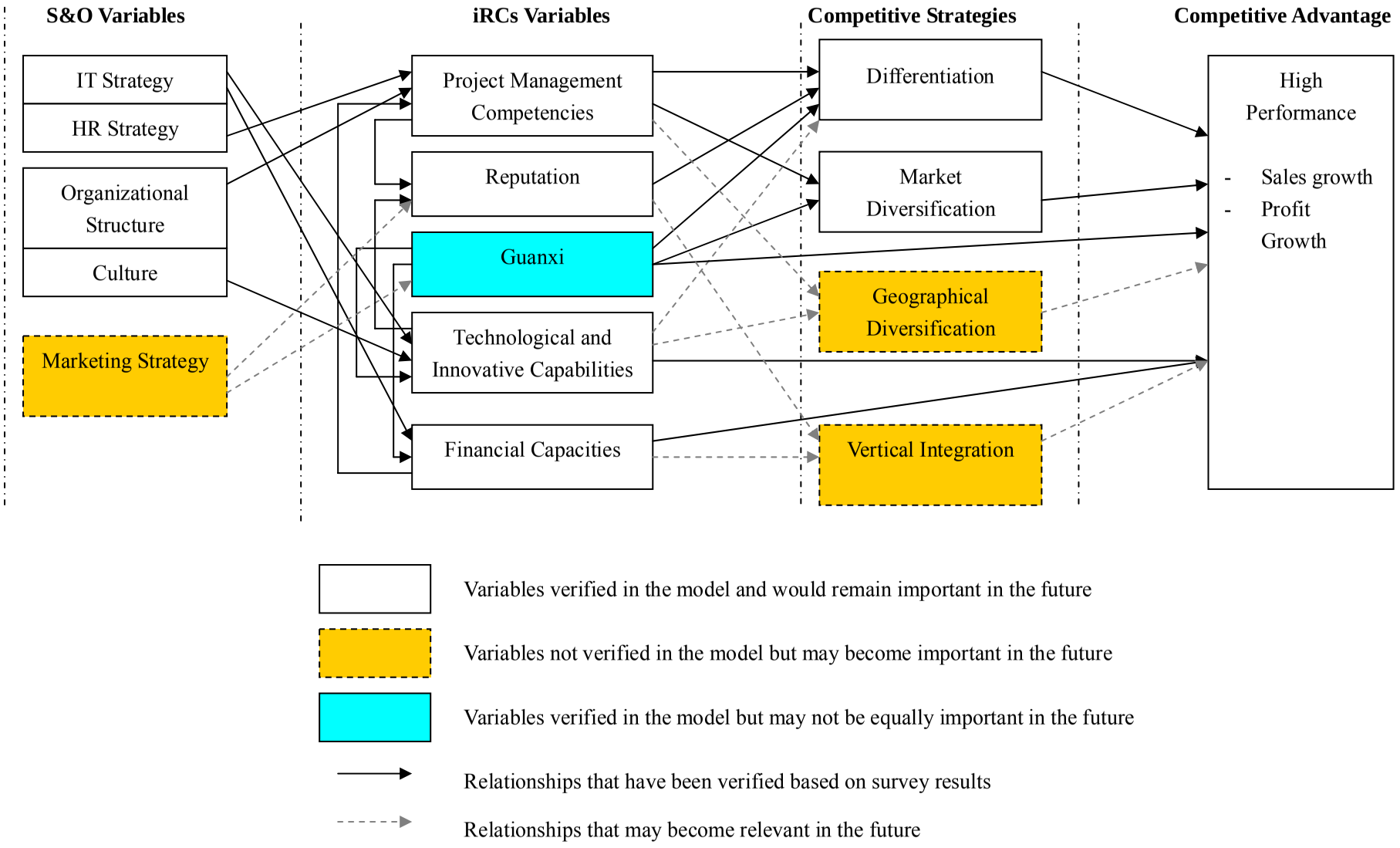

Figure 7.1 Relationships among Components in the Model: Present and Future Outlook

First and foremost, the top management should give first priority to build the fundamental variables, essentially the S&O variables plus Guanxi. From the case studies, it was found that not all S&O variables are applicable to supporting the iRC variables. Only four S&O variables are applicable: HR strategy, IT strategy, organizational structure and culture. The HR strategy would emphasize on employee resourcing, human resource development and payment incentive mechanism. IT strategy would emphasize on the development of various technical and management software or systems. The design of an organizational structure in terms of formalization and centralization is proven to be highly related to project management activities especially in the context of China. A strong corporate culture would emphasize on encouraging collaboration among employees in different departments and enhancing the spirits of teamwork. Externally, the top management also needs to expend efforts in developing Guanxi with related bodies, such as government agencies and financial institutions.

Cultivating these fundamental variables is just the first step. Next, the management would consider building the iRC variables based on these supporting fundamental variables. For example, the long-term development of technological and innovative capabilities is subjected to the influence of the IT strategy, culture and Guanxi, as verified in the analytical findings of the conceptual model. It should be noted some iRC variables are supported by other related iRC variables, so the sequence as to which iRC should be developed first is really a matter of choice given the individual circumstances faced by the company.

Successful cultivation of the iRC variables would help to establish competitive strategies of the firm. A right type of competitive strategies that fit well with the external environment would lead to a competitive advantage. However, the research results also indicate that a few iRCs, such as technological and innovative capabilities, financial capabilities, and Guanxi, directly contribute to achieving competitive advantage.

The sequence of development of all these variables and components is far from a trivial matter. For example, top managers who subscribe to the Classicist approach

would select the relevant types of competitive strategies first, before determining the right kind of supporting S&O or iRC variables for these strategies. This is because most Classical approaches embark on the analysis of external environment such as assessing the industrial structure and market positioning (Porter, 1980), prior to looking inside the firm boundary. On the other hand, managers who subscribe to the Processual approach would prefer to develop and strengthen the S&O and iRC variables first, prior to moving toward the right in Figure 7.1. Regardless of which approach is preferred, in the author's opinion, these preferences do not strictly conflict with Figure 7.1, which simply maps out the inter-relationships among various components.

There are some variables and inter-relationships in the hypotheses that were not supported by the results of questionnaire surveys and regressions. However, it is prudent for the management of Chinese construction firms to monitor them, especially since the conditions of China are dynamic and full of changes. These variables and inter-relationships are marked as dotted boxes and arrows in Figure 7.1. On the other hand, some variables in the model, that may be significant in today's context, may not carry the same weight in the future. These variables are also marked in the figure. These issues are furthered discussed below.

(1) Geographical diversification may become an important competitive strategy.

It was discussed in the dissertation that the protectionist policies of local government would hinder companies from pursuing a geographical diversification strategy. Gradually, with ongoing changes due to the WTO accession and as the Chinese construction industry becomes more matured, local government authorities would have to slowly diminish their intervention and heavy-handedness in the industry. It is foreseeable that in future, more and more companies with strong technological and innovative capabilities and project management competencies would be allowed to compete freely in the local markets. This would encourage companies to pursue the geographical diversification strategy to a fuller extent.

In the past, the central government's policies were more favorable to the

development of the eastern coastal regions. In recent years, however, the Chinese central government has determined to develop the western and north-east regions. In 2000, the State Council issued an order of <The Notification of the Steps of Developing the Western Regions>, which is a sign of placing focus on the inner regions. In 2003, Chinese Prime Minister Mr. Wen Jiabao clearly pointed out that the development of north-east regions should be considered as an important strategy of China. Thus, in the near future, these two areas would become the key regions of attracting investments and this will boost demand for new construction projects. Therefore, companies may consider entering into these regions with a geographical diversification strategy.

(2) Vertical/Functional integration may become an important competitive strategy

When comparing the large Chinese construction companies in the case studies with the top 6 international contractors in ENR's ranking in 2004 – Skanska (Sweden), Hochtief (Germany), Vinci (France), Bechtel (US), Bouygues (France), and KBR (US), it is found that these companies like to pursue backward integration into materials supply, equipment manufacturing, and design/consulting services, and forward integration into property and project development (sales, leases, property management, BOT operations, concessions), and equity investments (See Figure 7.2). For example, Vinci is the largest highway material manufacturer in Europe. Hochtief, a firm that is very active in the concession market, has set up a PPP (Public-private-partnership) institute that focuses on project financing.

The fact that top international contractors like to adopt a vertical/functional integration strategy implies the attractiveness or importance of this strategy. Given China's accession to WTO, many large international contractors would continue to enter and set a foothold in the China market. In order to compete with these firms, the Chinese companies have to learn from the successful experience of these top international contractors, especially the strategy that they have adopted. Therefore, the viability of a similar vertical/functional integration strategy should be studied seriously. To this end, the vertical integration strategy would require a company to first build up strong financial capabilities and reputation in the existing value systems/vertical

markets, as suggested by Table 6.13.

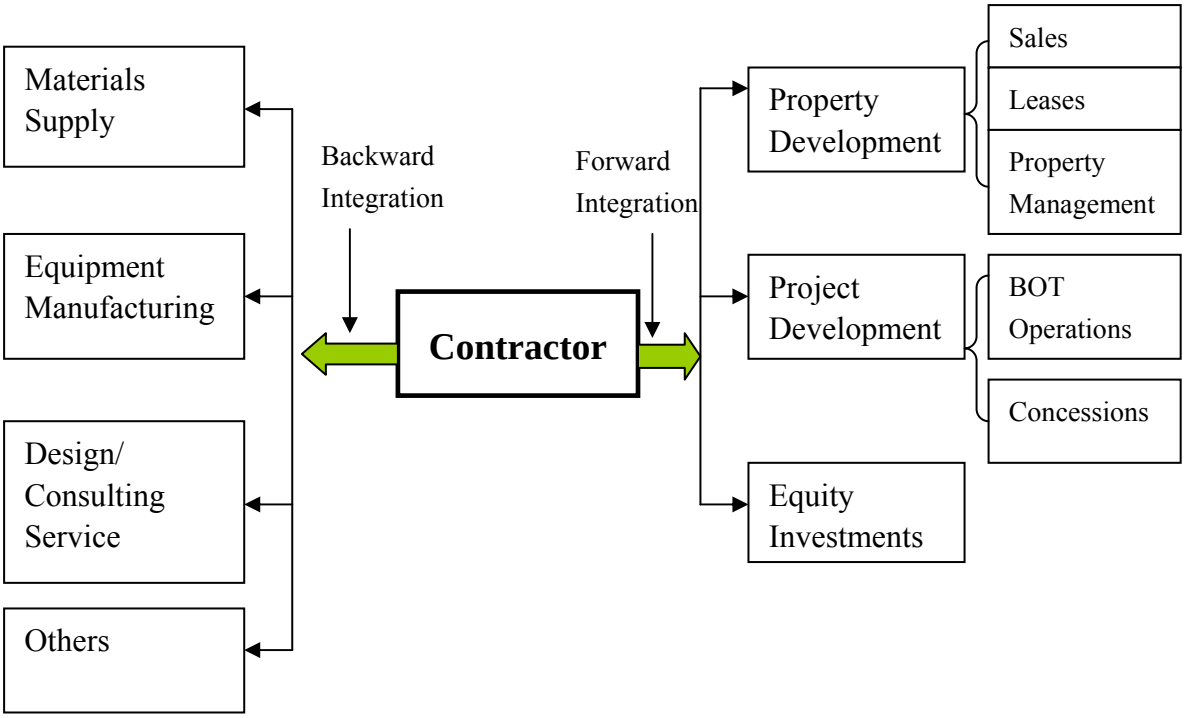

Figure 7.2 Vertical Integration Strategy Adopted by Top 6 International Contractors

(3) Technological and innovative capabilities would have a larger influence on the differentiation strategy

Although the statistical results did not confirm this relationship, this linkage should become stronger in the future. As projects are becoming more and more complex in some regions and urban cities such as Beijing and Shanghai, the clients would expect the contractors to provide and use specialized techniques and advanced technology to execute their projects and solve their practical problems. Consider the case of SCG. During the construction of the Shanghai Lupu Bridge, there were some difficulties in connecting the last three arch ribs. SCG finally managed to develop an innovative construction method to install the ribs, which has won them the National Technology Advancement Award in 2005. The capability to provide innovative solutions would project a reliable image to the clients.

(4) Guanxi may not impose a similar level of significance in the future

It is undeniable that Guanxi is a unique feature of doing business in China and is

very important in today's context. The results from this research indeed confirm that Guanxi either directly supports the development of competitive advantage of a firm or indirectly contributes to competitive advantage by supporting the differentiation strategy. However, when the government gradually reduces their intervention in the industry and the regulatory systems are better developed and more transparent, some of the operating uncertainties will gradually diminish. In that sense, Guanxi as a "stabilizing asset" against external uncertainties may not bear the same level of significance as in today's industrial conditions.

(6) Marketing Strategy may evolve as an important S&O variable in the framework

In this research, only four S&O variables are identified as supporting the iRC variables. Indeed, it is possible that other S&O variables may contribute to the development of competitive advantage in the future. The strongest possibility comes from marketing strategy. The case studies in this research found that a few of the case companies have put in place effective and systematic marketing strategies. It is important to realize that the Chinese construction industry is now transforming. Prior to economic reform, many construction projects were mainly assigned by the government and most companies need not care about marketing strategies. Although the industry has since slowly developed, some companies still have not formulated sound marketing strategies and adapted to the new environment.

Actually, marketing strategy can help to build up some iRC variables. According to Hillebrandt & Cannon (1989), marketing strategy would encourage a company to maintain and improve contacts with local authorities, architects and clients (Guanxi) and effectively project its strong image to the clients (reputation). Meng *et al* (2004) had also pointed out that marketing strategy can indeed help to improve the performance of a firm in the Chinese construction industry by promoting the development of Guanxi, bidding strategy, and image, as depicted in Figure 7.3.

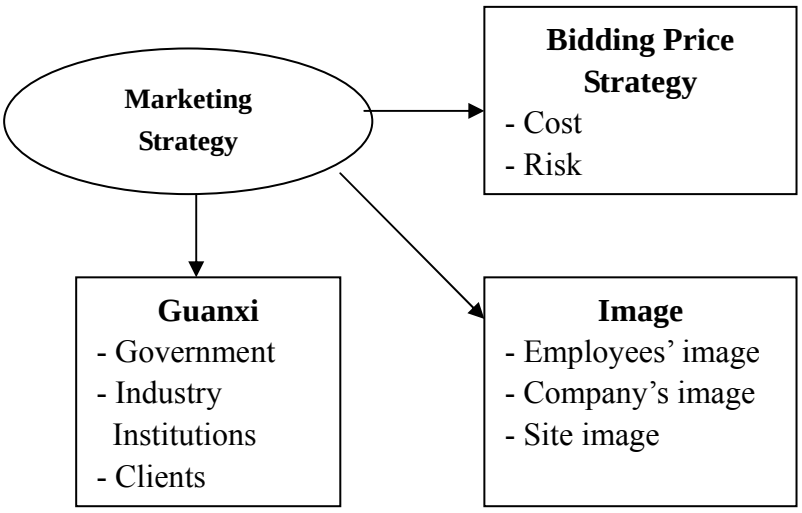

Figure 7.3 The Framework of the Marketing Strategy in the Chinese Construction Industry

Source: Meng *et al* (2004)

In the context of this research framework, it is proposed that the S&O variable of marketing strategy would play a role in developing the iRCs of Guanxi and reputation (image).

However, implementation of these strategies or variables may encounter some potential barriers in the Chinese construction context. One potential barrier is the control of government. Many of the larger Chinese construction companies still exist as state-owned enterprise (SOEs). These companies are generally lacking in autonomy – although nowadays they are given more power than before. Thus, as these companies develop their strategies, they would need to align their strategic objectives with the government's needs. This alignment would smoothen the path to implementing their strategies.

Another potential barrier is mindset – the way of thinking in China is sometimes quite different from the Western world. Many leaders of the Chinese firms still do not fully embrace the concept of market competition. Some still assume natural assignment of projects by the government. This obviously holds back the implementation of some of the initiatives identified in this study.

7.2 Limitations and Recommendations for Future Research

It is impossible to cover all aspects related to the strategic analysis of Chinese construction companies. There are some limitations in terms of the scope of this research, which lead to the recommendations for others to research in the future.

(1) Companies in the Chinese construction industry are classified into several qualification classes. This research mainly focuses on the first class qualification companies. Companies in other classes, which may target other market segments, would be exposed to different kinds of environmental factors and would demand different strategies to excel. Thus, future research should be tailored to study the specific context of these companies.

(2) The theoretical foundations of this research mainly combine strategic theories from industrial organizational economics (Classical approach) and the RBV and CBV theories (Processual approach). In terms of the two other schools, only the "I-Space" model (Section 4.1.3) and the concept of Guanxi are drawing some insights from the Systemic view. It is realized that there may be other theories from the Classical, Processual and Systemic schools that are useful in analyzing the Chinese construction industry. A good example includes the institutional theory (Shenkar and Von Glinow, 1994), which belongs to the Systemic view.

(3) The Chinese construction industry is not fully matured. The conditions of the industry are largely still in a flux. The model built in this research is only based on the current outlook and consensus of the interviewees and survey respondents. As the operating and market conditions improve, the model also needs to be revised to reflect the new circumstances. Some iRC variables identified in this research may not be equally significant, as emphasized previously. Conversely, other new resources or competencies might be seen as especially useful and should be incorporated into the model. Thus, future research is required to constantly update the conceptual model when situation warrants.

(4) There are thousands of large construction companies in China. However, the sample size of this research is only 85, which might be inadequate to represent the

whole population. This is due to the reason that data collection in the context of China is very difficult. In this research, for logistic reasons and the need to contact the right persons to respond to queries, the questionnaires were sent out through the author's correspondents in China who have past dealings with these firms. Thus, in future research, the sample size can be enlarged over time. It may be better to adopt a random sampling method to represent the whole industry if the response rate is acceptable.

(5) The questionnaire survey targeted mainly the larger Chinese contractor companies. Obviously, the opinions of other project stakeholders, including owners, government officers, design institutes and project consulting firms would also be valuable. As non-contractors, these stakeholders would be able to provide a more objective view about key competitive strategies and iRCs that would lead to sustainable competitive advantage of large Chinese construction enterprises. In future research, it would be good to sample opinions from these parties.

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APPENDIX A

PARAMETERS OF DIFFERENT REGIONS IN CHINA

A-1 Pre-tax Profit Margin and Percentage of High Quality Project of Different Regions in Year 2001

Regions	Pre-tax Profit Margin(%)	Percentage of High Quality Project(%)	Regions	Pre-tax Profit Margin(%)	Percentage of High Quality Project(%)
Beijing	5.24	26.4	**Hubei**	5.26	37.0
Tianjin	4.19	33.2	**Hunan**	5.21	35.6
Hebei	6.78	45.4	**Guangdong**	7.08	28.0
Shanxi	3.83	46.4	**Guangxi**	4.74	25.1
Inner Mongolia	4.57	40.8	**Hainan**	5.43	22.0
Liaoning	5.10	27.5	**Chongqing**	5.42	27.2
Jilin	4.98	47.9	**Sichuan**	5.04	37.3
Heilongjiang	4.54	38.1	**Guizhou**	4.73	23.5
Shanghai	5.35	27.1	**Yunnan**	4.63	37.7
Jiangsu	4.07	33.6	**Tibet**	9.03	31.6
Zhejiang	5.71	30.6	**Shaanxi**	4.00	44.0
Anhui	5.15	26.9	**Gansu**	4.88	34.0
Fujian	6.40	18.7	**Qinghai**	4.71	37.3
Jiangxi	4.28	27.6	**Ningxia**	5.00	22.3
Shandong	5.70	36.2	**Xinjiang**	1.05	33.3
Henan	4.48	45.3			

Source: China Statistical Yearbook (2002)

A-2 Value of Machines per Laborer, Labor Productivity, Pre-tax Profit Margin and Output Value per Enterprises of Different Regions in Year 2003

Regions	Value of machines per labor (RMB/person)	Labor Productivity (RMB/Person)	Pre-tax profit margin (%)	Output value /enterprise (10,000RMB)
Beijing	12554	19916	5.51%	6102.12
Tianjin	24308	22475	4.80%	5891.86
Hebei	10573	15169	5.79%	4923.81
Shanxi	10901	15705	4.19%	4792.62
Inner Mongolia	13703	15802	5.77%	3939.72
Liaoning	12298	15966	5.05%	3960.59
Jilin	13517	13900	4.47%	4413.84
Heilongjiang	18694	14835	5.28%	3021.19
Shanghai	13502	27720	6.69%	5952.23
Jiangsu	7935	20185	4.66%	6580.96
Zhejiang	7652	25842	5.68%	9219.57
Anhui	7927	14501	5.32%	3669.46
Fujian	9201	20956	5.58%	3806.96
Jiangxi	6599	14578	5.37%	3396.37
Shandong	7170	12943	5.92%	3498.73
Henan	10881	13257	4.69%	3674.13
Hubei	11934	17932	6.27%	4999.98
Hunan	8830	15700	5.51%	5166.18
Guangdong	10902	22056	7.54%	4503.49
Guangxi	10323	16816	5.39%	3159.72
Hainan	8409	12482	7.73%	3752.89
Chongqing	8156	15246	5.62%	3408.19
Sichuan	8705	13062	5.41%	3603.93
Guizhou	7754	16548	5.42%	3924.04
Yunnan	12400	13803	5.41%	3265.81
Tibet	12522	16593	10.62%	1811.28
Shaanxi	12941	14769	4.02%	5849.09
Gansu	10739	11520	5.11%	2845.88
Qinghai	17372	12930	4.81%	2217.58
Ningxia	21146	14177	4.62%	2507.07
Xinjiang	19465	19854	5.28%	4566.82

Source: China Statistical Yearbook (2004)

A-3 Asset Turnover Ratio and ROA of Different Regions in Year 2003

Regions	Asset Turnover Ratio	ROA (%)	Regions	Asset Turnover Ratio	ROA (%)
Beijing	0.72	3.99	**Hubei**	0.96	6.03
Tianjin	0.91	4.36	**Hunan**	1.21	6.68
Hebei	1.02	5.92	**Guangdong**	0.68	5.14
Shanxi	0.86	3.59	**Guangxi**	0.73	3.94
Inner Mongolia	0.98	5.63	**Hainan**	0.74	5.75
Liaoning	1.00	5.06	**Chongqing**	1.16	6.55
Jilin	0.86	3.83	**Sichuan**	0.93	5.04
Heilongjiang	0.74	3.90	**Guizhou**	0.86	4.68
Shanghai	0.77	5.18	**Yunnan**	0.82	4.45
Jiangsu	1.25	5.84	**Tibet**	0.70	7.41
Zhejiang	1.71	9.72	**Shaanxi**	1.05	4.20
Anhui	1.06	5.61	**Gansu**	0.79	4.06
Fujian	0.87	4.86	**Qinghai**	0.78	3.75
Jiangxi	1.00	5.39	**Ningxia**	0.85	3.91
Shandong	0.92	5.47	**Xinjiang**	0.95	5.00
Henan	0.97	4.53			

Source: China Statistical Yearbook (2004)

A-4 Average Profit Growth Rate and Average Output Growth Rate of Different Regions from year 1997-2003

Regions	Average Profit growth Rate(%)	Average Output Growth Rate(%)	Regions	Average Profit growth Rate(%)	Average Output Growth Rate(%)
Beijing	18.50	19.48	**Hubei**	28.55	30.19
Tianjin	24.65	31.83	**Hunan**	26.46	37.21
Hebei	21.48	25.04	**Guangdong**	22.56	22.71
Shanxi	27.30	32.14	**Guangxi**	20.29	24.39
Inner Mongolia	31.15	30.95	**Hainan**	19.10	18.29
Liaoning	32.98	31.04	**Chongqing**	22.70	25.68
Jilin	36.19	33.70	**Sichuan**	21.50	24.83
Heilongjiang	21.94	21.31	**Guizhou**	30.19	35.79
Shanghai	21.99	29.73	**Yunnan**	13.01	9.84
Jiangsu	23.87	29.53	**Tibet**	31.86	38.16
Zhejiang	27.25	31.76	**Shaanxi**	24.30	26.75
Anhui	28.04	33.36	**Gansu**	15.79	17.32
Fujian	20.90	27.03	**Qinghai**	31.38	43.56
Jiangxi	39.37	49.86	**Ningxia**	34.49	28.58
Shandong	16.70	20.28	**Xinjiang**	60.32	66.47
Henan	18.10	21.72			

Source: China Statistical Yearbook (2004)

A-5 Pre-tax Profit Margin from Year 1997- 2003, Mean, Standard Deviation and Standard Deviation/ Mean (Coefficient of Variance) of different regions

Regions	1997 (%)	1998 (%)	1999 (%)	2000 (%)	2001 (%)	2002 (%)	2003 (%)	Mean (%)	Std.D (%)	Std.D/Mean (%)
Beijing	4.89	4.90	5.01	5.30	5.24	5.54	5.51	5.20	0.27	5.23
Tianjin	3.72	3.91	3.60	4.05	4.19	4.72	4.80	4.14	0.47	11.27
Hebei	4.42	4.20	4.80	4.57	6.78	5.36	5.79	5.13	0.92	17.83
Shanxi	2.85	2.73	3.02	3.91	3.83	4.00	4.19	3.50	0.61	17.52
Inner Mongolia	3.07	3.85	4.38	4.29	4.57	5.17	5.77	4.44	0.87	19.63
Liaoning	2.96	2.14	3.75	4.28	5.10	4.84	5.05	4.02	1.13	28.25
Jilin	2.08	2.08	3.16	3.69	4.98	4.40	4.47	3.55	1.16	32.72
Heilongjiang	2.95	3.29	3.65	4.04	4.54	4.32	5.28	4.01	0.79	19.75
Shanghai	4.79	4.67	4.91	5.51	5.35	5.84	6.69	5.39	0.71	13.19
Jiangsu	3.44	3.48	3.34	3.80	4.07	4.26	4.66	3.86	0.49	12.62
Zhejiang	4.85	5.06	5.06	5.35	5.71	5.63	5.68	5.33	0.35	6.56
Anhui	3.47	3.40	3.80	4.16	5.15	5.21	5.32	4.36	0.85	19.47
Fujian	4.85	5.29	4.82	5.24	6.40	5.74	5.58	5.42	0.55	10.19
Jiangxi	3.46	3.42	3.68	3.85	4.28	5.49	5.37	4.22	0.87	20.71
Shandong	5.54	5.42	5.43	5.13	5.70	5.79	5.92	5.56	0.26	4.76
Henan	3.81	3.73	4.19	4.16	4.48	4.57	4.69	4.23	0.37	8.74
Hubei	4.03	4.42	4.79	4.78	5.26	6.13	6.27	5.10	0.84	16.54
Hunan	4.13	3.54	3.62	4.32	5.21	5.36	5.51	4.53	0.83	18.29
Guangdong	5.19	5.38	5.99	6.10	7.08	6.62	7.54	6.27	0.86	13.75
Guangxi	4.19	4.87	4.28	4.25	4.74	5.68	5.39	4.77	0.59	12.33
Hainan	5.76	3.14	5.29	4.90	5.43	7.36	7.73	5.66	1.54	27.27
Chongqing	4.12	4.06	4.21	4.38	5.42	5.25	5.62	4.72	0.68	14.33
Sichuan	4.03	3.84	4.13	4.46	5.04	5.31	5.41	4.60	0.65	14.04
Guizhou	3.20	3.19	3.41	4.31	4.73	5.27	5.42	4.22	0.97	22.89
Yunnan	4.86	4.76	4.97	5.19	4.63	4.68	5.41	4.93	0.28	5.76
Tibet	7.83	7.14	6.19	7.61	9.03	12.00	10.62	8.63	2.05	23.78
Shaanxi	2.99	2.69	3.09	3.50	4.00	4.17	4.02	3.49	0.59	16.82
Gansu	4.63	4.86	5.16	5.43	4.88	5.36	5.11	5.06	0.29	5.67
Qinghai	2.86	2.77	2.25	4.10	4.71	5.00	4.81	3.79	1.14	30.02
Ningxia	2.95	2.56	4.10	5.33	5.00	4.46	4.62	4.15	1.03	24.92
Xinjiang	2.80	2.62	4.13	0.82	1.05	2.67	5.28	2.77	1.58	57.06

Source: China Statistical Yearbook (2004)

A-6 Pre-tax Profit Margin, After-tax Profit Margin of different regions in Year 2003

Regions	Pre-tax Profit Margin (%)	After-tax Profit Margin (%)	Regions	Pre-tax Profit Margin (%)	After-tax Profit Margin (%)
Beijing	5.51	2.36	**Hubei**	6.27	2.19
Tianjin	4.80	1.86	**Hunan**	5.51	1.89
Hebei	5.79	2.32	**Guangdong**	7.54	3.77
Shanxi	4.19	0.88	**Guangxi**	5.39	1.67
Inner Mongolia	5.77	2.16	**Hainan**	7.73	3.64
Liaoning	5.05	1.62	**Chongqing**	5.62	2.35
Jilin	4.47	0.68	**Sichuan**	5.41	2.12
Heilongjiang	5.28	1.24	**Guizhou**	5.42	2.14
Shanghai	6.69	3.42	**Yunnan**	5.41	2.02
Jiangsu	4.66	1.96	**Tibet**	10.62	6.43
Zhejiang	5.68	2.66	**Shaanxi**	4.02	1.06
Anhui	5.32	1.77	**Gansu**	5.11	1.48
Fujian	5.58	2.11	**Qinghai**	4.81	1.82
Jiangxi	5.37	1.63	**Ningxia**	4.62	1.44
Shandong	5.92	2.77	**Xinjiang**	5.28	2.10
Henan	4.69	1.48			

Source: China Statistical Yearbook (2004)

APPENDIX B

GENERAL INFORMATION ABOUT CASE COMPANIES

1 HQCEC

China HuanQiu Contracting & Engineering Corp. (hereinafter referred to as HQCEC) is an international engineering corporation with EPC capability, integrating services including engineering, procurement, construction management and commissioning supervision. HQCEC is also a leading intelligence-intensive enterprise utilizing sophisticated technology.

With over fifty years of experience, HQCEC has tremendously contributed to the development of the Chinese chemical and construction industries and completed thousands of key national large and medium-sized projects in multi-sectors. HQCEC has established an effective project management system and a matrix organization management system widely adopted by international engineering corporations. As an accredited corporation, HQCEC has established ISO9001 Quality Assurance System, ISO14000 Environmental Management System, and OHSAS18000 Occupational Health and Safety Management System. In addition, the corporation owns a group of highly-skilled technical and managerial staff, including over a hundred senior staff members with doctorates or master's degrees; over one hundred advanced technical and managerial personnel working and trained in European, American or Japanese companies for two or more years; over 100 professor-class senior engineers, and more than 100 experienced experts competent for project management.

Among the top 200 design enterprise in a national survey, HQCEC's income per capital ranked first, so did its overseas income. According to statistics of The Ministry of Foreign Economic Relations and Trade, from 1997 to 2001, HQCEC was on the top of the list of value of business contracts and business volume of consulting and design enterprises for five years. According to the statistic of the Ministry of Finance, among 169 large states own enterprises (SOE) during 2000, the performance of HQCEC ranked 69th in all categories, ranked second in the chemical industry, and third place in the construction industry. According to the statistics published by Engineering News Record (ENR), HQCEC become one of the Top 225 International Contractors and Top 200 International Design Firms since 1998.

2 NFC

China Non-ferrous Metal Industry's Foreign Engineering & Construction Co., Ltd. (hereinafter referred to as NFC), a China's leading enterprise engaged in exploitation of overseas nonferrous metal resources and contracting of international nonferrous metal projects, is listed on the authoritative magazine Engineering News Record (ENR) as one of the 225 largest international contractors in the world.

NFC is mainly involved in the exploration of nonferrous metal resources both at home and abroad, international engineering project contracting, labor service cooperation and equipment import and export. Its business scope covers nonferrous metal exploration, design, construction, equipment purchase, personnel training, mining, dressing, smelting, and metal processing. NFC also undertakes general contracting of other projects including energy, transportation, public utilities and other industries or sectors. As a listed company, NFC is based on its well-operating

capital, efficient employees, knowledge-intensive development and scientific management.

While obtaining great achievements in the main business, NFC has allocated resources through diversified channels to invest in China Minsheng Bank, Minsheng Life Insurance and Guoyuan Fund Management Co., Ltd. as a large shareholder. It also extends its business to the field of electric power industry investment, real estate development, computer and IT.

Over the last two decades since its foundation, NFC, building upon the experience and technologies accumulated through five decades of development of Chinese nonferrous metal industry, has succeeded in developing large numbers of nonferrous metal projects abroad. This directly drives export of complete sets of machinery and electric equipment and labor services from China. NFC has been on the top position for many times in the evaluation of domestic foreign trade and economic cooperation businesses by the Ministry of Finance of China. Getting listed in China Shenzhen Stock Exchange on April 16 of 1997, NFC, on the basis of its strict observation of information disclosure and well-managed structure, ensures its normal operation and is accelerating its movement towards internationalized, industrialized and collectivized development.

3 SEI

SINOPEC Engineering Inc. (hereinafter referred to as SEI) is a subsidiary of China Petrochemical Corporation and a global engineering company engaging in feasibility study, technical consultation, geotechnical investigation, engineering, procurement, construction management & supervision, EPC contracting, project management, technical services. SEI ranked No. 58 among the 200 leading engineering companies in 2002 as compiled by ENR (Engineering News Record).

SEI is qualified to be involved in national Class A engineering projects with certificates in the following categories: engineering, engineering survey, cost estimate, project consultation, and environmental impact assessment, invitation to bid as well as fixed capital investigation in industrial and commercial fields. Quality system based on ISO 9001 version 2000 has been established and the Certificate for ISO 9001 has been granted.

Sophisticated platform and application systems have been setup in SEI, out of which integrated systems for engineering, project management as well as office automation have been developed. With these systems, SEI is enabled to perform engineering and management activities by following internal practice.

SEI has established extensive collaboration with worldwide-recognized licensors, engineering companies, R & D institutions and universities and has undertaken a great number of overseas projects. The company is gradually building up reputation in the export market.

4 Sinohydro

Sinohydro Corporation (hereinafter referred to as Sinohydro), a wholly state-owned enterprise and formerly known as ‘China National Water and Hydropower Engineering Construction Company’, is the nation’s dominant leader in the water and hydropower sector today. Headquartered in Beijing, its 23 wholly-owned subsidiaries, 2 holding companies, and other joint ventures and associated companies with more than 130,000 employees around the globe are contributing their hard work and talents to the company.

Since its establishment in 1950, Sinohydro has undertaken many notable hydropower projects in China. It has built more than 70% of the domestic mega and medium hydropower stations (total

installed capacity 50,000 MW), and is building more than 20 large and extra-large-scaled hydropower projects nationwide (total installed capacity approximately 40,000 MW).

With the continuous effort to diversify its business, Sinohydro has become active in the fields of roads, airports, harbors, buildings (both civil and industrial), environmental engineering, international trade, and others. It constantly contributes to adopt cost-effective approaches and deliver value for money to the clients.

Through successfully exploiting overseas construction market, Sinohydro has earned a worldwide reputation by means of its experienced working staff, cutting-edge technology and remarkable performance. The Engineering News Record ranked Sinohydro 57th among Top 225 Global Contractors and 89th among Top 225 International Contractors respectively, as published in May, 2003.

Equipped with construction-related experience and expertise of half a century, Sinohydro is effectively meeting the challenge of the changing face of the global construction marketplace head on. Combining its financial resources with state-of-the-art technology, Sinohydro distinguishes itself by offering services including Design-Build, EPC, and BOT.

5 CSCIC

China State Construction International Co. Ltd. is a subsidiary company wholly owned by China State Construction Engineering Corporation (hereinafter referred to as CSCIC). It is one of the largest global construction service providers in China and a modern enterprise operating completely in conformance with international practice. The company was established in 1993 and restructured with the merger of CSCEC's overseas business and part of its domestic business. With its head office located in Beijing, the Company has subsidiaries in all China's major cities and around 30 overseas subsidiaries in countries and regions like Singapore, Algeria, Botswana, US, Japan, Korea, Russia, Germany, Barbados and Ireland. At home, its business operation covers North China, East China, Southwest China, Northwest China, Northeast China and South China. Internationally, its business activities spread to Southeast Asia, Northeast Asia, North America, South America, North Africa, Southern Africa, Europe and the Middle East region.

CSCIC provides its contracted and potential customers around the world with high quality, complete and professional construction service. The main business of the company is to render services in project financing and development, planning and design, project management and general contracting, development of special technique and operation management for various types of building projects (such as office building, apartment, hotel, hospital, school, housing, industrial works and airport terminal) and for infrastructure works (such as urban water supply, water treatment, road and bridge, light rail works, dam and irrigation works, power plant and environmental works). The company strives to improve the living standard of end users while building substantial environment for the clients.

Since its founding, CSCIC has, through cooperation with famous contractors from Europe and America, learnt internationally advanced experiences of construction service and enterprise management. Meanwhile, CSCIC spares no effort in exploring and exploiting localized advantages. As a global and professional enterprise, CSCIC is ready to provide international standard services to its customers at home and abroad.

CSCIC has since its establishment provided international standard construction service at home and abroad to a number of world famous enterprises including Aventis from France, ABB and

Ericsson from Sweden, Bayer, Lufthansa and Siemens from Germany, Epson from Japan, Nokia from Finland, Hines from U.S.A, Bank of China, PetroChina, China Netcom and Haier. It is looking forward to providing more complete and professional services to more customers around the world.

6 CPECC

China Petroleum Engineering & Construction Corporation (hereinafter referred to as "CPECC") is a state-owned enterprise mainly engaged in projects in the petroleum industry, petrochemical industry and other related industries. It is one of the largest enterprises in China for contracting in international projects and is fully owned by the China National Petroleum Corporation.

In the past 40 plus years, CPECC has built quite a number of oil and natural gas fields, large and medium refineries, petrochemical plants, chemical fertilizer plants, oil or gas pipelines by absorbing advanced technologies and managerial skills from various countries in the world and bringing its own initiative into play. Now CPECC has become a mainstay and a principal force of China in construction in the petroleum and petrochemical industries.

CPECC is one of the Chinese companies that enjoyed the earliest entry into the international contracting market and presently maintains business relations with companies in more than 40 countries and regions worldwide. It has successfully completed a series of large-scale turnkey projects throughout the world, winning numerous high acclaims from the owners (clients), governments and financial institutions which further increased its standing in the international business community. In 1993, CPECC was listed amongst the World's Top 225 International Contractors where it has remained in the list ever since.

CPECC boasts its excellent engineering staff and managerial personnel, solid technical strength, superior equipment, rich experience in construction and the capability to contract large-scale industrial projects from initial development and design, procurement, construction to commissioning and start up. The main business of CPECC includes:

1) Contracting of petroleum and petrochemical projects, including building of oil and natural gas fields, construction of pipelines, construction of refineries, petrochemical plants, chemical fertilizer plants and gas processing plants, construction of oil tanks and gas tanks, construction of industrial and civil buildings, construction of roads and bridges, infrastructure projects and other projects;
2) Working as Project Management Consulter (PMC) for consultation, engineering or construction of oil or gas field, refineries and pipeline projects;
3) Manpower supply for construction of petroleum or petrochemical projects;
4) Imports and exports of technologies, equipment and materials under engineering contracting and labor service cooperation projects.

7 TCEMC

Tianjin Construction Engineering Main Contracting Co., Ltd.,(hereinafter referred to as TCEMC) is a subsidiary company of Tianjin Construction Engineering Group (Holding) Co., Ltd., and a national superior grade main contractor. Its capital investment exceeds RMB 360 million, with an annual turnover of approximately RMB 1.5 billion and gross construction area of over 1.5 million square meters.

The scope of work of TCEMC includes foreign invested hotels, governmental infrastructure project, residential project, M&E installation, steel component fabricating, ready-mixed concrete,

construction technology consultant, and project management. The company achieved the ISO 9002 award in 1998, and the ISO 9001 in November 2001, and obtained the National CCQS award and the Royal UKAS Certificate of United Kingdom.

TCEMC has been the main contractor of a number of prestigious projects in Tianjin such as the Hyatt Hotel, Sheraton Hotel, Tianjin International Building, the Exchange Plaza, Gold King Tower, COSCO Hotel, and Tianjin Athletic Centre. Furthermore the company obtained five *'Lu Ban'* Construction Awards and two national Excellent Quality Awards in construction. The company has established several construction records in Tianjin, such as the highest level, the deepest foundation, the largest floor area, etc. Also, the company has completed 22 projects in 11 countries in Africa and Asia Pacific.

TCEMC is also a consulting company with intensive technology, capital, management, personnel and international management system. The company has 221 personnel of intermediate level and above, of which 67 are of supervisory level, 2 experts who enjoy allowance from the State Council, and 81 First Grade project Managers. In addition, the Company has a team of 120 engineers and project management personnel who possess project management experience in foreign countries. The company utilizes innovation, dedication, and cautiousness. Being factual as its objective, it aims to provide high quality and satisfactory main contracting services to its clients.

8 CHEC-TPCC

China Harbor Engineering Company Tianjin Port Construction Corp (hereinafter referred as CHEC-TPCC) was established in 1945. It is mainly engaged in harbor construction, while also involved in bridge and airport construction, dredging and some other public works.

Over 60 years, CHEC-TPCC has built a lot of large projects, such as the Malta shipyard, Mauritania Harbor, Macau International Airport, Pakistan Karachi Harbor, Tianjin Harbor, Dalian Harbor, Yingkou Harbor, Yantai Harbor, Rizhao Harbor, Huanghua Harbor, Zhuhai Harbor, Guangzhou Harbor, Dalian Shipyard, Pudong International Airport, Tianjin Airport, Donghai Bridge and several hundred km of highway. Furthermore, the company obtained seven *'Lu Ban'* Construction Awards and nine national Excellent Quality Awards in construction. The company achieved the ISO 9002 award in 1998. In 2002, the company achieved the award of 'National excellence Construction Company'.

9 BUCEC

Beijing Urban Construction Engineering Co. Ltd (hereinafter referred to as BUCEC) is a large, comprehensive construction company with a Grade 1 architectural subsidiary. It is also one of the Top 225 International Contractors according to Engineering News Record. The company has capital assets of RMB 2 billion, and has employees of 13,000, of which 1100 have high grade professional titles. The company undertakes all kinds of civil and industrial construction, municipal works, subway, highway, airport and real estate development, etc. Furthermore, the company obtained nine *'Lu Ban'* Construction Awards and two national Excellent Quality Awards in construction.

The company had passed authentication for quality control, protection and professional safety and health management, and was appraised by the Beijing Government as 'Adhere to the contract, Faithful to partners'; and 'Excellent promotion company in quality works'. The company's quality guideline is 'Obey the laws, faithful to partners, create environmental and excellent projects, make safe and healthy working environment'.

10 SCG

Shanghai Construction Group (hereafter referred to as SCG) is a public listed company in China. The business scope of SCG includes: civil engineering, commercial building, hydraulic project, steel structure work, manufacturing construction materials and equipment, and real estate development.

SCG is one of the Top 225 International Contractors according to Engineering News Record. In 2001, it ranked 79th in 225 international contractors and 4th in China.

On the basis of total domestic output value, it is the second largest construction enterprise in China (the largest enterprise being the China State Construction Engineering Corporation (CSCEC)).

It is also one of the sixteen civil engineering and construction companies listed in the stock market in China. Among the top 50 best performing companies in China that are publicly listed, only SCG features as a construction company in the list, and ranks 37 in the Shanghai & Shenzhen stock market.

In Shanghai, 80% of keystone projects and symbolic buildings were built by SCG, which included the world third tallest building Jinmao, the Lupu bridge, subway tunnel, city viaduct, museum, TV station tower, etc.

11 CREC

China Railway Erju Co. Ltd (hereafter referred to as CREC) is a public listed company in China, and it's headquarter is located in Sichuan Province. CREC mainly undertakes design, equipment installation, supervision, and technical consultation for the construction of railways, highways, bridges, tunnels, underground engineering, water conservation, electric power, airports, harbors, mines, municipal works, industrial & civil buildings at home and abroad. Furthermore, its business also covers industrial production, machine and construction equipment leasing, materials and goods trade, financial investments, as well as real estate.

CREC have attained the ISO9000 qualification system and 14000 management system certification. Since 1984, CRCC has been awarded 5 China Construction *LuBan* Prize – the highest honor for construction enterprises in China, 22 national prizes and many provincial or ministerial prize for its top quality construction. It also has obtained 318 key scientific and technical achievements, of which 13 were awarded as National Scientific & technical Achievement Prizes.

12 CICI

CITIC International Contracting Inc. (hereinafter referred to as CICI), established in March 1986, is a company directly under the CITIC (China International Trust Investment Corporation) Group.

Since its establishment, the company has completed nearly one hundred medium to large scale projects in sectors of industry, energy supply, transportation and civil constructions including railways, electric railways, subways, bridges, tunnels, highways, municipal roads, five-star hotels, extra-high buildings, gyms, golf courses, sport venues, railway stations, airports, dams, etc.

In compliance with "CITIC Style" promoted by former Vice President Rong Yiren and sticking to the principle of "Honesty, Quality Assurance, Minimum Profits and Faithfulness", CICI is among the first companies adopting engineering contracting methodologies and project management

technologies prevalent internationally. With the advantage of CITIC Group's unequalled predominance in international business, CICI has achieved a lot in international project and construction management, EPC and BOT contracting. All these have built CICI with excellent credits and reputations.

CICI has been certified with quality management system ISO9001, environmental management system ISO14001 and occupational health and safety management system GB/T28001. It has also been awarded by the Ministry of Construction 5 kinds of General Contractor & Specialist Contractor Qualifications:

- Construction Contracting Class A for
  * Building Engineering
  * Highway Engineering
  * Municipal Works and Public Utilities Engineering;
- Specialty Contracting Class A
  * Architectural Fitting-up Engineering
  * Highway Foundation Engineering

The company is the only member of Hong Kong Mechanical and Electrical Engineering Contractors Association with Chinese-capital background and a member of Hong Kong Chinese Enterprises Association as well as Hong Kong and China General Chamber of Commerce.

Some typical examples of domestic and overseas projects of design and construction contracting completed by CICI are:

- Beijing Landmark Towers, a four-star hotel awarded with "LuBan Prize"-- the top prize of civil construction in China
- Xi'an Sheraton Hotel, a five-star hotel also awarded with "LuBan Prize"
- Xi'an Hyatt Hotel, a five-star hotel awarded with the "State Excellence Prize"
- Ningbo Daxie Sea-Spanning Railway and Highway Bridge, the first extra large combined bridge with the railway and highway in China
- Tianjin Tanggu Haihe Bridge, a single-towered, double-cabled and unsymmetrical slanting-tied bridge with its tower 168 m high and its main span 310 m wide, the Asia-first and the World- third large among all bridges of the same type. During the construction of Tianjin Tanggu Haihe Bridge, international project management technologies are employed for progress control and achievement of all excellent-qualities and Zero-Accident are made.
- The MTR Tseung Kwan 0 Extension, the first large scale M/E installation project contracted by an enterprise in Hong Kong with Chinese capital background.
- 2008 Olympic Games Main Venue -- the National Stadium in Beijing Olympic Green. As the contractor of Area A, CICI is doing her utmost to build this historical landmark.

Through a long-term practice of domestic and overseas engineering contracting, CICI has incubated a team of experienced technicians, established a series of scientific and standardized operation systems on bidding, procurement, project management, quality control, safety control, local-network management and control, personnel administration, finance control, etc. It has guaranteed to provide its clients with low price, safe and efficient services in all kinds of engineering sectors.

APPENDIX C

A SAMPLE OF THE CASE DATA COLLECTION TEMPLATE – HQCEC

1 Financial Performance

1) Operational Performance (1 Million RMB)

Year	1997	1998	1999	2000	Average
Revenue	674.8	1,101.2	1,124.7	1,237.3	1,034.4
Revenue Growth		63.21%	2.13%	10.01%	25.11%
Pre-tax Profit	83.7	91.5	90.9	94.9	90.2
Pre-tax Profit Growth		9.31%	-0.69%	4.42%	4.35%
Net Profit	53.5	57.8	57.5	59	56.9
Net Profit Growth		8.13%	-0.54%	2.67%	3.42%

2) Capital Structure

Year	1997	1998	1999	2000	Average
Total Equity	534.2	592	649.6	718.6	623.6
Long-term Liabilities	0	0	10	0	2.5
Total Liabilities	44.2	50.4	64	49.8	52.1
Total Assets	578.4	642.4	713.6	768.4	675.7
Current Liabilities	44.2	50.4	54	49.8	49.6
Current Assets	435.2	484.8	527.6	540.5	497

3) Financial Ratio

Year	1997	1998	1999	2000	Average
Profitability Ratio					
Pre-tax Profit Margin	12.4%	8.31%	8.08%	7,67%	9.12%
Net Profit Margin	7.92%	5.25%	5.11%	4.77%	5.76%
Return-on-Assets(ROA)	9.42%	9.00%	8.06%	7.68%	8.49%
Return-on-Equity(ROE)	10.0%	9.76%	8.85%	8.21%	9.21%
Leverage Ratio					
Debt-to-Asset	7.66%	7.85%	8.96%	6.48%	7.74%
Liquidity Ratio					
Current Ratios (Current Asset/Current Liabilities)	9.82	9.62	9.78	10.86	10.02
Efficiency Ratio					
Total Asset Turnover (Revenue/Total Assets)	1.17	1.71	1.58	1.61	1.52

2 Observations on Competitive Strategies

(1) Scope of Competition

Market Segmentation[3]

	Petrochemical[4]	Chemical[5]	Power Plant[6]	Environment[7]	Civil	Building[8]
Supply	*	*		*		
Feasibility Study & Planning	*	*	*			
Financial Consultation & Fund Raising	*	*		*		
Engineering Design	*	*	*	*	*	
Construction, and Management	*	*	*	*	*	*
Project Supervision Management Consultant		*				
Technology Development	*	*				
Owner/Develop/Equity Investment	*	*	*	*		*

(a) There are some representative projects in more than 1200 big or middle scale projects that HQCEC designed and constructed in China, including eight sets of ethylene devices, nine sets of epoxy ethane/ ethanediol devices, three sets of bivinyl devices, two sets of styrene devices, five sets of transpex devices, four sets of polyethylene devices, ten sets of polypropylene devices, six sets of PVC/VCM devices, two sets of ABS devices, eleven sets of chemical fertilizer devices, two sets of chemical fiber devices, forty sets of light industry and nicety chemical devices, ten sets of pharmaceutical devices, thirty-four sets of large-scale stock tank, thirty-five sets of building for civil use, fifty-six sets of joint or foreign sole investment devices, twenty-three sets of EPC general contract project.

(b) Besides spreading the business in more than thirty provinces, cities and autonomous regions in domestic market, since the middle period of 1990s, HQCEC makes a great progress in the exploitation of international engineering business. After HQCEC obtained the first foreign EPC project through open bid in 1995, they have consecutively completed consultation, design and EPC for more than forty projects, including projects funded by World Band, ADB and financing by HQCEC. Each year, the contract price of foreign project reach 0.402 billion RMB and the foreign business have reached 60% in all the business in HQCEC. In recent years, HQCEC has dispatched 2300 person-time to carry project task out of China. There is more than 600 people work in foreign country at best. In design industry, HQCEC has consecutively kept ahead in foreign business for five years.

[3] Different regions in more than thirty provinces, cities and autonomous regions, as well as southeastern Asia, Western Europe, America and Middle East.
[4] Involved into oil field facilities; oil refining, gas field facilities, oil & gas transmission lines
[5] Involved into chemical fertilizer; fine chemical industry; acid industry; alkali industry
[6] Involved into power plant construction process from feasibility to completion, power transmission & distribution
[7] Involved into water treatment, supply and drainage, environmental protection facilities
[8] Involved into real estate development and operation

(2) Generic Competitive Strategy

HQCEC adopts differentiation strategy instead of cost leadership by providing high standard project management service, high reputation and high technological level.

3 Observations on iRCs Variables

Guanxi Resource

In history, HQCEC was directly administrated by Ministry of Chemical Industry and State-owned Assets Supervision & Administration Commission of the State (SASAC), Thus, HQCEC had formed strong Guanxi relationship with these government authorities. HQCEC is also the 'AAA' level customer of China Construction Bank and China Export-Import Bank, so he also built the Guanxi relationship with these banks. Finally, HQCEC keeps close relationship with domestic and overseas research institutions and universities, such as building Guanxi resource with HuaBei Design institutes, China Chemistry University, etc.

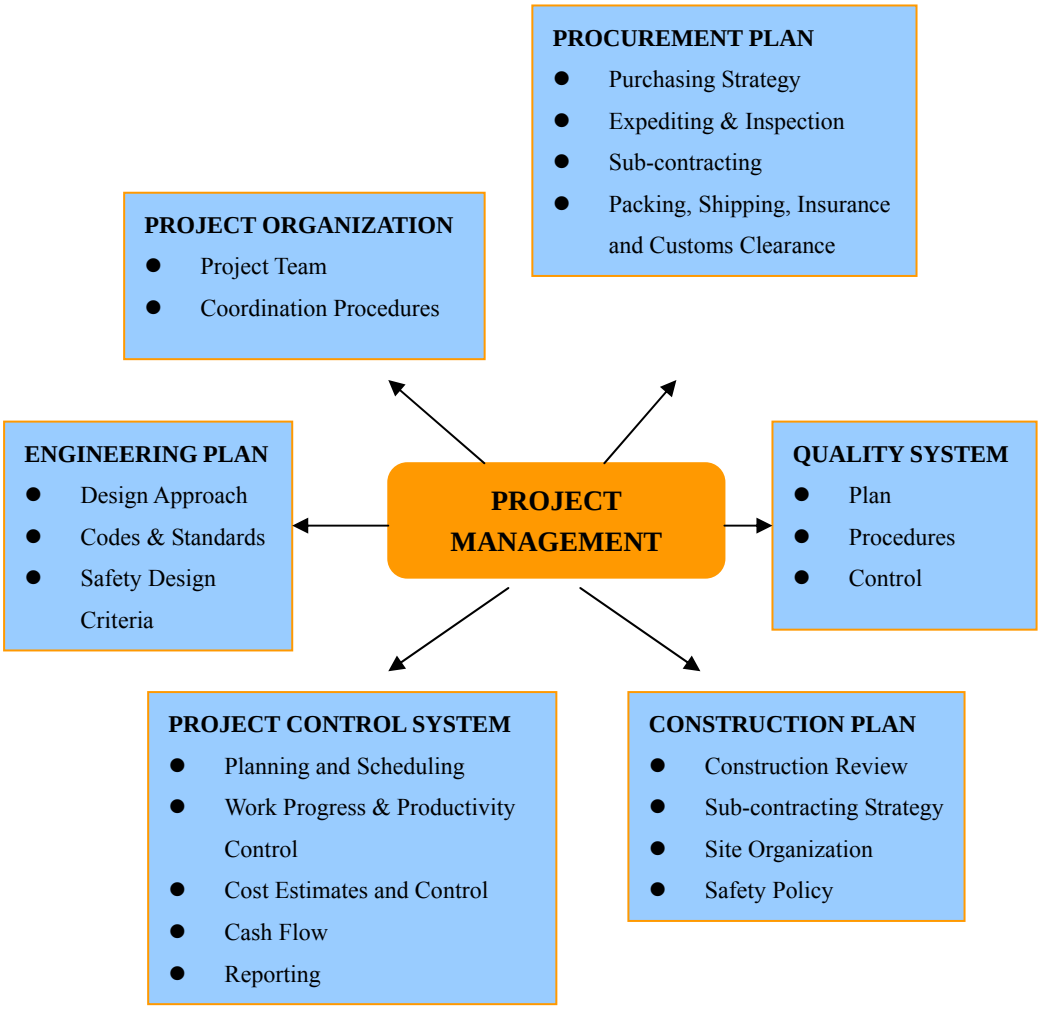
Technological and Innovative Capability

HQCEC pay attention to the research in technological areas and try to raise the technical level. He endeavors to follow up and assimilate the advanced international technologies. HQCEC keep close relationship with international licensors and engineering companies in patent cooperation as well as domestic or overseas institute and universities to develop advanced technology and fully take advantage of technology capacity and experts. At the same time, HQCEC have established a post doctoral research station to conduct the development of new technology and transfer the research fruit to the industrial application under the direction of academicians of China Science Academy and many professionals. HQCEC have several patented technologies. According to the clients' requirement, HQCEC could compare, select and provide the advanced domestic or overseas technologies and take charge of engineering and construction for the clients.

Over past years, HQCEC has been awarded altogether 138 items of prizes for its technological excellence, including 3 international "Golden medal Prize", 1 invention prize, 28 prizes awarded by the state, 106 prizes awarded by Ministry.

Project Management Competencies

HQCEC pay attention to project management and all the activities which are centered around project management. Project manager take charge of the project management under the direction of president. With the excellent specialists, good work environment, superior management philosophy and methods, HQCEC control the whole process of a project throughout consulting, proposal, bidding, contract negotiation, construction, inspection & test and service after sale. At the same time, HQCEC take the quantitative and dynamic management on the project scope, contract, scheduling, safety, cost, engineering, procurement, construction, finance, risk, material and document. By taking the most strict and reliable measure to secure the full execution of contract, HQCEC provide reliable product and service for the clients.



Some of the project management activities include:

Quality Control

1) ISO9001 quality security system is running smoothly in HQCEC. HQCEC has established quality policy as Superior quality, Social commitment, constantly improvement and client satisfactory.
2) The quality assurance system covers all phases of engineering, procurement, and contracting activities
3) The effectiveness of the quality system is constantly monitored by the quality committee
4) The quality system is defined by the quality manual and company procedures
5) The quality management is under the authority of the Quality Manager who reports to the Vice-Chairman

Procurement

- Establishing a global vendor qualification and evaluation system extended to new markets.
- Evaluating the reliability of vendors and sub-contractors on a "total costs basis" and not only on price.
- Interactive cooperation with vendors and sub-contractors for greater reliability. Tracking orders to vendors and sub-vendors to keep projects on schedule.
- Purchasing materials and equipment on a worldwide competitive basis through the group's

procurement network.

- Establishing local presence in several countries in order to avoid delays in complying with customs regulations.

4 Observations on some S&O variables

Human Resource and Human Resource Strategy

HQCEC pay attention to scout and cultivation of talented persons very much and constantly put the increasing competency of all staff on the most important position. HQCEC have a group of excellent technical and management expert characterized by Four Hundred, namely, 115 professor level senior engineer; 120 employees having experience working in Europe, USA, Japan for more than two years; 103 employees holding master degree (including double bachelor degree) and Ph.D; 100 employees acting as project managers, engineering managers, procurement managers, construction managers, commissioning managers as well as specialists in business, contract, scheduling, quality assurance, cost control and safety management. Among these excellent employees, there are seventeen superior managers passing the test held by Project Management Institute (PMI) and getting the title as Project Management Professional (PMP). Ninety-eight percent of technical staff in HQCEC could use English as their working language and conduct engineering design and construction according to the European, American and Japanese standards. These excellent technical and management specialists continue to provide best quality product and excellent services and contribute to the continuous development of HQCEC.

HQCEC provide series of *training programs*, such as training of new staff, part-time training, short term training and long time off work training, network training, long term & short term overseas training, which raise the competence of the staff to adapt to the new environment and new requirement and secure the healthy, prompt and continuous development of HQCEC.

IT strategy

HQCEC pay attention to the research about information system integration, development, and application. IT has put large amount of human resource, physical resource and financial resource to establish a complete set of integrated information system.

This system consists of corporation management information system, project information integration system and CAD system. With international advanced network hardware, engineering application software system and many kinds of database systems, the computed based management panel has been established into a network since 1998. On this panel, PDS, PDMS, SMART PLAN PID, INTOOLS, P3 and HQIIS are integrated as comment management methods. Now, all the drawings are completed by computers. According to the requirements of clients, HQCEC could provide comprehensive service and 2D or 3D CAD services.

The architecture of HQCEC's CAD/CAE systems is built around the concept of engineering data warehouse and of a 3D design tool (Plant Design System), on a Windows NT platform. An integrated material work process and system facilitates the cost effective and timely identification, quantification, acquisition, delivery and installation of all materials, and provides complete on-line information to downstream users and processes. Every project has a "Walk through the plant" 3D virtual model designed using all engineering disciplines.

Over 1000 PC workstations and peripherals, linked to HQCEC's LAN (local area network). HQCEC's WAN (wide area network) integrates subsidiary companies, partners, clients and vendors.

Organizational Structure

1) Under the president, there are vice presidents and chief engineers as well as relevant management and working divisions.
2) HQCEC establish individual organization structures to complete prophase consultation, proposal & bidding, contract management, quality assurance, safety running, engineering, procurement, construction, commissioning, after sale service.
3) The head office of HQCEC has established a consulting division, a domestic business division, proposal division, project estimation & cost control division, human resource division, financial division, technical management division, computer & information center, project management division, engineering division, procurement division, construction management division and commissioning division.
4) Among all relevant companies of HQCEC, the head office is the core, the full capitalized subsidiary company and stock-control company consist of close connected tier, the stock-hold company and long term stably cooperative engineering and construction company consist of cooperation tier.
5) At the same time, HQCEC have established more than twenty representative offices. All of these units are comprised of an united organization and each of the units take s full advantage and fulfill the demand of market and client to the maximum.

Corporate Mission and Culture

Mission Statement: "Presenting to the whole World China's best technologies, products and services through the projects we engineer and construct and meanwhile, with our talent incorporating the advanced technologies and equipment from developed countries into the projects we engineer and construct."

Culture:

Continuous improvement in innovation, adoption and application of new technology;

Continuous improvement in quality;

Employees' success arises as the consequence of HQCEC's success, which is totally dependent on the success of clients;

Human Resource as foundation assets; work as a group; continuous development and training.

APPENDIX D: QUESTIONNAIRE (Translated Version)

1 General Information

(1) Total number of the employees in the company:

1. <100, 2. 100-200, 3. 200-500, 4. 500-1000, 5. >1000

(2) Job position of the respondent in the company:

Engineering__, Project manager__, Department manager__,

Vice-president__, President__, Others (please state)____.

2 Firm Performance

(3) Please indicate, in the most recent 3 years, the average sales growth rate of your company：

1. <5%, 2. 5%-10%, 3. 10%-15%, 4. 15%-20%, 5. >20%

(4) Please indicate, in the most recent 3 years, the average profits growth rate of your company：

1. <5%, 2. 5%-10%, 3. 10%-15%, 4. 15%-20%, 5. >20%

3 Competitive Strategies

(5) Cost Leadership Strategy

Please choose one or more items listed below for which your company has advantages over your competitors:

Cost of material and equipment procurement		Administration cost	
Manpower cost		Subcontracting cost	
Cost control during the construction process		Others, if any	

(6) Differentiation Strategy

Please choose one or more items listed below for which your company has advantages over your competitors:

Reputation/brand name		Acquiring financial resources	
Project management competencies		Guanxi resources	
Construction technology and innovation level		Others, if any	

(7) Regional Diversification

Please indicate how many provinces the company's projects are located in:

1___ 2-3___ 4-6___ 7-10___ >10

(8) Market Diversification

Please choose one or more items listed below which belongs to the company's existing project types:

Road/tunnel/bridge		Residential apartment/commercial building/industrial plant	
subway/airport/railway		Special building(sport center/museum)	
harbor/dock		Petrochemical project	
Hydraulic/dam project		Metallurgy project	
Environmental Engineering		Others, if any	

(9) Vertical Integration

Please choose one or more items listed below which belongs to the company's existing business scope:

Engineering design		Real estate development	
Supervision		Construction plant and materials	
Project consulting		Others, if any	

4 Important Resources and Competencies (iRCs)

(10) Guanxi: Please evaluate your company's Guanxi with the following bodies:

	Poor 1	2	Normal 3	4	Excellent 5
Government/regulatory bodies					
Financial institutions					
Clients					
Research institutes					
Subcontractors/suppliers					

(11) Technological and Innovative Capabilities

Please indicate whether your company possesses the following contents in the technology and innovation aspects:

Setting up special department to conduct technological innovation		Winning technological innovation awards/patents	
Investing funds into technological innovation every year		Building long-term relationships with research institutes	
		Others, if any	

(12) Reputation

Please evaluate your company's reputation on a five point scale ranging from poor to excellent

1. Poor 2. Fair 3.Satisfactory 4.Good 5.Excellent

(13) Project Management Competency

Please evaluate your company's project management level in the following activities:

	Poor 1	2	Normal 3	4	Excellent 5
Schedule management					
Cost management					
Quality management					
Contract management					
Procurement management					

(14) Financial Capabilities

Please evaluate the firm's financial capabilities along the following dimensions:

Poor — Normal — Excellent

	1	2	3	4	5
Capacity to acquire financial resources from bank or other financial institutes					
Ability to make middle and long term investments					
Accounting and financial management					

5 Strategic and Organizational (S&O) Variables

(15) HR Strategy: Please evaluate the firm's human resource management in the following aspects:

Poor — Normal — Excellent

	1	2	3	4	5
Detailed prescriptions for the employee's job responsibility					
Training and education					
Performance appraisal system					
Reward system					

(16) IT Strategy: Please indicate whether your company possesses the following IT systems:

Office automation system		Financial management system	
Bidding system		Human resource management system	
Project management system		Engineering technology development system	
		Others, if any	

(17) Organizational structure – formalization

Please choose one or more items listed below for which your company has established formalized procedures, rules, or regulations:

Project management		Responsibility of the department	
Quality management		Human resource management	
Contract management		Financial management	
Cost management		Marketing management	
Technology management		Others, if any	

(18) Organizational structure - centralization

Please choose one or more decision-making items listed below which are controlled by the headquarters:

Bidding decision		Selection of technological scheme	
Material procurement		Project cost control	
Setting of contractual terms		Capital budget control	
Subcontractor selection		Allocation of manpower	
Structure of project team		Others, if any	

(19) Organizational culture

Please choose one or more items listed below which represent an influential theme in your company culture:

Emphasis on project quality		Organizational learning	
Emphasis on reputation & brand name		Customer satisfaction	
Emphasis on human development of capital		Pursuing innovation	
		Others, if any	

中国工程承包企业战略管理调查问卷:

1 基本信息：

(1) 企业共有多少员工？ A. <100, B.100-200 C.200-500, D.500-1000, E. >1000

(2) 问卷填写人职务：工程师，项目经理，部门经理，公司副总经理，总经理, 其他:_____

2 公司绩效：

(3) 请标明公司最近 3 年的平均营业额增长了多少？

A. <5%, B. 5%-10%, C. 10%-15%, D. 15%-20%, E. >20%

(4) 请标明公司最近 3 年的平均净利润率增长了多少？

A. <5%, B. 5%-10%, C. 10%-15%, D. 15%-20%, E. >20%

3 竞争战略

(5) 同竞争者比较，公司是否在下列项目成本项上比竞争者具有竞争优势？(多选 挑 √)

材料/机械采购成本		管理费用	
人工成本		分包商成本	
施工过程成本控制		其他(请注明)	

(6)同竞争者比较，公司是否在下列方面具有竞争优势？(多选 挑 √)

公司的品牌/信誉及项目的质量		较好的融资能力	
较高的项目管理水平		与业主具有良好的关系	
较高的施工技术水平及技术创新能力		其他（除成本优势）	

(7) 公司所承揽项目分布在多少个不同地区？

A. 1 B. 2-3 C. 4-6 D. 7-10 E. 10 个以上

(8) 请选择公司的工程业务范围(多选 挑 √)

基础设施	挑 √	**房屋建筑**	挑 √
公路\隧道\桥梁		民用住宅\商业大厦\工业厂房	
地铁\机场\铁路		特殊建筑（体育场馆\政府大厦）	
港口\码头		**工业项目**	
水工\大坝		化工	
电力设施		冶金	
环境工程		**其他工程（请注明）**	

(9) 请问公司除了工程施工以外,是否还涉足其他业务? (多选 挑 √)

设计		房地产	
监理		施工机械或材料生产加工	
咨询		其他(请注明)	

4 资源及能力变量

(10) 请评价公司的关系资源

	1	2	3	4	5
和政府监管部门（比如质量监管部门，税收行政管理部门等）之间的关系？					
和金融机构（银行等）之间的关系？					
和客户（比如政府公共项目客户和私人及外资项目客户）之间的关系？					
和大学等科研机构之间的关系？					
和分包商/供应商之间的关系？					

(11) 公司在技术创新方面是否具备下列内容: (多选 挑 √)

有专门的技术研究部门	
每年投入专门资金用于技术研发	
有独家专利产品或获得过省\部级以上技术创新奖励	
与大学等科研院所有长期稳定的业务协作关系	
其他(请注明)	

(12) 请评价公司的品牌资源

A. 很差　B. 一般　C. 比较满意　D. 比较好　E. 非常好

(13) 请评价公司的项目管理水平?

	1	2	3	4	5
成本管理					
进度管理					
质量管理					
合同管理					
采购管理					

(14) 请评价公司金融能力?

	1	2	3	4	5
从银行或其他金融机构融资的能力					
公司中长期投资的能力					
会计及金融管理					

5 策略及组织变量

(15) 请评价公司的人力资源管理制度：

	不好 1	2	3	一般 4	很好 5
是否对员工的岗位职责有详细规定?					
是否经常对员工进行培训					
是否有完善的绩效考核制度					
是否有完善的薪酬福利制度					

(16) 请问公司是否正在使用下列计算机信息管理系统：(多选 挑 √)

办公自动化系统		财务管理信息系统	
投标报价管理系统		人力资源管理系统	
项目管理信息系统		工程技术软件	
其他(请注明)			

(17) 公司是否在下列方面形成规范化的程序文件或管理手册？(多选 挑 √)

项目管理		部门职责	
质量管理		人事管理	
合同管理		财务管理	
成本管理		市场营销管理	
技术管理		其他(请注明)	

(18) 在项目实施过程中，总部对下列哪些方面进行控制：(多选 挑 √)

投标决策		技术方案制订	
物资采购		项目成本控制	
订立合同		资金控制	
分包商选择		人事管理	
施工组织设计		其他(请注明)	

(19) 公司的企业文化包含下列哪些内容：(多选 挑 √)

重视工程质量		不断学习	
重视公司信誉及品牌		客户满意	
重视人才		追求创新	
其他(请注明)			

Appendix E: Interview Questions

Brief introduction of interviewee

- Briefly introduce your role in the company
- Briefly describe your company's background
- What is the outlook of your company in terms of the profit and the sales growth? (Please show me the financial reports/other detailed information if it is convenient.)

Main business strategies adopted by the Company

- What are the main business areas of your company?
- What are the main regions of your company's business?
- Does your company have any business related to real estate development and investment?
- Does your company integrate any businesses related to upstream activities, such as material/equipment manufacturing?
- What are the types of systematic measures or procedures adopted in your company to control cost?
- In your opinion, what are the types of special aspects that your company possesses which your competitors don't have?

Main supporting resources and competencies

- Does your company have any close relationship with clients/government/financial institutes? If yes, please describe in detail (including the name of relevant institutions, strategy to develop *Guanxi*, etc.)
- Discuss some of the following key aspects related to the development of new techniques/products in your company:
    - types and modes of innovation
    - amount of investment in R&D
    - collaboration parties in R&D
    - organizational structure related with R&D
    - awards received that are related to innovation (if any)
- General description of the financial capability of your company
    - How do you acquire the necessary financial resources? From the bank or some other financial institutes? Is it easy to acquire or do you need to utilize your *Guanxi* resource?
    - Are there any substantial investment activities made by the firm? If yes, please provide more detailed information.

  - What are the other special activities or procedures involved in financial management?
- Describe the strength of your firm in relation to the following aspects of project management:
  - Cost management
  - Schedule management
  - Quality management
  - Contract management
  - Procurement management

Other Aspects

- Human resource management:
  - Training and educational system of your company
  - Performance measurement system
  - Reward system (incentive mechanisms of your company)

- Please roughly introduce the components of your company's IT system

- Organizational structure:
  - Organizational chart and reporting structure
  - Formalized documents and handbooks for operations and management control systems

- Discuss the prominent cultural aspects of your company.