The Hong Kong Polytechnic University
Department of Building and Real Estate

Contractor's Competitiveness and Competitive Strategy in Hong Kong

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CERTIFICATE OF ORIGINALITY

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it reproduces no material previously published or written, nor material that has been accepted for the award of any other degree or diploma, except where due acknowledgement has been made in the text.

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ABSTRACT

Understanding an organization's competitiveness and hence finding the competitive strategy has been an important issue for construction businesses, which has led to the increasing research efforts contributed to this research area. Hong Kong construction industry is vibrant and has special characteristics. Contractors in the local construction market are from different countries with different experiences and backgrounds. It is essential for contractors to adequately realize their competitiveness and therefore develop competitive strategies. However, few research efforts have been done on examining contractors' competitiveness and competitive strategy in the Hong Kong construction industry. This study aims to conduct the research on understanding contractors' competitiveness and competitive strategy in the context of Hong Kong construction industry.

A theoretical competitive strategy model is developed for helping contractors formulate better strategy in competition. The external and internal competition environment in the local construction industry is examined, which helps contractors to identify their opportunities, threats, strengths and weaknesses in the local market. Key competitiveness indicators (KCIs) are identified through a questionnaire survey. And a fuzzy competitiveness rating method is introduced for helping to assess contractors' competitiveness. The results provide useful references for contractors to understand their competitiveness in the local construction industry.

Furthermore, typical competitive strategies used in the local construction industry were identified. The competitive strategy model is validated by using the data collected from the second questionnaire survey. The results of correlation analysis show that the external and internal competition environment has substantial impacts on contractors' performance and selection of competitive strategies; and effective competitive strategies will lead to higher performance in competition. The results of cluster analysis show that contractors in the local construction industry take different strategic orientations by assuming different roles such as reactor, analyzer, prospector and defender.

Competitiveness and competitive strategy are closely interrelated in the strategic management of construction businesses. Contractors should clearly understand their competitiveness in particular market segments and formulate their competitive strategies through effectively utilizing their internal resources and capabilities to grasp the potential opportunities in the external environment, and hence achieve superior performance in competition. The findings in this study are important references particularly to those overseas construction companies for understanding the local construction industry. Whilst the data used in the analysis are collected from the Hong Kong construction industry, the findings provide useful references for conducting comparative studies between Hong Kong and other countries or regions.

PUBLICATIONS ARISING FROM THE THESIS

Journal Papers

1. **Tan, Y.T.**, Shen, L.Y., Yam, M.C.H., and Lo, A.A.C. (2007). Contractor Key Competitiveness Indicators (KCIs): a Hong Kong Study. *Surveying and Built Environment*, 18(2), 33-46.

2. **Tan, Y.T.**, Shen, L.Y., Lu, W.S., and Shen, Q.P. (2008). Multiple-objective bidding strategy using goal programming technique. *Management Decision*, 46(4), 656-672.

3. **Tan, Y.T.**, Shen, L.Y., Khalid, A.G. and Song, S.C. (2008). An examination of the factors affecting contractors' competition strategy: a Hong Kong study. *International Journal of Project Organisation and Management*, 1(1), 4-23.

4. **Tan, Y.T.**, and Shen, L.Y. (2010). A fuzzy competence requirement model for competitive bidding strategy. *Construction Innovation: Information, Process, Management*, 10(1), accepted for publication.

5. **Tan, Y.T.**, Shen, L.Y., and Langston, C.A. (2008). Contractors' Competition Strategies in Bidding: a Hong Kong Study, *Journal of Construction Engineering and Management*, under review.

6. **Tan, Y.T.**, Shen, L.Y., and Liu, Y. (2008). Construction Project Selection Using Fuzzy TOPSIS Approach. *Journal of Modelling in Management*, under review.

Conference Papers

1. Shen, L.Y., **Tan, Y.T.**, and Yam, C.H. Michael. (2004). Application of goal programming technique in forming bidding strategy. *Proceedings of CRIOCM 2004 International Research Symposium on Advancement of Construction Management and Real Estate*, 6-7 December 2004, Hong Kong, China, 130-138.

2. Shen, L.Y. and **Tan, Y.T.** (2005). Applying the fuzzy resources allocation (FRA) model by different contractors for different types of projects. *Proceedings of CRIOCM 2005 International Research Symposium on Advancement of Construction Management and Real Estate*, 30 October - 2 November 2005, Hangzhou, China, 542-548.

3. **Tan, Y.T**., Yam, C.H. Michael, and Lo, A.C. Ann. (2007). Contractor Key Competitiveness Indicators (KCIs): Identification and Analysis. *Proceedings of CRIOCM 2007 International Research Symposium on Advancement of Construction Management and Real Estate*, 8-13 August 2007, Sydney, Australia, 505-514.

4. Shen, L. Y., **Tan Y. T.**, Song S. C., and Yu M. X. (2007). Factor analysis on contractor competition strategy: a Hong Kong study. *Proceedings of 5th International conference on Construction Project Management and 2nd International Conference on Construction Engineering and Management*, 1-2

March 2007， Singapore, Conference CD-Rom, Section 2B, 20-31.

5. **Tan, Y.T.**, and Shen, L.Y. (2007). Factor Analysis on contractor's competitive bidding strategy. Proceedings of the Academic Forum for Management Science and Engineering, 27-31 October 2007, Tianjin, China, 74-82.

6. **Tan, Y.T.**, and Shen, L.Y. (2008). Factors affecting contractors' competitive bidding strategy. *Proceedings of the Second Faculty Postgraduate Research Conference*, 19 January 2008, Hong Kong, China, 18-24.

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CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

Understanding an organization's competitiveness and hence finding the competitive strategy is important for the success of a business, and studies on competitiveness and competitive strategy have been extensively conducted by many researchers (Porter, 1980; 1985; Pettigrew, 1988; Hu, 2001; Hitchens et al., 2003). In construction industry, relevant studies can be classified into two major streams. One focuses on competitiveness assessment and methods to improve competitiveness (Shen et al., 2003; 2006). The other group focuses on how competitive strategies are developed (Betts and Ofori, 1992; Warszawski, 1996). Improving competitiveness is one of the most important objectives for construction businesses and is the driver of the formulation of a competitive strategy. In return, a competitive strategy enables a contractor effectively utilize its resources to achieve the objective of improving competitiveness. Therefore, competitiveness and competitive strategy are closely interrelated and their characteristics will be both studied in the thesis.

1.1 Background of the Research

1.1.1 The Construction Industry

The construction industry is one of the main pillars of Hong Kong's economy. The output of the industry has been fluctuating significantly. In 2006, the total gross value of construction work performed by main contractors was $90.0 billion, which decreased much from $133 billion in 1998 (Census and Statistics Department, HKSAR Government). The contribution of the construction industry to the overall

GDP (Gross Domestic Product) also decreased much since 1997, as shown in Figure 1.1. The decrease is the result of the impact of the financial turmoil in Asia in late 1997. There have been few large construction projects since the completion of the Airport Core Programme.

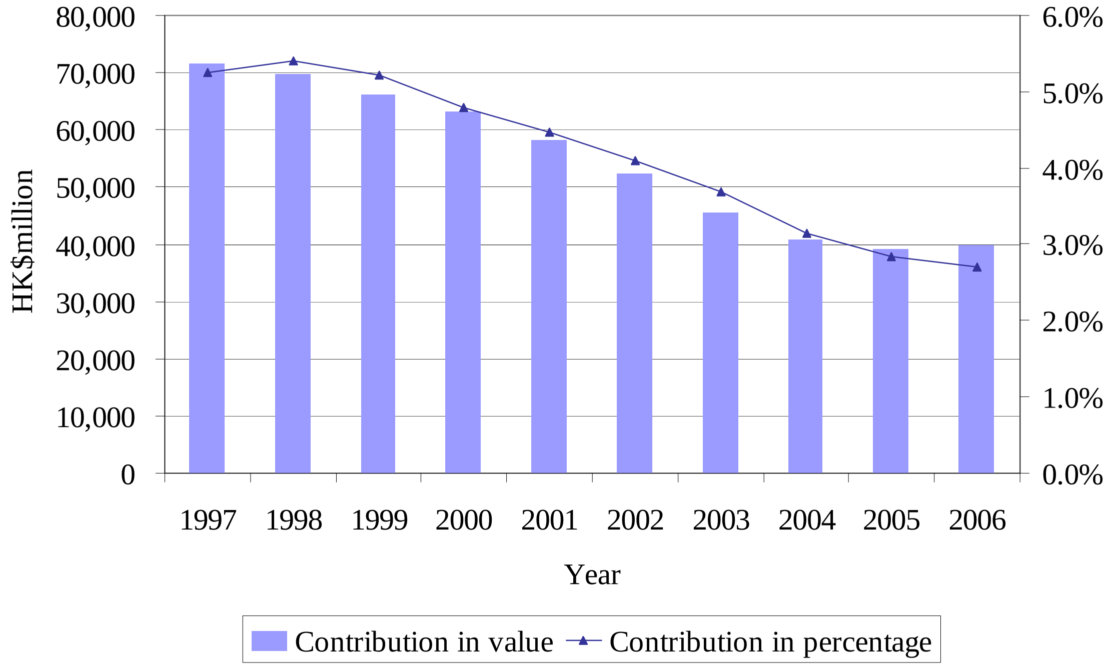

Figure 1.1 Contribution of construction industry to GDP: 1997 - 2006

Source: Census and Statistics Department, HKSAR Government

However, the construction industry is expected to recover with the implementation of 10 major infrastructure projects for economic growth addressed in the government's 2007-08 Policy Address (2007). Furthermore, the construction industry plays an important role in improving the quality of the living environment. Despite the recent decrease in investment in infrastructure, there are many infrastructure projects developing with the recovery of the economy from the financial crisis, such as the completion of Airport Core Programme Highways

Projects and public residential building under the Housing Authority's Housing Programme. New large infrastructure projects are proposed in the government's policy and there will be a substantial increase in civil engineering works in the near future.

Construction activities can be broadly divided into two areas, namely public sector projects and private sector projects. Public sector projects are commissioned by the Government of the Hong Kong Special Administrative Region, Mass Transit Railway Corporation, Kowloon-Canton Railway Corporation and Airport Authority, and the projects under the Home Ownership Scheme, commissioned by the Housing Authority. Private sector projects are commissioned by private developers. Figure 1.2 shows the gross value of construction works by the two sectors from 1997 to 2006. The gross value decreased a lot since 1997. In particular, public works dropped substantially as few large public works were conducted in the last decade. The Hong Kong Government has realized the need to increase the industry's output. In the government's 2007-08 Policy Address, the Chief Executive said:

"……I will push ahead with 10 large-scale infrastructure projects within my term of office. These projects will not only expand the room necessary for Hong Kong's further development, but also improve our transportation, thereby linking up our socio-cultural and business activities with more efficient transportation systems……"

"A rough estimate of the added value to our economy brought about by these projects, from commissioning to a mature stage, would be more than $100 billion annually, amounting to some 7% of our GDP in 2006. In addition, some 250 000 additional jobs would be created……"

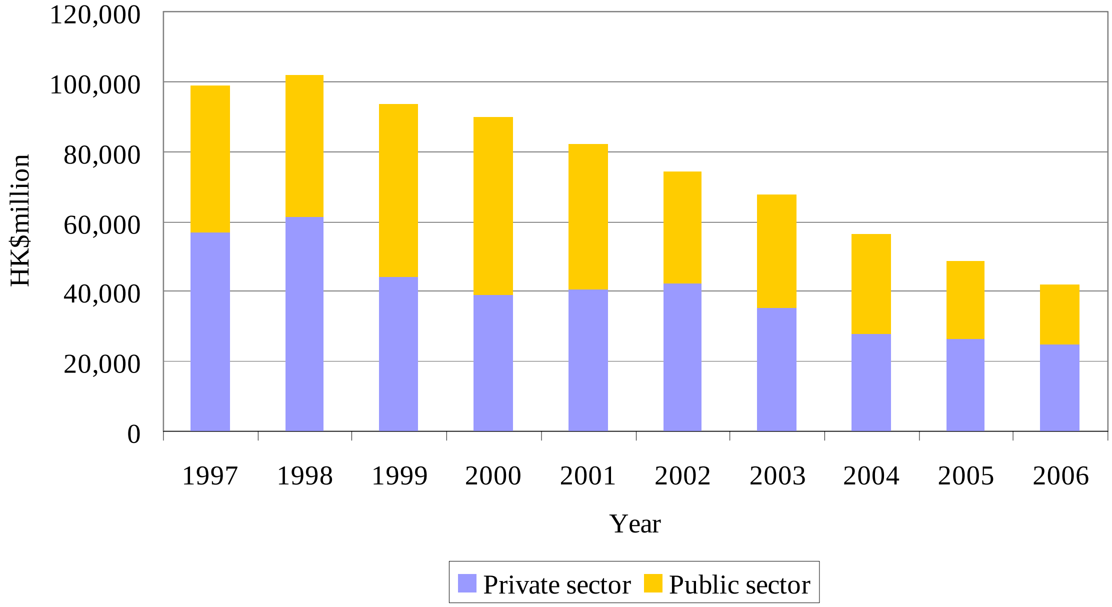

Figure 1.2 Gross value of construction works performed by main contractors at construction sites by sector: 1997 - 2006

Source: Census and Statistics Department, HKSAR Government

1.1.2 Problem Statement

The Hong Kong construction industry has experienced difficulties and uncertainties over past decade, and the government has been taking measures for supporting the industry. In April 2000, the Chief Executive appointed the Construction Industry Review Committee (CIRC) to examine the current state of the construction industry, identify specific actions and good practices to improve the efficiency of the industry, and advise on an order of priority for implementation. The CIRC submitted a report to the Chief Executive on 18 January 2001. The key problem areas affecting the local construction industry were identified in the report, as summarized in Table 1.1.

Table 1.1 Key problems affecting the local construction industry

Key problem areas	**Discussion**
Poor site safety record	• In the past ten years, there were about 200 000 injuries and 608 fatalities.
Unsatisfactory environmental performance	• Increased complaints against the construction industry for non-compliance with environmental protection requirements • Increased construction and demolition (C&D) material • Project owner and team place little emphasis on the environmental performance of the built facilities and service.
Need for a more client-focused approach	• The industry is rife with examples of substandard work, shoddy workmanship, cost overruns and project delays • Lack of a culture of continuously improving on its products to meet the needs of the end-users.
Extensive use of traditional and labour-intensive construction methods	• Local construction is on the whole heavily reliant on labour-intensive in-situ construction methods • Use of prefabrication and modular components is not common.
An inadequately trained workforce	• The skill levels of local construction workers vary significantly • Most employers are not keen to engage direct labour or invest in training • There is little incentive for workers to upgrade their skills.
Tendency to award contracts to the lowest bidders	• Cut-throat competition has sometimes led to unrealistically low bids • Many industry participants aim to meet only the minimum requirements set by clients • Increasing the profit margins through variations and claims, and some may try to reduce their losses by cutting corners.
Short-term attitude to business development	• Investment in construction-related research and development across the industry is low • There is little interest in building up the industry's long-term competitiveness through the use of innovative technologies and more efficient processes.
Non value-adding multi-layered subcontracting	• Subcontracting of construction works is a long-established practice in local construction • Inadequate control and supervision over the subcontractor's work results in poor construction quality.
Declining productivity growth and high building cost	• Building cost in Hong Kong is among the highest in advanced economies.
Fragmentation and adversarial culture within the industry	• Co-operation on an industry wide basis is very limited • Absence of a teamwork culture in the industry and lack of a common purpose among stakeholders.

Source: CIRC, 2001

Addressing the problems encountered by the local construction industry demand the contributions of collaborative efforts from all relevant parties, including the government, clients, contractors, subcontractors, suppliers, consultants and other stakeholders. However, difficulties exist in solving the problems and the change of culture will take a long time since many of these problems have been generated from long-established practices and processes. The decreasing trend of construction output in recent years reduced the pace of change and improvement in the industry, resulting in more intensive competition in the market. It is a long term goal to improve the performance of the industry and nurture an effective and healthy competition environment in the local construction industry.

CIRC's report presents many areas for potential improvement in the Hong Kong construction industry and requests the contribution of all industrial stakeholders, including a call for contractors to improve their performance by adapting to a more changeable environment. The report particularly points out that contractors should find ways to improve competitiveness. In line with this, research works have been undertaken for helping contractors to understand their competitiveness in the market. A typical work by Chiang et al. (2001) presents a comprehensive analysis on the Hong Kong construction market structure. In the same study, four initiatives are suggested to help contractors enhance their competitiveness. These initiatives are: (1) facilitating supplies, in particular the supply of finance; (2) raising demand for construction work; (3) building up a strategic alliance with industry; and (4) keeping a stable work load. However, there are few studies investigating how contractors' competitiveness in the local market can be properly measured. Thus, an effective method for measuring competitiveness is needed for helping contractors understand their competitiveness, and thus to develop competitive strategies. A competitiveness measurement and a method for identifying a competitive strategy are needed for helping contractors to participate actively in the industry, thus contributing to the healthy development of the local construction market. These issues lead to the development of the background of this research, which addresses the following major research questions:

- How to assess contractors' competitiveness and identify their competitive resources in the context of the Hong Kong construction industry?
- How to help contractors to formulate a competitive strategy to achieve superior performance in different market segments?

1.2 Research Objectives

The overall aim of this research is to find solutions to the central issue "*How to improve contractors' competitiveness and develop competitive strategy in the local construction industry?*". This aim is achieved by developing a competitiveness indicator system and establishing a competitive strategy model. The competitiveness indicator system can help contractors understand their competitiveness and take relevant strategic analysis to identify their strengths and weaknesses. The competitive strategy model can help contractors to formulate their competitive strategies by considering external environment and internal resources. For accomplishing this research aim, the following specific objectives are planned:

- To examine external and internal environment and the way they affect contractors' competitiveness and competitive strategy.
- To develop the measurement system for contractor competitiveness, identify key competitiveness indicators and assess contractors' competitiveness.
- To develop a competitive strategy model and use the model to help contractors develop their competitive strategies in the local construction market.
- To classify contractors into different groups according to their different strategic orientations, and analyze their different performance, company characteristic, adaptability to the external environment, and competitive resources.

1.3 Scope of the Research

The scope of a research is to define to what extent and what issues the research will address. In this study, the scope of the research is defined in three aspects, including the domain selection, firm selection, and strategy analysis level. Firstly, there are two distinct types of market structure in construction: contracting and speculative construction (Langford and Male, 2001). This study focuses on the whole construction market. Secondly, the target firms in this study are contractors working in the local construction industry of Hong Kong. Members of the Hong Kong Construction Association are selected since they represent the major characteristics of contractors in the Hong Kong construction industry. Thirdly, the competition strategy can be defined in three levels: corporate level, business level and function level. This study is for corporate and business level rather than function level.

There are several key terms and concepts used in this research. These terms are defined as follows:

Competitiveness

A contractor's competitiveness refers to its ability to provide products and services in a more effective and efficient way than its competitors and achieve and sustain superior performance in the industry.

Competitive strategy

Porter (1980) defined 'competitive strategy' as "… *a combination of the ends (goals) for which the firm is striving and the means (policies) by which it is seeking to get there*." In the construction industry, a contractor' competitive strategy is to define a set of objectives, including the value of construction contracts and profits, and arrange relevant actions specific to the contractor and necessary resources for achieving these objectives.

Competitive resources

According to the resource-based view, a firm's competitive advantage comes from its internal competitive resources. And these competitive resources have the attributes as valuable, rare, inimitable, no substitutes. For a contractor, its competitive resources may come from one or more of the six aspects, including corporate image, technology and innovation, marketing, financing, project management skills, and organization and human resources. The identification of competitive resources will lead to the formulation of competitive strategy.

Construction industry and market

An industry is a supply side concept and a market is a demand side concept (Langford and Male, 2001). The distinction between market and industry is summarized as follows (Kay, 1993):

- *A market is defined by demand conditions, is based on consumer needs and is characterized by the 'law of one price', and is bounded by the ability of the consumer to substitute one product for another.*
- *An industry is determined by supply conditions, is based on production technology and is defined by the markets chosen by firms. Industries are determined by the manner in which production is produced.*

The construction industry has its own characteristics. The products are delivering various facilities to meet clients' needs, such as living, working, transport etc. The determination of product price is reverse of manufacturing since the price is normally determined prior to the completion of products.

The construction market has various demands and clients. And these demands and clients can be from any industry. Therefore, contractors can choose different market segments for competition. For example, a large contractor may choose to compete in all market segments; but a small repair and maintenance contractor may only choose a building segment for competition.

Contractors

Contractors are the major performers in the construction industry. Contractors use their 'know-how' on construction of buildings or infrastructures to arrange necessary resources for constructing facilities to meet clients' needs and a contract between contractor and client is signed for allocating the roles and responsibilities. Contractors can be further divided into general contractors and sub-contractors.

1.4 Significance of the Research

Contractors play an important role in promoting the development of construction industry. This study aims to help contractors identify their strength and weakness, improve their competitiveness, and develop competitive strategy using their organizational resources. The result of the study provides valuable reference or guideline for contractors working in Hong Kong. Contractors in Hong Kong face opportunities, and also threats. Gaining and sustaining competitive advantage is the most important strategic issue to contractors' business development. The improvement in contractors' business will in turn contribute to the healthy development of the local construction industry.

1.5 Organization of the Dissertation

Figure 1.3 shows organization of the dissertation. The contents of each chapter are as follows.

Chapter 1 presents the background of this research, the objectives to be achieved, the scope and significance of the study. Regarding the background, the problems existing in the construction industry of Hong Kong are examined.

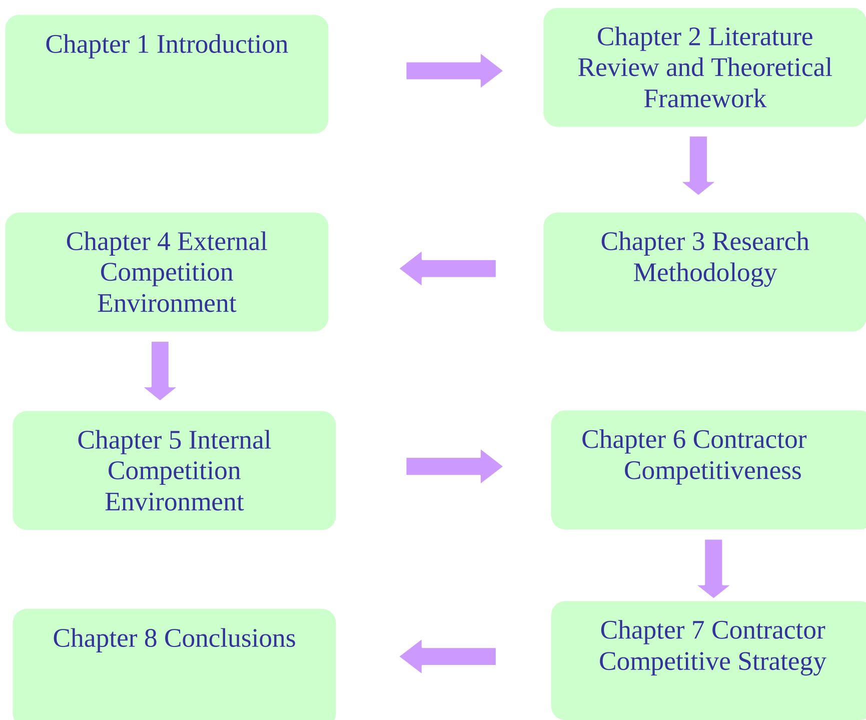

Figure 1.3 Flow chart of organization of the dissertation

Chapter 2 presents the literature review on the basic theories of strategic management, including the industrial organization, resource-based view and Porter's three generic competitive strategies. This comprehensive literature review leads to the formulation of conceptual model of competitive strategy for construction business. This conceptual model provides the framework of the research and its implications in the construction industry are also discussed in this chapter.

Chapter 3 introduces the research methodology to be used in this study. Questionnaire survey, interviews and workshop are the major methodologies adopted in the study. Serial surveys enable deep understanding and analysis of the strategic management in the construction industry.

Chapter 4 examines the external competition environment for construction firms working in Hong Kong. The remote environment, industry and market structure and characteristics of Hong Kong construction industry are analyzed.

Chapter 5 presents the characteristics of contractors operating in Hong Kong, and the analysis on contractors' internal resources and capabilities, relationships with other parties. Contractors working in Hong Kong have different backgrounds, organization structures and market domain. The analysis of internal resource and capability and relationship with various parties could help contractors to identify their strengths and weaknesses which will be useful for formulating competitive strategy in competition. A quantitative model, called GP-OBS, is used to demonstrate how the internal resources affect contractors' competitiveness and competition strategy.

Chapter 6 demonstrates a system of competitiveness indicators for assessing contractors' competitiveness. Based on a questionnaire survey and workshop, the Key Competitiveness Indicators (KCIs) are identified. With the identified KCIs, a fuzzy competitiveness rating method is developed for measuring contractors' competitiveness.

Chapter 7 conducts the survey to validate the conceptual model of competitive strategy for construction business. The results help contractors to understand how the external environment and internal environment affect competitive strategy and performance, the relationship between competitive strategy and performance, and contractors' strategic orientations in competition.

Chapter 8 concludes the key findings of the study, and also highlights the limitations of this study. The recommendations for further research based on this study are also addressed.

CHAPTER 2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

2.2 Competitiveness

2.3 Competitive Advantage

2.4 Competitive Strategy

2.5 Strategy in Construction

2.6 Competitive Strategy Model

2.7 Summary

CHAPTER 2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

This chapter presents a comprehensive literature review on competitiveness, competitive advantage and competitive strategy within the context of construction industry. The literature review leads to the development of a theoretical framework of the thesis. Two main streams of competitive advantage, namely industrial organization view of competitive advantage, and resource-based view of competitive advantage are introduced. Porter's (1980) three generic competitive strategies are introduced. The understanding on these theories is important to further investigate their application in the construction industry.

2.2 Competitiveness

2.2.1 Generic Competitiveness

The concept of competitiveness has been widely used in economics and business management, particularly in the context of national competitiveness. The World Economic Forum (WEF) and the International Institute of Management Development (IMD) yearly publish competitiveness reports to measure the competitiveness of different nations. Recently, WEF has started forward to introduce the competitiveness in the context of regions and industries. The products of the WEF concerning the competitiveness are shown as follows:

- Global Competitiveness Report

- Africa Competitiveness Report
- Travel & Tourism Competitiveness Report
- Arab World Competitiveness Report

In addition to national competitiveness, the concepts of firm competitiveness and industrial competitiveness have also been adopted in different contexts. Industry bodies and firms are keen to understand and improve their competitiveness, as competitiveness is the key to the success or failure in a market economy (Porter, 1980). The concept of competitiveness can be viewed from three levels as shown in Figure 2.1.

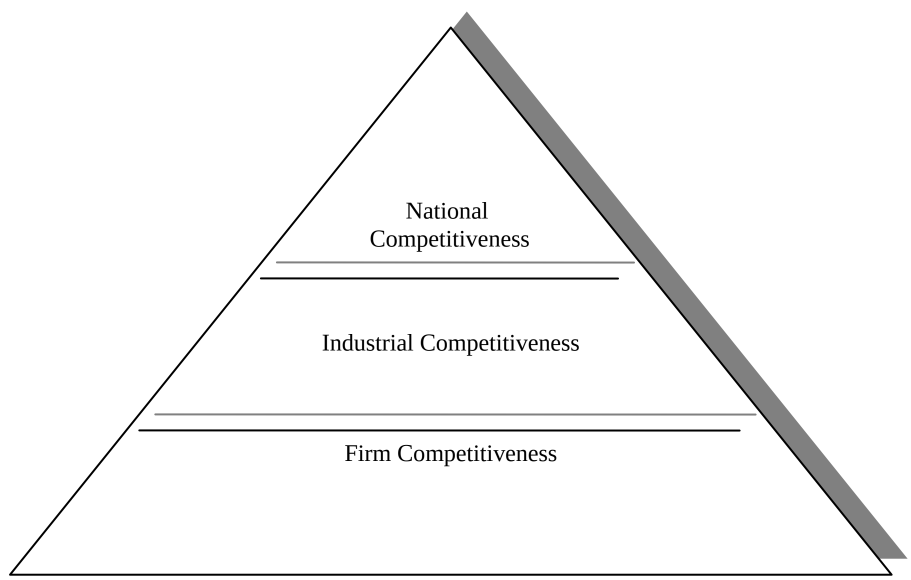

Figure 2.1 Competitiveness concept in three contexts

There are a number of definitions about the concept of competitiveness as adopted in different contexts. For example, Scott and Lodge (1985) gave the definition of national competitiveness as "*a country's ability to create, produce, distribute and/or service products in international trade while earning rising returns on its resources*". Industrial competitiveness is the ability of a company or industry to meet challenges posed by foreign competitors (US Department of Energy, World Competitiveness Yearbook 2003 (IMD, 2004)). Ivancevich et al. (1997) defined firm competitiveness as "*the degree to which a firm can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its employees and owners*".

2.2.2 Contractor Competitiveness

The subject of contractor competitiveness has been covered extensively in the literature. Traditional research on contractor competitiveness emphasizes on tender price and less attention has been given to evaluating a contractor's performance attributes (for example, Holt et al., 1995; Jennings and Holt, 1998; Kumaraswamy and Walker, 1999). Price competitiveness is still popular as a mechanism for awarding contracts to contractors (Drew and Skitmore, 1997; Hoxley, 1998; Drew et al., 2001). Nevertheless, the recognition that a quality service cannot be obtained if only the lowest tender is accepted has led to a growing urge for a shift from 'lowest-price wins' to 'multi-criteria selection' practice in the contractor selection process. Hatush and Skitmore (1997) suggested that evaluation of contractor competence should consider a wide range of factors such as financial soundness, technical ability, management capability, reputation and safety performance. In another research by Lam et al. (2000), an artificial neural network was used as a decision support tool for pre-qualifying contractors through examination of the multiple contractor competitiveness variables. Wong et al. (2000) investigated UK practice and found that 'lowest-price' is not necessarily the client's principal selection criterion, and suggested that cost has to be considered in the selection process alongside an evaluation of the contractor's ability to fulfill the multiple objectives inherent in the project. These studies have introduced various methods for awarding construction contracts through assessing contractor competitiveness by using multiple criteria. However, they have not yet introduced methods for helping contractors to formulate competitive strategies when multiple performance attributes are applied in the contractor selection process.

Shen et al. (1999) has developed an optimal bid model for assisting contractors in determining better bidding strategy when considering the tender price and construction time collectively. This development is based on the understanding that clients are increasingly calling for bids requiring submission of both the tender price and contract time. This model was developed by applying Iso-line and regression analysis techniques. The typical weakness of the model however is that it does not consider other performance attributes such as quality performance, environmental performance, and safety standard.

In examining the major parameters used for assessing contractors' competitiveness in the Chinese construction market, Shen et al. (2004) formulated the competitiveness parameters in seven areas: management skill, technical ability, financing ability, organization structure, marketing ability, social influence, and contribution to project. Whilst these parameters provide a reference tool in assisting contractors in improving their competitiveness in the Chinese construction market, they provide the basis for conducting the comparison on competitiveness assessment practice between China Mainland and other countries or regions such as Hong Kong.

2.3 Competitive Advantage

There are two main perspectives on sources of competitive advantage. The first one is grounded in the earlier works of Mason (1939) and Bain (1959) in the area of industrial organization economics and mostly developed by Porter (1980, 1985). It is termed the industrial organization view of competitive advantage. The second one is grounded in the earlier work of Penrose (1959) and subsequently developed by a number of researchers (Wernerfelt, 1984; Barney, 1991; Mahoney and Pandian, 1992; Barney, 2001; Makadok, 2001). It is termed the resource-based view of competitive advantage. These two perspectives of competitive advantage have become the most vital approaches for studying factors that underlie a company's superior performance. The following sections will discuss the concepts and implications of these two theories of competitive advantage.

2.3.1 Industrial Organization (IO) View

There are two major approaches for interpreting the performance of industrial organization, namely the structure-conduct-performance approach and the Chicago School Approach. Whilst these two approaches will be compared with discussion, newly developed approach in the literature, namely New Industrial Organization, will be introduced.

The Structure-Conduct-Performance (SCP) Approach

The industrial organization view of competitive advantage was initially developed by Mason (1939) and Bain (1956, 1959). The basic concept of primary IO theory is that an industry's structure has an impact on firm returns. An industry's structure is determined by certain attributes including the existence and value of barriers to entry, the number and relative size of firms, the existence and degree of product differentiation in the industry, and the overall elasticity of demand for the industry (Bain, 1956). Industries characterized by a small number of firms, large barriers to entry, a large degree of product differentiation, or low demand elasticity benefit their firms to earn higher returns than firms in industries without these attributes.

In Mason and Bain's model, the relationship between the structural characteristics of industries and performance of the firm has come to be known as the structure, conduct, and performance paradigm, as shown in Figure 2.2. Industrial structure determined the behavior or conduct of firms, and their joint conduct determined the collective performance of the firms in the market (Mason, 1939, 1949; Bain, 1956).

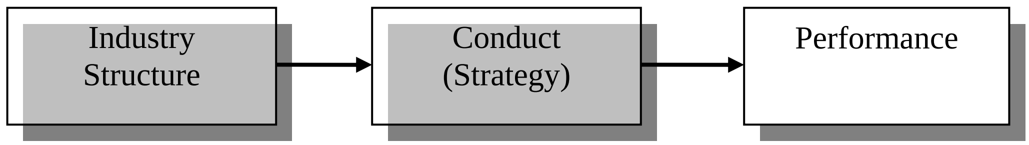

Figure 2.2 Preliminary structure – conduct – performance paradigm

In the structure-conduct-performance model, an industry's structure is characterized by buyer's and seller's concentration, product differentiation, barriers to entry and mobility. Buyer's and seller's concentration refers to the market shares of the largest buyers and sellers. Product/service differentiation refers to the degree to which the product/services can be modified or improved. Entry barriers refers to the advantages of an established seller in an industry over a potential entrant seller, and these advantages enable the established sellers to persistently raise their prices above a competitive level without fearing new firms to enter the industry (Bain, 1956). Some of the most commonly barriers include economics of scope, organizational learning and economics of scales. Mobility barriers represent the same conceptual features as entry barriers but refer to existing firms rather than potential entrants. Bain (1956) also argued that the ability of new firms to enter the market should be considered beyond the configuration of the industry's existing firms.

The Bain/Mason paradigm of IO is a useful contribution to strategy formulation in an industry. It offers a systematic model for assessing the nature of competition in an industry. Identifying the structure of the industry in IO terms casts the spotlight on the crucial aspects of the firm's industry environment, and illuminates such critical concepts as barriers to entry and demand elasticity. The model also allows an analysis of the performance a firm could hope to achieve in its industry. It reinforces the important point that not all industries are equal in terms of their potential profitability. Thus the model can help firms predict a performance level that can reasonably be expected.

However, the traditional SCP model was challenged by many empirical findings. For example, firms with large market share tend to earn more profit according to SCP view. The real case could be that firms with the most efficient or the lowest cost have the largest market share. Another example is that the firms' strategic actions could influence the strategic decisions of potential entrants or rivals, and consequently influence the industry structure. Furthermore, the traditional SCP paradigm also led to many aggressive antitrust policy initiatives.

The Chicago School Approach

The Chicago School approach was initially developed to provide a rational interpretation of the legal structures on business and of the real business practices. According to Chicago approach, the above normal profit and large market share are due to the firms' efficiency in production and distribution. The scholars of the Chicago apply the concepts of price theory to explain firms' behavior and market structure. As an early proponent of this approach, Stigler (1968) suggested that organization researchers should use microeconomic theory to design empirical studies, market and public policy. The Chicago School researchers rely heavily on the price theory models to predict the conduct and performance, and design empirical studies. As Demsetz notes,

"*all the conclusions [of the Chicago school] derive from the attempt of maximizers to overcome certain kinds of costs impediments… That approach was contrary to what was then the general approach in the literature, which was, every time you saw something that was peculiar in terms of the framework of the perfect competition model, to mystically conjure up the word monopoly and stop the analysis right there*. " (Kitch, 1983:204)

The Chicago School economists proposed different empirical conclusions comparing with those reached by followers of the SCP approach in the early stage. The examples are as follows:

- SCP economists claimed that there was strong empirical evidence suggesting a positive relationship between monopoly power and profits. Chicago School economists, however, argued that the true relationship might well be that increased efficiency led to increased market power and increased profits.
- SCP economists claimed that the firms tended to restrain output to increase market price through monopoly power or by collusion. Chicago School economists argued that effective collusion was not likely to persist since effective collusion required costly monitoring and enforcement.
- SCP economists claimed that advertising was an entry barrier to create the monopoly power. Chicago School economists argued that advertising could

reduce the cost of customers for searching out relevant prices in the market and build up firms' reputation.

The New Industrial Organization

In recent decades, there is a good consensus among the economists in industrial organizations. The ideas in the consensus come into the new industrial organization. A key part of the new industrial organization is to use game theory to model the firms' behavior in an industry. ***Game theory*** came into being with the classic Theory of Games and Economic Behavior (von Neumann and Morgenstern, 1944). The essential feature is that it provides formal models to analyze conflict and cooperation between firms and individuals. Competition among firms is viewed as a game of strategies, or battle plans of the actions of a firm. Certainly, the outcomes of games depend on the assumptions made by game theorists. And the economists attempt to devise the games that come closer to approximating the real world.

With the development of new industrial organization theory, it is recognized that IO theory is useful to the analysis of strategic choices by firms within industries, and the contribution is growing rapidly since new researches reduced the differences between IO theory and strategic management (Porter, 1981). As a result of new development, IO theory has moved from a useful tool in industrial analysis to taking a central place among the conceptual frameworks in the policy field.

Furthermore, the economists have been turning to a new approach, new empirical industrial organization (NEIO). The NEIO approach uses the systematic statistical evidence in the study of single industries to understand firms' conduct in an industry. The review and related methodology of NEIO approach is introduced in Bresnahan (1989) and the main ideas of NEIO are summarized in Waldman and Jensen (2007) as follows:

- *Price-cost margins cannot be observed. A researcher, unable to observe a firm's marginal cost, can infer it from behavior or can use differences between closely related markets to identify the effects of changes in marginal cost. Alternatively, some NEIO studies measure market power without any measures of marginal cost at all.*
- *Because of institutional details, industries are so individual that researchers cannot learn anything useful from broad cross-section studies of industries.*
- *NEIO studies try to specify and estimate the behavioral equations by which firms set price and quantity.*
- *NEIO studies identify and estimate the degree of market power.*

2.3.2 Resource-Based View

Concept of Resource-Based View

The origins of the resource-based view (RBV) can be traced back to earlier studies (Coase, 1937; Selznick, 1957; Penrose, 1959; Stigler, 1961; Chandler, 1962, 1977; and Williamson, 1975). These studies have been an influential impetus for the development of the resource-based view of the firm. The organization can be considered as ‘collection of resources’ and the resources of the firm are the primary determinant of competitive advantages. These resources possessed by competing firms within industries may be different (i.e., resource heterogeneity) and these difference may be long lasting (i.e., resource immobility).

Following the above researchers, the resource-based view was formally mentioned in Wernerfelt’s (1984) article ‘A resource-based view of the firm’ and was developed by other researchers (Barney, 1991; Amit and Schoemaker, 1993; Peteraf, 1993; Hoopes et al., 2003). The fundamental principle of the RBV is that the competitive advantage of a firm lies primarily in the application of valuable resources at the firm’s disposal (Wernerfelt, 1984; Rumelt, 1984). To transform a short-run competitive advantage into a sustained competitive advantage requires that these resources are heterogeneous in nature and not perfectly mobile (Barney, 1991; Peteraf, 1993). Mahoney and Pandian (1992) conducted a comprehensive review on the principles of the resource-based view, and presented a list of typical research works, as shown in Table 2.1. These research works contribute great to the development of resource-based view of competitive advantage.

Table 2.1 Resource-based view literature

Main Content	**References**
• Distinctive competencies and core competencies are those difficult to replicate.	Andrews, 1971.
• Corporate culture that is valuable, rare and imperfectly imitable due to social complexity, tacit dimensions and path dependency.	Barney, 1986; Fiol, 1991.
• Culture that is the result of human action but not of human design.	Arrow, 1974; Hayek, 1978.
• Invisible assets that by nature is difficult to imitate.	Itami, 1987.
• Valuable heuristics and processes that are no easily imitated.	Schoemaker, 1990
• Response lags.	Lippman and Rumelt, 1982.
• Time compression diseconomies.	Dierickx and Cool, 1989.
• Resource position barriers.	Wernerfelt, 1984.
• Unique or rare resources that are not perfectly mobile.	Barney, 1991.
• Resources and limited strategic. Substitutability by equivalent assets	Dierickx and Cool, 1989.
• Valuable non-tradable or imperfectly tradable resource.	Barney, 1991.

Source: Mahoney and Pandian, 1992:363-380.

There are different resource categorizations in the literature (Hitt and Ireland, 1985; Thompson and Strickland, 1987), and Barney (1991) examined the previous studies and classified resources into three categories:

- physical capital resources
- human capital resources, and
- organizational capital resources.

Physical capital resources include the physical technology used in a firm, a firm’s plant and equipment, its geographic location, and its access to raw materials. Human capital resources include the training, experience, judgment, intelligence, relationships, and insight of individual managers and workers in a firm.

Organizational capital resources include a firm's formal reporting structure, its formal and informal planning, controlling, and coordinating systems, as well as informal relations among groups within a firm and between a firm and its environment. These classifications are echoed in other studies. For example, in Porter's (1991) research, firm resources were classified into two groups: external and internal resources. External resources refer to processes that are outside the boundaries of an organization, such as relationships with other parties. Internal resources refer to organization processes within the boundaries of an organization, such as coordination of activities and routines.

However, not all resources are sources of competitive advantage. To have the competitive advantage, a firm resource must have four attributes (Barney, 1991):

- it must be valuable;
- it must be rare among a firm's current and potential competition;
- it must be imperfectly imitable; and
- there are no strategically equivalent substitutes for this resource.

These attributes can be considered as empirical indicators for determining a firm's specific resources, with heterogeneity and immobility, which can be used for generating sustained competitive advantage.

Application of RBV

It is considered difficult to apply the RBV in the real business practice since the internal organization of firms is a critical variable. The identification of firm specific resources requires managers to have a fully understanding of the organization, product and also the environment. Researchers have also struggled to find proper ways to measure resources because many are intangible (Godfrey and Hill, 1995; Hult and Ketchen, 2001). Nevertheless, the RBV has affected many research disciplines in management, including the human resource management (Wright et al., 2001), economics and finance (Combs and Ketchen, 1999; Lockett and Thompson, 2001), entrepreneurship (Alvarez and Busenitz, 2001), marketing (Srivastava et al., 2001), international business (Peng, 2001). Barney (2001) suggested that the resource-based view could be positioned relative to three theoretical traditions, including SCP based theories of industry determinants of firm performance, neo-classical microeconomics, and evolutionary economics. Therefore, RBV provides a useful method both for researchers and practitioners to take strategic analysis internally.

New Development of RBV

Following the RBV theory, relevant concepts have been developed in other studies. Teece et al. (1997) introduced the concept of dynamic capability and argued that simply having the resources meeting Barney's requirements alone is not sufficient to gain a sustainable competitive advantage. The important issue is how a firm uses these resources. For example, simply having extensive financial resources is not sufficient for achieving sustainable competitive advantage if the money is not used properly. The more important thing is how to use these financial resources effectively within a strategic context and enable them to generating rents for the firm.

The relationship between RBV and performance has been attracting great deal of research efforts (Grant, 1991; Collis and Montgomery, 1995; McGee and Finney, 1997). Grant (1991) particularly studied the mechanisms through which competitive advantage can be sustained. The successful organizations should take all their activities to be consistent with their strategy. Moreover, the strategy should enable the firm to better exploit its core competencies which may come from the opportunities in external environment or internal resources and capabilities, or in combination. From a strategic perspective, the RBV emphasizes that firms should choose strategies that are best supported by their specific resources and capabilities, this is echoed by the study of Chandler and Hanks (1994).

Comparison between the Two Competitive Advantage Views

In comparing with the industrial organization view of competitive advantage, resource-based view explains the source of competitive advantage from a different angle. The comparison between the two views can be summarized in Table 2.2. Based on industrial organization view, restraints on output through monopoly power or collusion, or investment on entry barriers are primary sources of persistent above normal returns (SCP paradigm), and the size and scope of firms is determined by the production and distribution efficiencies (Chicago School). Firms in a contestable market have homogeneous and perfectly mobile resources and the entry barriers will be reduced with perfect competition (Chicago School). One important application of IO theory is to provide a useful tool for policy makers, such as the antitrust public policy case. Based on resource-based view, the firm is taken as the analysis unit for understanding sources of persistent above normal profit. Firms have heterogeneous and immobile resources in an imperfectly competition market. The resources characterized with valuable, rare, imperfectly imitable, and non-substitutable can be the sources of competitive advantage in competition. The major application of the RBV is to find the firm specific resources and develop relevant firm strategies.

Table 2.2 Differences in two views of competitive advantage

The Two Views	Analysis unit	Firm resource	Sources of competitive advantage	Application
Industrial organization view	Industry	Homogeneous and mobile	Products and market factors: entry barriers, product differentiation, number and size of firms, elasticity of demand	Firms' strategy, public policy
Resource-based view	Firm	Heterogeneous and immobile	Resources characterized with valuable, rare, imperfectly imitable, and non-substitutable	Firms' strategy

2.4 Competitive Strategy

The concept of competitive strategy has been widely used in business management and many research efforts have been done in various industries. In order to fully understand the concept, the definitions of strategy and Porter's three generic competitive strategies are introduced in this section.

2.4.1 Definitions of Strategy

Nowadays, the term 'Strategy' is widely used in the discipline of business management. Strategy has become the most important part of the business management. Therefore, 'what is strategy' will be addressed first. Different definitions of strategy can be found in business management studies, and the following are some examples:

Chandler (1962) defined the strategy as "…*the determination of the basic long-term goals and objectives of an enterprise, and the adoption of courses of action and allocation of resources necessary for carrying out these goals*."

"…*corporate strategy is the pattern of major objectives, purposes, or goals and essential policies and plans for achieving those goals, stated in such a way as to define what business the company is in or is to be in and the kind of company it is or is to be*." (Andrews, 1971)

"A strategy is a commitment to undertake one set of actions rather than another" (Oster, 1999).

"…*strategy is management's game plan for growing the business, staking out a market position, attracting and pleasuring customers, competing successfully, conducting operations, and achieving targeted objectives*." (Thompson et al., 2006)

There are still other classifications of the definition of strategy. For example, Mintzberg et al. (2002) reviewed the concepts relative to strategy and grouped them into five categories, including strategy as plan, ploy, pattern, position and perspective.

Based on the above definitions, the strategy for business organizations can be defined as "*to identify an organization's long-term objectives or goals with considering the competition environment, and take relevant actions by matching its internal resources to the competition environment effectively for achieving the scheduled objectives or goals*".

Another term 'Tactic' has been quoted in the discipline of strategy management. It is argued that the main difference between 'Strategy' and 'Tactic' lies in the scale of action or the perspective of the leader (Mintzberg et al., 2002). Strategy defines a set of goals or objectives for the organization on a continuing basis. Tactics are the short-duration and adaptive actions for achieving limited goals. In other words, strategies may be considered as advanced statements to guide the organization's action (tactics). Nevertheless, the two items are often used exchangeably. The 'Tactic' to the chief executive officer may be a 'Strategy' to a department manager.

From a practical viewpoint, developing a strategy is a complex process since all factors affecting strategic decision should be considered. Thus, Thompson and Strickland (2003) suggests that an effective strategy should incorporate three elements, namely customer needs, customer groups to be served, and the competencies the firm needs to deliver value. In order to deliver this value and accomplish organizations' goals, firms need to clear their strategic intent and set up audacious goals, for example being dominant in certain market. Strategic intent occurs when a firm wants to pursue an ambitious strategic objective and concentrates its competitive resources on that. Sometimes, the executives may not clear about the existing successful strategy which is clear to others. Therefore, one must look at the actual emerging pattern of the organization's goals, policies and major programs to see what its true strategy is (Mintzberg, 1972).

Normally, strategies are the answers in management level to how the firm will pursue the organization mission and strategic vision. Thompson and Strickland (2003) point out that whether a firm's strategy is good or not relies on its completeness, internal consistency, rationale, and suitability to the situation. They further suggest two empirical indicators of strategy performance:

- whether the company is achieving its stated financial and strategic objectives; and
- whether the company is an above average performer.

2.4.2 Porter's Generic Competitive Strategies

Porter's three generic strategies have been widely used in the management field. Porter (1980) suggests that "…*there are three potentially successful generic strategic approaches to outperforming other firms in an industry: overall cost leadership, differentiation and focus*". The three generic strategies were further developed in Porter's later book. Porter (1985) believes that a firm can have two basic types of competitive advantage, namely low cost and differentiation. And the combination of the two competitive advantages and the scope of the firm's operation (the target market segment) will lead to the three generic strategies: cost leadership, differentiation and focus. The focus strategy has two variants, cost focus and differentiation focus. The three generic strategies are shown in Figure 2.3.

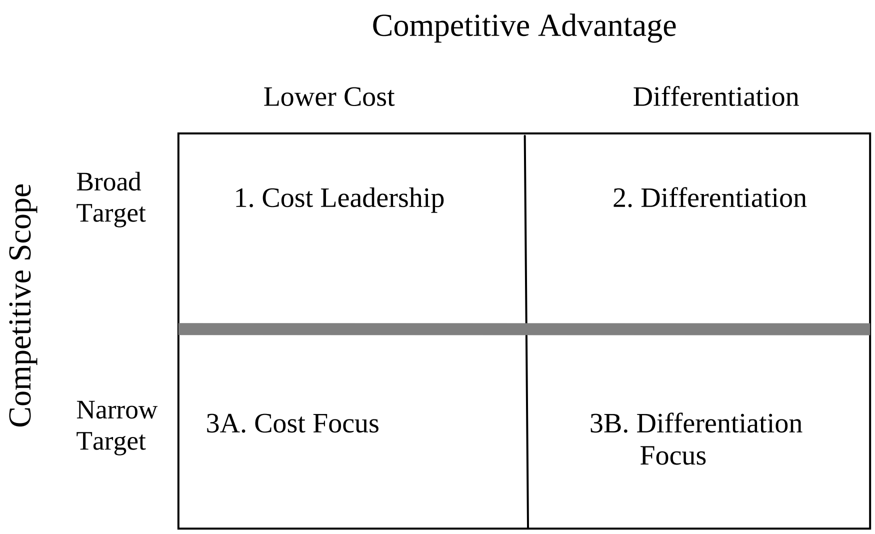

Figure 2.3 Porter's three generic competitive strategies (*Source: Porter, 1985*)

Cost Leadership

The cost leadership strategy originated from experience curve concept which was popular in 1970s. When implementing cost leadership strategy, a firm's major objective is to become the low cost producer in its industry. Based on the analysis of industry structure, a firm needs to exploit all sources of cost advantage in its industry. The sources may include "*the pursuit of economies of scale, proprietary technology, preferential access to raw materials and other factors… Low cost producers typically sell a standard, or no-frills, product and place considerable emphasis on reaping scale or absolute cost advantages form all sources*"(Porter, 1985).

Cost leadership enables a firm to achieve an above average performance in its industry. However, successfully implementing the cost leadership strategy requires different resources and skills. Porter (1980) identified the commonly required skills and resources for cost leadership as follows:

- Sustained capital investment and access to capital;
- Process engineering skills;
- Close supervision of labour;
- Products designed for ease of manufacture;
- Low-cost distribution system.

Differentiation

Differentiation strategy is to create a product or service which is unique in an industry. The unique attributes of the product or service should provide superior values to the customers. Since the product or service is unique in one or more dimensions, the price elasticity of demand will be reduced and customers tend to be brand loyal. There are different ways for differentiation. "*Differentiation can be based on the product itself, the delivery system by which it is sold, the marketing approach, and a broad range of other factors… a differentiator, therefore, must always seek ways of differentiating that lead to a price premium greater than the cost of differentiating… the logic of the differentiation strategy requires that a firm choose attributes in which to differentiate itself that are different from its rivals*" (Porter, 1985).

The following skills and resources are required in implementing differentiation strategy (Porter, 1980):

- Strong marketing abilities
- Product engineering
- Creative flair
- Strong capability in basic research
- Corporate reputation for quality or technological leadership
- Long tradition in the industry or unique combination of skills drawn from other business
- Strong cooperation from channels

Focus

The focus strategy is to select a few target markets for competition. This strategy enables a firm to better meet the needs of the target market than its competitors who compete more broadly. It is important to select appropriate target market for implementing this strategy. "*Segment structural attractiveness is a necessary condition since some segments in an industry are much less profitable than others… most industries have a variety of segments, and each one that involves a different buyer need or a different optimal production or delivery system is a candidate for a focus strategy*"(Porter, 1985).

Similarly, the relevant skills and resources are required in implementing focus strategy. The identified skills and resources for above two strategies are applicable in this strategy, but in particular target market.

Stuck in the Middle

Porter (1980, 1985) asserts that a firm should select one generic strategy in competition. But not every firm can develop its strategy successfully. "…*the firm failing to develop its strategy in at least one of the three directions – a firm that is 'stuck in the middle' – is an extremely poor strategic situation*" (Porter, 1980). This viewpoint is challenged by other researchers. Gilbert and Strebel (1987) disagreed with this by arguing that the highly successful companies have adopted 'outpacing strategies'. They gave example of Japanese automobile manufacturers who use low cost strategy first to secure markets, and then take a differentiation strategy by increasing the quality. Miller (1992) also questions the point 'stuck in the middle' and believes that there is a viable middle ground between strategies. Mintzberg et al. (2002) argue that the cost leadership and differentiation can be both achieved simultaneously. These different arguments are positive and represent the further development of the generic strategies. The three generic strategies set the basic theory for studying competitive strategy.

The Value Chain

The generic strategies are based on the two competitive advantages: low cost and differentiation. However, the sources of competitive advantage are various (Porter, 1985). For analyzing the activities a firm performs, Porter (1985) developed a useful tool, namely value chain. The value chain provides a structured way to analyze different activities happened in a firm and help to understand the potential sources of cost reduction and differentiation. The generic value chain is shown in Figure 2.4. The activities within value chain are not independent and they are interrelated. The linkages among the value activities may lead to competitive advantage.

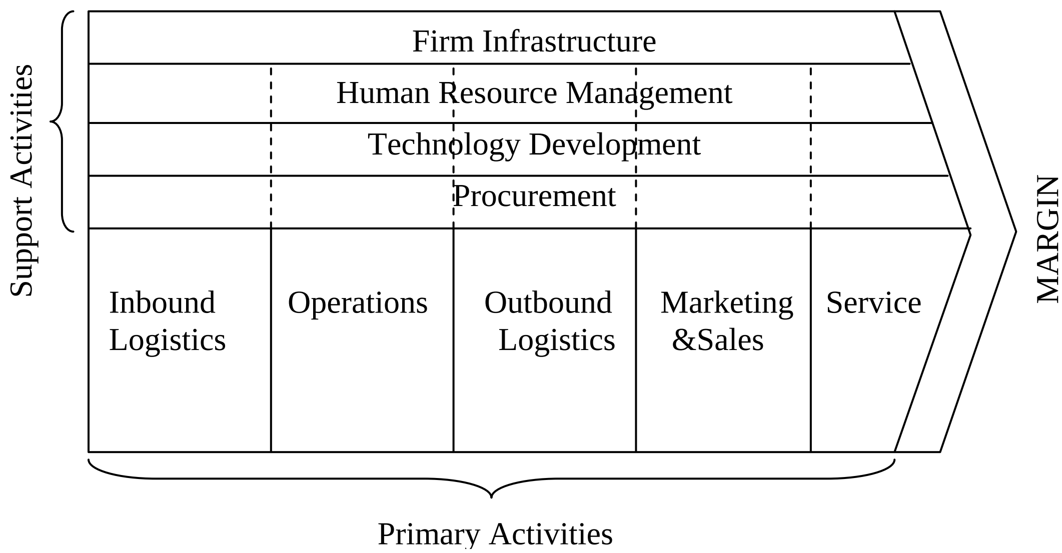

Figure 2.4 The generic value chain (Source: Porter, 1985)

The value chain is a useful analysis tool for defining a firm's activities which can achieve cost advantage or differentiation advantage. The cost advantage can be achieved by better understanding costs and cut the activities without adding value to the product or service. In differentiation, a firm should focus on those value activities related to the core competencies and perform them better than competitors. Porter (1985) identified the drivers of cost and uniqueness related to value chain activities, as shown in Table 2.3. These drivers provide a general framework for managers to identify relevant value activities related to cost advantage or differentiation advantage.

Table 2.3 Drivers of cost and uniqueness

Drivers of cost	**Drivers of uniqueness**
• Economies of scale	• Policies and decisions
• Learning	• Linkages among activities
• Capacity utilization	• Timing
• Linkages among activities	• Location
• Interrelationships among business units	• Interrelationships
• Degree of vertical integration	• Learning
• Timing of market entry	• Integration
• Firm's policy of cost or differentiation	• Scale (e.g. better service as a result of large scale)
• Geographic location	• Institutional factors
• Institutional factors (regulation, union activity, taxes, etc.)	

Source: Porter, 1985

2.5 Strategy in Construction

2.5.1 Bidding Strategy

Contract bidding is a mechanism for distributing works to willing contractors, and contractors need to make strategic decisions in respect of: (1) the selection of contracts to bid for; and (2) the bid levels necessary to secure them (Skitmore, 1989). The pricing of the bid normally comprises a two-stage formulation process consisting of cost estimate and subsequent mark-up, e.g. overheads, profit and risk (Fellows and Langford, 1980).

A contractor's bidding strategy is concerned with setting the mark-up level to a value that is likely to provide the best pay-off (Douglas, 1989). The contractor must choose a price high enough to provide sufficient contribution to overheads and profits, yet low enough to ensure that a sufficient volume of work is actually obtained in an environment of considerable uncertainty about the behaviour of the competitors.

Bid mark-up models have been investigated extensively in the literature. Friedman (1956) proposed a probabilistic approach to determine the most appropriate mark-up level for a given contract. Smith (1995) identified three approaches for bid modeling: (1) models based on probability theory; (2) econometric models; and (3) regression models. The regression model has many potential uses for contractors in a competitive bidding environment (Carr and Sandahl, 1978), for example, to determine a contractor's optimum mark-up level.

Furthermore, other theoretical methods are used for helping contractors formulate competitive bidding strategies. The analytical hierarchy process (AHP) method, merged with the operational method, was used to assess the probability of winning when multiple criteria were considered in bidding (Seydel and Olson, 1990; Cagno et al., 2001). Based on artificial neural networks (ANN), relevant bidding models have also been developed for mark-up estimation (e.g. Moselhi et al., 1991; Moselhi et al., 1993; Hegazy and Moselhi, 1994; Li and Shen, 1999; Liu and Ling, 2003). In addition, the relevant computer based decision support systems, such as DBID proposed by Moselhi et al. (1993), InMES (integrated mark-up estimation system) proposed by Li and Love (1999), were developed for simplifying the application of models. Moreover, Ahmad (1988) introduced a multi-criteria decision making approach to formulate competitive bidding strategies. Fayek (1998) developed a competitive bidding strategy model based on the fuzzy set theory and a prototype software system named PRESTO (Project Estimating and Tendering Tool) was proposed to assist contractors in formulating competitive bidding strategies. Shen et al. (1999) developed an optimal bid model for assisting contractors in determining better bidding strategies when considering tender price and construction time collectively.

In practice, contractors adopt various competition strategies to enhance their chances of winning contracts. Fine (1975) has identified several strategies including random bidding when work levels are low, selective bidding and severely competitive bidding with claim back options within the limits of the contract. Stone (1983) has also suggested that some firms accept lower standards of work than others and that there are differences in efficiency and therefore, cost. An unbalanced bidding strategy may be taken in a bidder-based lump sum bidding practice in which the submitted unit prices are taken as the contractual unit prices (Wong, 2004). For international contractors, forming joint ventures with local partners has become a popular strategy when entering into new markets, especially into developing countries (Lim and Liu, 2001). Besides foregoing strategies, risk control has been considered an important part in bid decision, especially for international construction projects which involve numerous uncertainties and complexities (Han et al., 2005).

2.5.2 Corporate/Business Strategy

Many studies on corporate/business strategy for construction were undertaken in UK in the 1970s (e.g. Lea et al., 1974; Sadler et al., 1974; Lansley et al., 1979). Lansley (1983, 1987) discussed how construction firms changed their strategy in response to the changes in environment. Johnson and Scholes (1988) developed a framework integrating strategic alternatives into four major groups, including generic competitive, generic directional, strategic variations, and finally, strategic mode. Ramsay (1989) considered the implications of business objectives and strategy to large construction contractors by examining two dominant trends, concentration through acquisition and merger, and diversification. Hillebrandt and Cannon (1990) utilized the framework for a business strategy proposed by Ramsay (1989) to analyze the business management approaches of some large UK contractors.

In Hasegawa's (1988) work, six strategies were identified for Japanese contractors to enable them to be strategically placed in the changing global construction industry. These strategies include a transactional approach, new business development, integrated engineering constructor, total project management, technology development and exploring financial strategies. Cannon and Hillebrandt (1990) suggest four means of product differentiation in construction, including offering a range of project management method; extending from construction into design; extending into financial packaging; extending forward into commissioning and facilities management. For diversification, UK construction firms have moved into development, consultancy, plant hire, mechanical and electrical engineering, production or sale of building materials and components, and such unrelated areas as health care, printing and waste disposal. Rashid (1991) analyzed the global strategies of construction firms and found that some large construction companies treat the whole world as a single market, and seek to develop competitive advantages which provided superiority for challenging anyone and fulfilling the most demand work. These companies have geared their businesses towards solving the client's problems and needs, thereby adding greater value to their services. In addition to product differentiation, diversification, acquisition and mergers, these enterprises establish collaborative relationships with manufactures, financiers, research institutions, policy makers and other contractors.

After that, the research efforts on corporate strategy, strategic planning and management in construction continued with many publications (Abdul-Aziz, 1994; Warszawski, 1996; Venegas and Alarcón, 1997; Chinowsky and Meredith, 2000; Langford and Male, 2001; Kale and Arditi, 2002). More recently, Seaden et al. (2003) examine the relationship between business strategy and innovative practice and find that most listed business strategies are positively related to innovative practices. Cheah et al. (2004) conduct an empirical study on strategic performance of 24 large international construction firms and find the strategies leading to success are various. They also suggest that construction firms need to take an open perspective of strategy. Whitla et al. (2006) examine the global strategies used by British construction firms and find that most firms make little use of globally integrated strategies.

These studies provide valuable references for understanding the strategic management in construction. However, they were developed under different location backgrounds so that the findings may not be applicable in other regions or countries. And these research efforts did not provide a systematic method for helping construction companies to develop competition strategies in the market. Therefore, there is a need for a new methodology to help understand organizational competitiveness and competitive strategy within construction contexts.

2.6 Competitive Strategy Model

As discussed above, there is a need for a systematic method to help construction companies understand their competitiveness and formulate competitive strategies. Such method should be able to:

- integrate the theories in strategic management and provide a systematic framework for understanding the competitive strategy in the context of construction industry.
- provide a useful framework for construction firms to identify their competitive strategies based on the analysis of external environment and internal competitive resources.
- provide a systematic approach for construction firms to refine their strategic management process and make clear about the sources of competitive advantage and superior performance in the construction industry.

- provide a useful framework for construction firms to refine their thinking about their position in the construction industry and which resources would be necessary for superior performance.
- provide a valuable framework for international firms to make a comprehensive analysis of new markets and develop their entry strategy into the new market.
- help the Government departments to understand the competition status in a particular industry and make relevant policies to create a favorable competition environment for firms in that industry.

Therefore, a conceptual model is suggested, as shown in Figure 2.5, for meeting these requirements. The conceptual model integrates four major elements in strategic management, including external environment, internal environment (competitive resources), competitive strategy and performance.

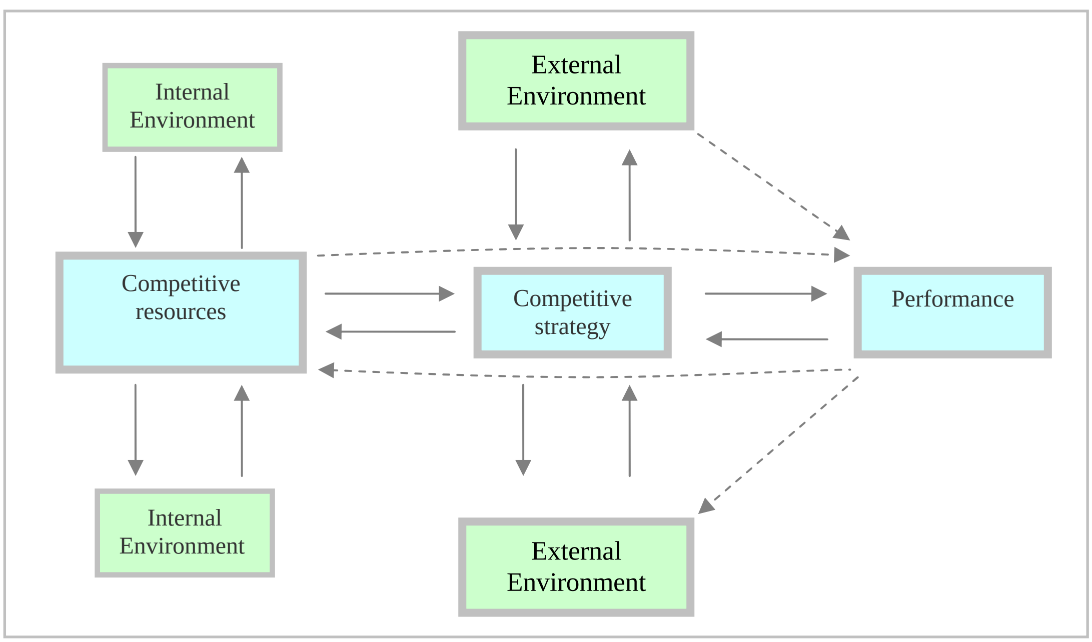

Figure 2.5 The conceptual model of competitive strategy

The model presents the relationships between the four elements. According to the industrial organization theory, the industrial structure determines a firm's conduct, and their joint conduct determines the firm's performance. Therefore, the external environment has substantial impacts on a firm's competitive strategy and performance. Meanwhile, there are feedback effects of firms' conducts and performance on the industrial structure (external environment). Based on resource-based view, the internal competitive resources can be the source of a firm's competitive advantage and efficient usage of these resources can improve a firm's competitiveness. Then, matching the internal competitive resources to the external environment will lead to the formulation of the firm's competitive strategies. Normally, effective competitive strategies will lead to good performance. In some cases, the competitive resources can also lead to good performance because the firms have not recognized these resources and developed them to competitive strategies. In that case, the performance can remind the firms' managers that there may be some kind of competitive resources existing in the firms which can be developed to competitive strategies. But in some cases, the good performance may be the result of booming period of an industry. Then, firms need to analyze the results from different perspectives and review their strategies time by time.

Normally, the external environment is considered in the early stage of the strategic management process and also is the first thing for firms to enter into a new industry (Pearce and Robinson, 2005; Sherman, et al., 2006). The external environment can be divided into the remote, industry and task environment. For remote environment, there are normally five main factors that originate beyond any firms' operating situation, including economic, social, political, technological, ecological factors. The remote environment presents firms with opportunities and threats, but a single firm can not exert meaningful influence on the remote environment. For example, when the economy slows and the investment on construction will decrease, and an individual contractor is likely to suffer decline in its business. But that contractor's efforts in stimulating the local construction industry can not reverse the situation. For the industry environment analysis, Porter's (1980) five forces model is normally considered a useful tool. And the relationships with various parties are normally used for the task environment analysis.

Competitive resources influence a firm's performance from internal side and can be controlled in the strategic management. According to Barney's points, the competitive resources should be valuable, rare, inimitable and non-substitutable. In construction industry, the competitive resources could be from good reputation, advanced technology, marketing, financing, project management skill, and organization & human resources. And clear understanding the relationship between contractor's competitive resources and competitiveness enables contractors to utilize their resources in an efficient way. Therefore, contractor competitiveness is also discussed in this study.

Based on the environment and competitive resources analysis, the relevant strategies would be developed to conduct a firm's activities. The competitive strategies are those which have good adaptability to the competition environment. Strategy can be examined from different levels, such as corporate level, business level and functional level. For example, a diversified firm has construction as one of its business, and would have strategies in three levels. The strategies in corporate level would focus on the firm's directions or goal, including growth, maintenance, harvest or corrective/turnaround. The strategies in construction business would be in the business level and the bidding strategies for construction projects would be in the functional level.

In order to add values to its stakeholders, a firm needs to achieve good performance in competition (for example maximum profits). Then, the performance is one major indicator to evaluate the effectiveness of strategies. Normally, an appropriate competitive strategy will lead to good performance in a favorable environment. If not, the firm should review its strategic management process and correct the problems which may exist in strategy formulation, implementation or control. There is no one strategy that will make a firm successful forever. Each firm needs to evaluate its strategy and review the strategic management process regularly to make sure the firm's goals achieved, especially in a dynamic environment.

The conceptual model is a framework for executives and researchers to understand the competitive strategy of construction firms in a dynamic environment. A firm's performance depends on the identification of appropriate competitive strategy and the formulation of competitive strategy is the result of analysis of external environment and internal competitive resources. Moreover, the model is dynamic and can be further developed as new factors determining the superior performance are discovered. The application of the model in the local industry will be discussed in following chapters.

2.7 Summary

A comprehensive literature review on theories of strategic management is conducted in this chapter. The industrial organization theory considers that the industrial structure could have great influence on firms' performance which takes the view from external. Porter is one of the major contributors in this theory and proposed the five forces model for industrial analysis. On the other hand, the resource-based view asserts that the internal competitive resources are the sources of firm's superior performance which takes the view from internal.

The comprehensive literature review also leads to the formulation of this research. A company's competitive advantage may come from the industrial structure or internal competitive resources. And the combination of industrial analysis and internal resources analysis will help the company to formulate the competitive strategy, and consequently achieve superior performance. However, what has not been well addressed in the literature is "is it the same situation for the construction company?" The construction industry has its own characteristics, such as low entry barrier, unique for every project, knowledge-based, and clients with various backgrounds. These characteristics make the competition more complex than other industries.

Therefore, this study is designed to understand competitive strategies with reference to the construction industry and construction companies in Hong Kong. And an alternative approach is needed to help construction firms understand their competitiveness and develop competitive strategy. In line with this, a conceptual model is proposed as a result.

CHAPTER 3 RESEARCH METHODOLOGY

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

The choice of research method is the key for a successful research. In this chapter, the research methodology adopted in this study will be discussed and presented. The main methods for collecting and generating research data are the questionnaire survey and the interview. A series of questionnaire surveys has been conducted to understand construction business competitiveness and strategy with reference to the Hong Kong construction practice. These data are also used to analyze contractor competitiveness and to develop effective competition strategies for contractors in selected segments. The following sections provide the details of the research method employed in this thesis.

3.2 Research Design

The research objectives have been established in the previous chapter. The methods for achieving these objectives will be addressed by designing the research in an appropriate manner. The discussions on these methods follow the logic illustrated in Figure 3.1.

From the industry background review, it can be found that the Hong Kong construction industry will face great challenges in the future. This review leads to the formulation of the primary research question of this study: how a Hong Kong construction company could improve competitiveness and devise a competitive strategy to achieve superior performance. Despite a decline in the construction industry during the previous decade, it is expected to boom once again with the government's new policy, alongside recent economic recovery efforts. Thus, it is important for helping Hong Kong contractors to design competitive strategies for the next growth period. This is the main reason behind the conduct of a research of this kind at this time.

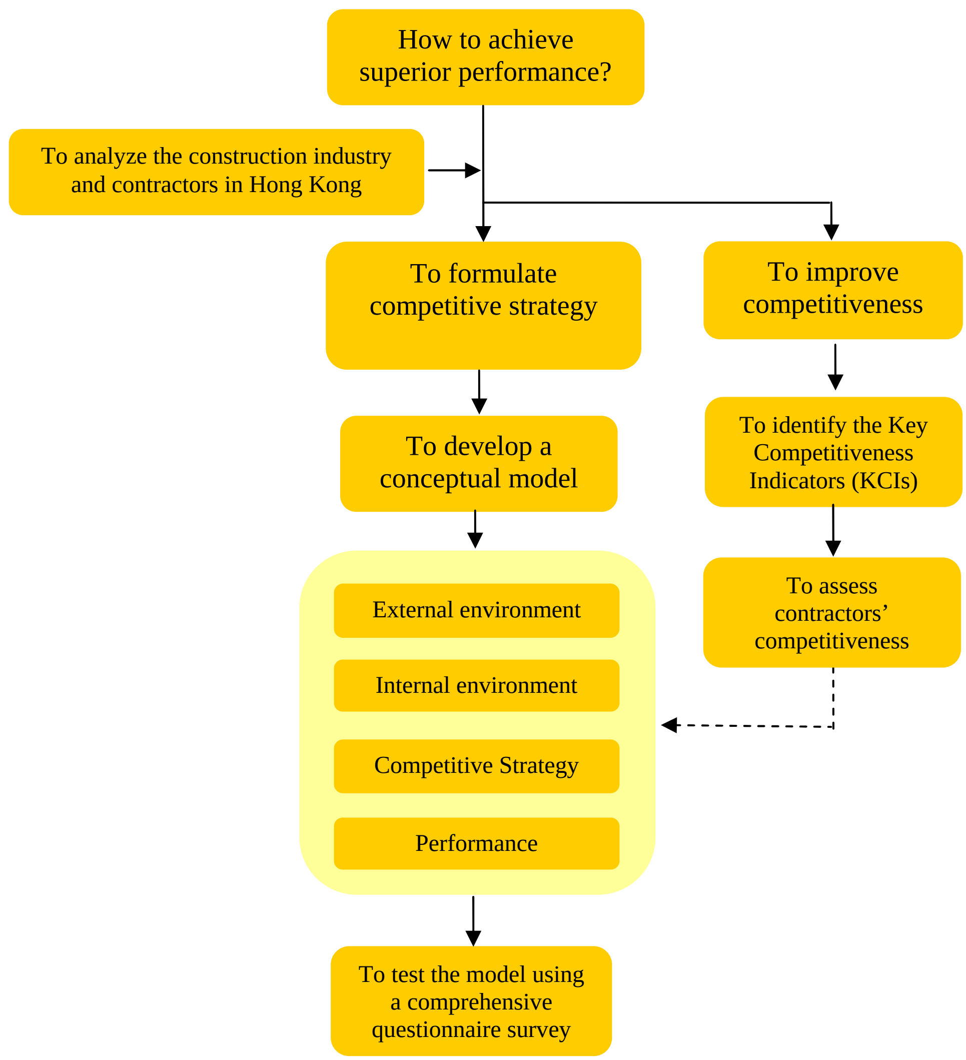

Figure 3.1 Research design of the study

Before responding to the question above, Hong Kong's construction industry, namely external environment of construction business, and its contractors, internal environment of construction business, are analyzed. As a result, a comprehensive understanding of the competition environment in the context of Hong Kong's construction industry will be established. And the primary research question can be answered from two facets of strategy management, namely, contractors' competitiveness and contractors' competitive strategy.

In order to understand contractor competitiveness, a set of parameters for assessing contractors' competitiveness is established and the key competitiveness indicators (KCIs) are identified. By using the competitiveness assessment parameters and the procedures established, contractors can conduct an internal evaluation and identify their position in the industry. This assessment approach can also be employed to identify contractors' competitive resources which may be potential sources of competitive advantage. Furthermore, the KCIs are used in the competitive strategy analysis.

In the competitive strategy study, a set of factors concerning external environment, internal resources, competitive strategy, and performance is identified based on a comprehensive literature review. Meanwhile, the Industrial Organization and Resource-based theories can explain the superior performance from a different angle. According to the Industrial Organization theory, a superior performance comes from the industry structure (external environment). In contrast, the Resource-based theory argues that superior performance comes from internal competitive resources (internal environment). In this study, these two theories are integrated to explain their influence on competitive strategy formulation, which can lead to superior performance in a competition. Accordingly, a conceptual competitive strategy model is developed and tested through a comprehensive questionnaire survey in the Hong Kong construction industry.

3.3 Research Method

There are five common research methods applied in the social sciences, namely, surveys, experiments, archival analysis, histories, and case studies (Yin, 1994). Yin (1994) further suggests that the selection of the most appropriate method depends on the type of research operation (what, how, why, etc.), the degree of researchers' control over variables, and the research focus. In selecting a research method, the key point is to consider the logical analysis of the links between data collection and analysis, as well as the main questions to be addressed, and the conclusions. Therefore, when embarking on a research, the following should be considered: the research questions, the kind of data, and the data analysis approach.

A questionnaire survey is commonly used in social science; and it is used as the main method in this thesis. Other methods, such as interview and workshops, are likewise chosen to complement and validate the survey questionnaire. The core issues of this research are the competitiveness and competitive strategy of contractors in Hong Kong. In order to gain a comprehensive understanding of strategy management in the construction business in Hong Kong, a series of questionnaires are conducted as follows:

- In questionnaire survey 1, the key competitiveness indicators are identified to assist contractors analyze their strengths, weaknesses, and their positions in industry by comparing them with those of other firms.
- In questionnaire survey 2, competitive strategies in the corporate level are discussed. The impact of both the external and internal environment on a construction firms' performance and competitive strategy, as well as the relationship of a construction firms' performance with competitive strategy are further explained. And the cluster analysis is conducted to classify contractors into different groups according to their different strategy orientations.

Furthermore, the following theoretical methods are also considered appropriate for relevant data analysis in this study:

- goal programming for optimal bidding strategy;
- relative importance index for indicators ranking;
- fuzzy competitiveness rating; and
- relevant statistical methods with the assistance of an SPSS (Statistical Program for Social Sciences) package, including internal consistency, correlation coefficient, and cluster analyses.

The selection of these theoretical methods will be introduced in relevant chapters, particularly in chapter 5, 6 and 7.

3.4 Survey Sample

3.4.1 Sample Selection

The objective of sampling is to seek a practical way of collecting data while ensuring that the sample will provide a good representation of the population. There are various ways of sampling depending on the nature of the population. These are random, judgmental, and non-random samplings (Fellows and Liu, 2003).

If there is no evidence of variations in the population structure, or if the variations of structure is negligible, random sampling will be an appropriate choice. Otherwise, it is necessary to restrict the sampling in a particular frame which represents the particular population structure. In this case, either the judgmental or non-random sampling should be used.

In random sampling, each member of the population has an equal chance in the selection process. This selection can be carried out using random numbers from tables or computer programs. In a judgmental sampling, the judgment on a well informed research target is used to determine the items of the population which would form the sample. However, such sampling may have bias and the reasons for using this method should be noted clearly in the research. In non-random sampling, the following three methods are used to obtain the samples:

- systematic sampling;
- stratified sampling; and
- cluster sampling.

The sample for this study is drawn from a population of construction companies in the Hong Kong construction industry. According to the Census and Statistics Department's statistical data, the number of building and civil engineering establishments in Hong Kong reached 19,057 in 2006. Generally, it is quite a large population and the sample selection will represent various contractors with different backgrounds. In this research, the judgmental sampling method is used to draw samples from the population of construction companies in Hong Kong. Finally, members of the Hong Kong Construction Association are selected as samples in this thesis for the following reasons:

- The Hong Kong Construction Association (HKCA) includes major building and civil engineering contractors working in Hong Kong, including local, Chinese, and international contractors.
- HKCA members can be considered as representatives of different sectors or market segments, and their industry performance is approbatory.
- As major industry performers, they intend to promote excellence in construction and to facilitate industry development in a healthy manner. Based on this premise, they are willing to participate in these surveys.

The executive officers of the organizations are chosen as the research informants, since they are expected to possess the most knowledge regarding the company's external and internal environment, competitive strategy, and performance. The names of these officers were also obtained from the Hong Kong Construction Association. The contact information was used solely for research purposes and kept confidential. In each survey questionnaire, all association members served as the targets. Thus, they could also receive the preliminary results of the last survey.

3.4.2 Sample Size

According to a study by Dillman (2000), four factors should be considered in determining sample size, namely, sampling error, population size, variation in answers, and confidence level. Sample size can be determined using the following formula:

$$Ns = \frac{(Np)(p)(1-p)}{(Np-1)(B/C)^2 + (p)(1-p)} \tag{3-1}$$

Where:

Ns: sample size for the desired level of precision;

Np: population size;

p: proportion of the population that is expected to choose one of the response categories (yes/no);

B: acceptable sampling error; and

C: Z statistic associated with the confidence level; 1.96 corresponds to the 95% level.

All contractors on the Hong Kong Construction Association member list are targeted. There are different response rates in the two surveys. In the first survey, there are 81 valid replies having a response rate of 24%, while the second has 60 replies with a response rate of 19.2%. According to Owen and Jones (1994), an average of 20% of questionnaires returned is considered satisfactory. And in the construction industry, a good response rate is around 30% (Black et al., 2000). Therefore, the response rate in this research is acceptable. The sample sizes are 81 and 60 for the two surveys, respectively. However, it is interesting to know whether or not these sample sizes can represent the population. In formula (3-1), the four parameters can be obtained except for the sampling error. Thus, it is necessary to determine if the sampling error is acceptable. In 2006, there are a total of 19,057 building and civil engineering establishments in Hong Kong. Since this number can be used as the population size, the 95% confidence level is selected. It is also assumed that the answers will be homogeneous and will set the p value to 0.8. By applying these values in formula (3-1), the sampling errors were obtained as $\pm$8.7% and $\pm$10.1%, for the first and the second survey, respectively. Overall, these sampling errors are considered acceptable for this research.

3.5 Design of Research Surveys

3.5.1 Review on Previous Studies

The importance of questionnaire design for an effective survey has been addressed by many researchers (Sheatsley, 1983; Czaja and Blaire, 1996; Newman, 1997). Their recommendations focus on questionnaire presentation, questionnaire organization through topics, the use of ‘change of theme’ questions, instructions for the interviewer, space between questions, the numeration of the questions, and so on. Accordingly, a good questionnaire poses questions that respondents can answer without much effort, can maintain their interest, and does not entail too much of their time (Brace, 2004). Response rates are influenced by many factors, including the questionnaire's dimensions and sizes, cover pages, type and color of paper used, ordering of the questions, as well as the envelope and stamps used to send the questionnaire (Diaz de Rada, 2005).

Furthermore, researchers have realized that mixed-mode surveys can help overcome the difficulties of obtaining an adequate response rate by only using one method. In this type of survey, some respondents are surveyed by interview and others by a complete mail questionnaire. A problem arises when most answers to a particular question vary depending on the survey method. To solve this, there is an increasing need for the use of combined survey methods to achieve high response rates (Schwarz et al., 1991). Due to technological developments, new methods of self-administering surveys are gaining rapid growth. Hence, electronic mails, Web, and touch-tone data entry methods have become feasible nowadays.

Dillman (2000) developed the Tailored Design Method to increase response rates and reduce survey error. The advantages of using this method are considered as follows:

- Tailored design is the development of survey procedures that create respondent trust and perceptions of increased rewards and reduced costs for being a respondent, which take into account features of the survey situation and have as their goal the overall reduction of survey error.

- Actions are motivated by the return and these actions are expected to bring and in fact, usually do bring, from others. The likelihood of responding to the request to complete a self-administered questionnaire is greater when the respondent trusts that the expected rewards of responding will outweigh the anticipated costs.
- Many aspects of questionnaire and implementation process can be shaped to create trust and influence the respondent’s expectations for rewards and costs.
- Exchange concepts must be communicated visually through the use of visual design principles for the development of questionnaire.
- Knowledge of survey population, sponsorship, and survey content must be considered in order to develop the most effective means for increasing rewards, reducing costs, and establishing trust.
- Successful Tailored Design seeks to reduce survey errors from coverage, sampling, measurement, and non-response.

There are several ways to create perception of increased rewards, reduce social costs for being a respondent, and establish respondent trust (Dillman, 2000). In fact, researchers can provide rewards to respondents in various means. They can enclose monetary or material incentives, align with professional groups, make the questionnaire interesting, ask for advice, inform respondents that opportunities to respond are scarce, and offer a summary of results. Researchers can also reduce the respondents’ cost by providing stamped and addressed return envelopes, making questionnaires appear short and easy, and by assuring confidentiality or anonymity. Finally, trust with respondents can be established through various approaches.

Researchers can offer university sponsorships, follow up mailings to make the task appear important, and invoke other social exchange relationships.

3.5.2 Design of Surveys

Dillman’s (2000) Tailored Design Method is adopted for survey in this study. The following characteristics are employed to develop the said surveys.

Providing rewards

- Positive regards and phrases, such as “we very much appreciate your help” or “many thanks in advance” are adopted in the cover letter.
- Respondents are made aware that they are part of a carefully selected sample according to their expertise and experience in the construction industry.
- The importance of the research and its relevance to the respondent’s company are also addressed in the cover letter.
- The research findings will be shared with the respondents.
- The questionnaire is made more interesting to respondents by improving its layout and design, question ordering, and by enhancing its understandability and readability.

Reducing the cost for being a respondent

- Respondents are informed that completing the questionnaire will only cost them little time.
- The questionnaire shall not exceed four pages to make it appear short and easy to complete.

- Most questions can be answered by selecting from a range of responses which reduces the respondents' mental effort in completing the questionnaire.
- The questionnaire was structured in a way that it provides a vertical flow of answering questions, and all the questions were grouped by content and type.
- An electronic version of the questionnaire was also sent to respondents whose email addresses are available since this will be easier to complete and replied to.

Establishing trust

- The cover letter is printed on the letterhead stationary together with the university logo.
- A real signature was used on the cover letter.
- The contact information of the research was also provided on the cover letter.
- The names of the research group members appeared on each page of the questionnaire.
- The respondents were informed that the research group will advise them of any progress in a timely manner.
- Confidentiality is guaranteed in the cover letter and that all the collected information from the survey would be considered confidential.

It is also reported that follow-up actions and contacts have a great impact on response rates. Without follow-up contacts, the response rates would be less than 20 to 40 percent with those normally obtained with the Tailored Design Method. Moreover, this can also be said occur no matter how interesting the questionnaire or impressive the mail package is (Dillman, 2000). As such, each follow-up contact is an opportunity to appeal for the completion and return of the questionnaire. Here, a total of three follow-up contacts are conducted after two, four, and eight weeks of the initial mailing. However, researchers have to balance the cost and time when considering the implementation of follow-up contacts (Fox and Robinson Debra Boardley, 1998; Erdogan and Baker, 2002).

Based on the cost and time balance in this study, a reminder letter which includes a replacement questionnaire is sent to non-respondents four weeks following the initial mailings. Basically, the mailing has a similar appearance with that of the original mail. A short cover letter is also included to inform the non-respondents that their questionnaire had not been received and are appealed for return. Furthermore, notes of positive regards and phrases of gratitude are added in the cover letter. Examples of the cover letter and questionnaire design used in this study are presented in the Appendix A and B.

3.5.3 Reliability and Validity of Surveys

The use of Tailored Design Method can help increase response rates. On the other hand, the reliability and validity of surveys are also addressed in the survey. The reliability and validity of a survey have a major impact on research results since they provide assurance that a questionnaire really provides a meaningful answer to the research question.

Reliability refers to the consistency of a measure and to the probability of obtaining similar results if the measure is to be duplicated (Oppenheim, 1992). Reliability can be measured in several ways, including the test-retest reliability, the internal consistency, the split-half, and the parallel-form methods. Among them, internal consistency is the most commonly used method in studies.

Validity is concerned whether the question or score can measure what it is supposed to measure (Oppenheim, 1992). It has different types: content, concurrent, predictive, and construct validities.

To ensure the reliability and validity of a survey questionnaire, researchers use different methods. As such, some will refer to the questionnaires used in previous research studies which have been proven reliable and valid. On the other hand, some will conduct a pilot survey or interview to examine reliability and validity. Therefore, these research approaches are adopted to formulate the questionnaires in this study. Prior to designing the questionnaire, a comprehensive literature review is conducted and a questionnaire draft is formulated. Subsequently, interviews with selected professionals and academic researchers associated with the construction industry are carried out to improve the questionnaire's reliability and validity. These approaches have been proven effective during the latter analysis of data collected.

3.6 Summary

This study employs multiple research methods. Survey to the practice is the major research method. In this chapter, the research design and method, sample selection, and survey design are discussed, and other theoretical methods adopted in this study are also highlighted. These discussions facilitate clear understanding of the research methodology adopted in this study.

CHAPTER 4 EXTERNAL COMPETITION ENVIRONMENT

CHAPTER 4 EXTERNAL COMPETITION ENVIRONMENT

4.1 Introduction

External environment influences a firm's choice of strategy and action and, ultimately, its organizational structure and internal process. A study by Sherman et al. (2006) stated that "*understanding the dynamics of the external environment is crucial to strategic management because these dynamics present one of the major forces for change. The interactive forces in the external environment have the ability to either support the operations of the firm or to detract from it; they can create market opportunities or threaten the very existence of the firm*". This implies that analysis of the external environment enables construction firms to clearly understand the environment's dynamics, identify opportunities and threats, and formulate competitive strategies appropriate for such environment.

Business external environment can be examined in three levels, namely, remote, industry, and task environments. This is illustrated in Figure 4.1 In this chapter, the external competition environment for contractors in Hong Kong is analyzed in three levels. Specifically, the Hong Kong economy is analyzed in the remote environment level, while the characteristics of Hong Kong's construction industry are examined in the industry environment level. And the relationships among different parties are investigated in the task environment level.

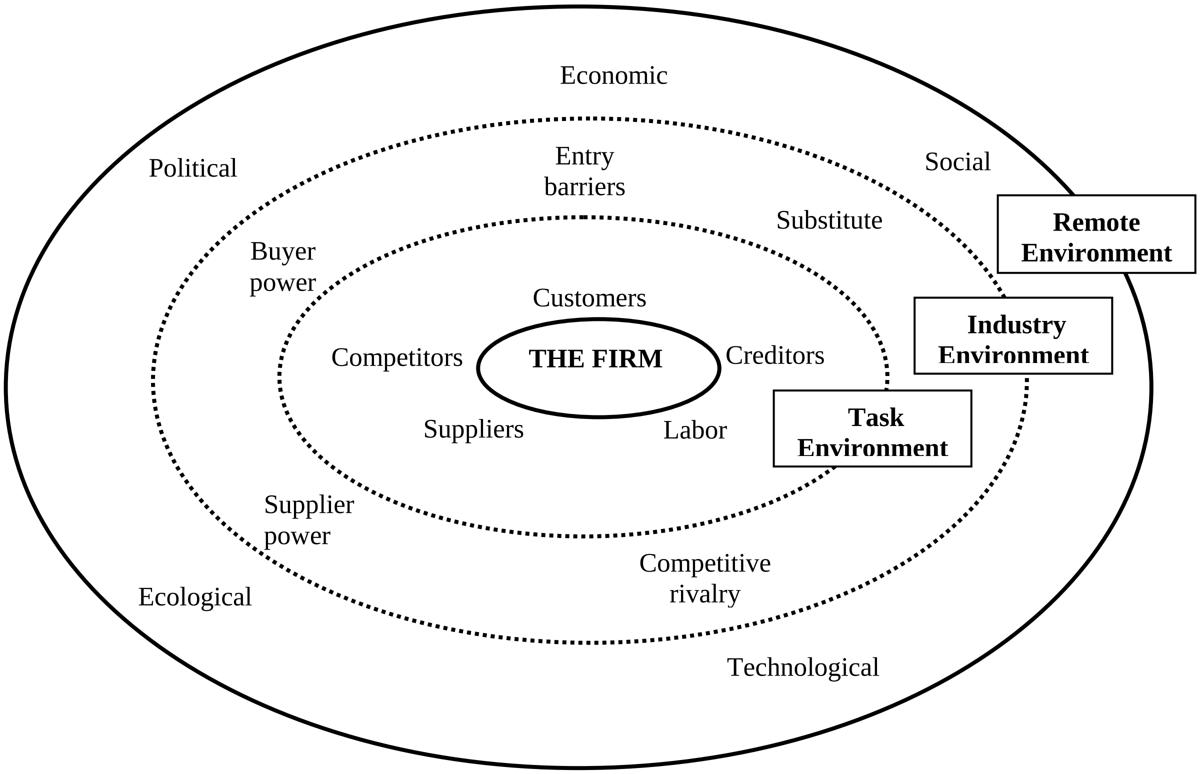

Figure 4.1External environment for a business firm (*Source: Pearce and Robinson, 2003*)

4.2 Remote Environment: Hong Kong Economy

4.2.1 An Overview

Before the Second World War, Hong Kong was merely a fishing port and a re-export center. Accordingly, Hong Kong's eventual economic success can be attributed to the provision of a free port and the pursuit of *laissez-faire* principles (Chou, 1966; Cheng, 1982; Hsia, 1984). Industrialization in Hong Kong began in the late 1950s. By the late 1970s, it had achieved a high degree of industrialization. As such, investment from developed countries and immigrants from Mainland China contributed greatly to this rapid industrialization. Simultaneously, Hong Kong was transforming into a banking and financial centre in the Asia region. Still in the late

1970s, the economic reforms and open trade in Mainland China provided Hong Kong an opportunity to revitalize its re-export business. Gradually, manufacturing plants were migrated from Hong Kong to the Guangdong province and other parts of southern China. With this, Hong Kong's service sector expanded dramatically and soon overtook manufacturing as a pillar of its economy. However, the 1997 Asian financial crisis posed significant influence on Hong Kong's economy. Subsequently, its economy experienced a downturn. In recent years, however, it is apparent that the Hong Kong economy is recovering from the financial crisis. This economic development became evident in its Gross Domestic Product (GDP), as shown in Figures 4.2 and 4.3. It can also be gleaned that Hong Kong's economy experienced a high and rapid growth before 1997. For the most part, it underwent "winter" from 1997 to 2004, and eventually gained pace after 2004.

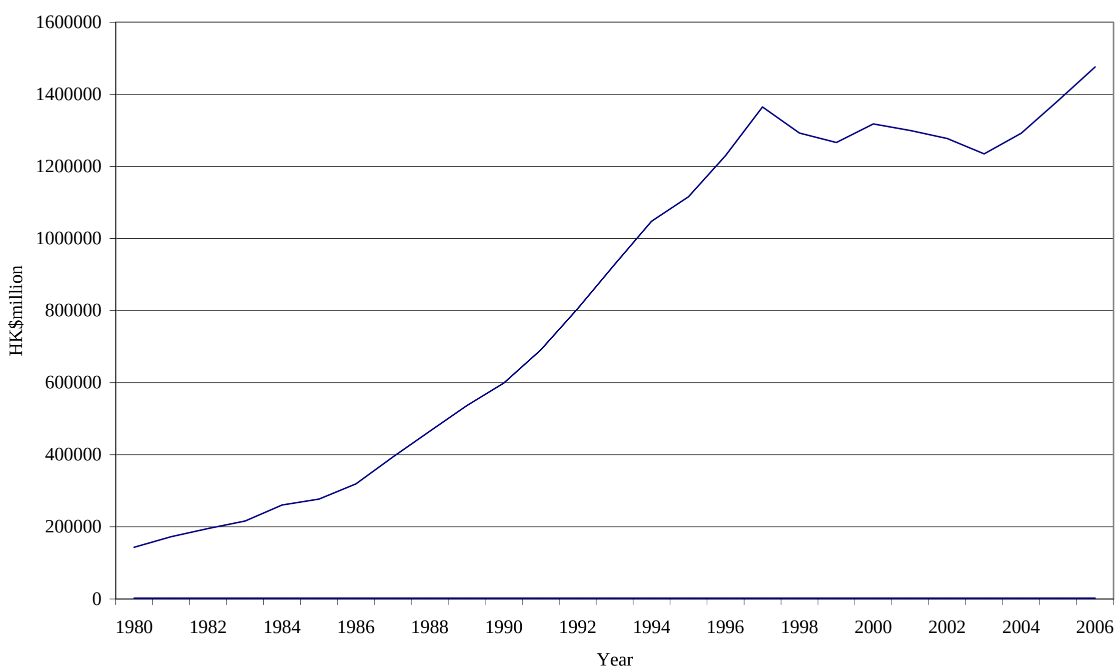

Figure 4.2 Hong Kong's Gross Domestic Product (at current price): 1980 - 2006
Source: Census and Statistics Department, HKSAR Government.

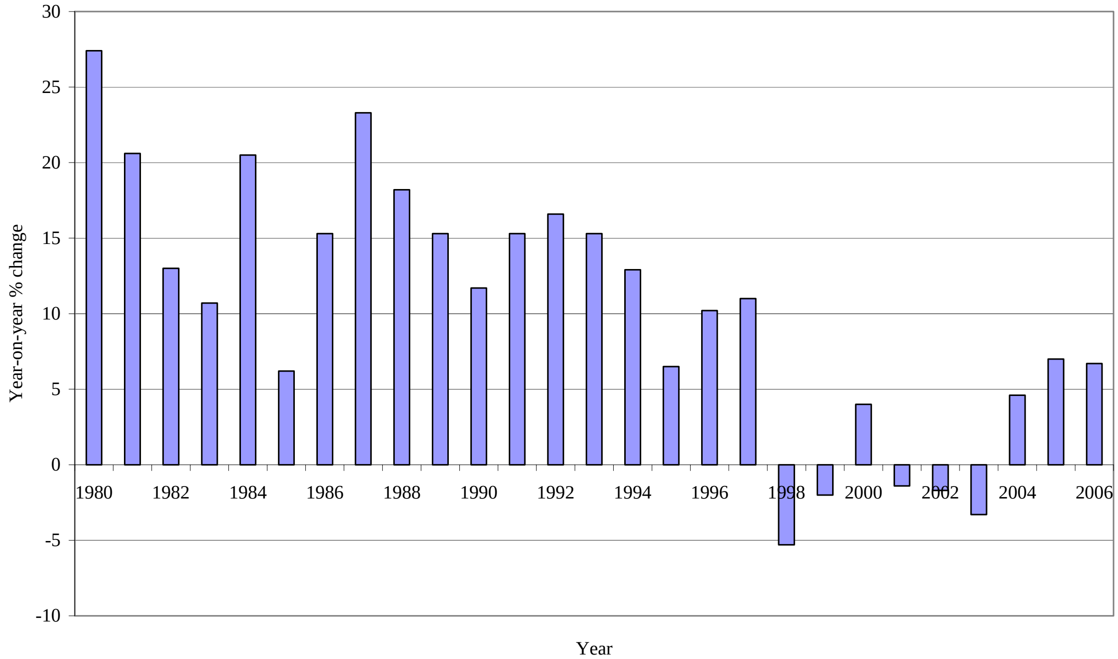

Figure 4.3 Year-on-year % change of GDP (at current price): 1980 - 2006

Source: Census and Statistics Department, HKSAR Government.

4.2.2 New Challenges

Over the past two decades, Mainland China's economic progress has posed challenges, as well as opportunities for Hong Kong. In turn, Hong Kong has managed to maintain its freest economic status and remained as an international metropolis. With the rapid development of the Chinese economy, Hong Kong's economy is expected to gradually integrate with the larger Chinese economy. Thus, the Hong Kong economy faced new challenges, and that is to maintain her international status and achieve positive results in the said economic integration. Additionally, the Hong Kong economy has to explore new areas of competitiveness while sustaining its existing competitive advantages.

In order to boost Hong Kong's economy, the central government in Beijing introduced a number of economic rescue policies. This includes the via-free travel for visitors from Guangdong, Shanghai, Beijing, and eventually to other cities; and the conclusion of two Closer Economic Partnership Agreements (CEPA and CEPA II). These policies were implemented to reduce tariffs on Hong Kong exports and to encourage further Hong Kong investments in the services sector. By mid-2003, the central authority in Beijing announced the possibility of allowing Hong Kong to be the first offshore center for the Renminbi business in 2004. This has certainly enhanced Hong Kong's role as an international financial centre.

4.2.3 Economic Strategies

Following the Asian Financial Crisis, the Hong Kong SAR Government had developed economic strategies in order to facilitate its economic recovery. These strategies include economic fine-tuning, infrastructure development, urban redeployment, public housing and utilities privatization, technological development, economic base widening, financial sector consolidation, and a long-term investment behavior commitment (Li, 2006). In Li's work, it was stated:

"Despite various comparative advantages that Hong Kong possesses, new competitive advantages are needed. Hong Kong needs to foster long-term investment attitudes and behaviour. Apart from investment in stocks and real estate, Hong Kong requires more investment that can large its real economic sector. It needs real economic activities that can expand its current output, such as manufactures,

exports and tradable services, or future productive capacities, such as infrastructure, R&D development and innovation in industries."

The report "Hong Kong 2030" is a long-term development plan, and it has reported on the strategy structure of Hong Kong. Under the vision "*to strengthen our position as Asia's World City,*" there are three main directions of the Hong Kong economy. These include providing a quality living environment, enhancing economic competitiveness, and strengthening links with the Mainland. For each direction, there are themes identifying the areas of attention, along with the measures describing possible actions. The strategy structure is summarized in Table 4.1.

Table 4.1 Strategy structure of Hong Kong

Vision		**Asia's World City**	
Directions	Providing a quality living environment	Enhancing economic competitiveness	Strengthening links with the Mainland
Themes	• Create a sense of place • Smart use of space and the built fabric • Improve the environmental quality for healthier • Ensure adequate and timely provision of housing land and supporting infrastructure and widen housing choices	• Reinforce hub functions • Revitalise degenerated urban and rural areas • Provide an environment conducive to human capital development • Leveraging on our links with the Mainland	• Strengthen physical links with the Mainland • Capitalise on the strategic locational advantages of boundary areas • Facilitate information exchange and conduct regional studies • Facilitate development of a "city-region"
Measures	……	……	……

(Source: http://www.pland.gov.hk/p_study/comp_s/hk2030/eng/finalreport/)

The analysis of the remote environment provides contractors the important information on economy development and new policies which will benefit the construction industry. The improving economy of Hong Kong in recent years implies that the economy has entered into next growth period. According to Government policy on economy and relevant studies, there is a need for more investment on infrastructure (especially the cross-boundary infrastructure), housing, and revitalization of old districts to provide a quality living environment for citizens, and enhance the connection with mainland China. This will mostly benefit the construction industry and contractors in Hong Kong. Therefore, contractors in the local industry should take this opportunity to improve their competitiveness. And strategy managers in construction business need to rethink their current strategies and take adjustment to formulate competitive strategies for this opportunity.

Furthermore, the stable political and social environment in Hong Kong provides a healthy competition environment for contractors with different backgrounds. And contractors also need to pay attention to the new technology which would lead to revolutionary changes in industry, and consider reduce the impact on ecological environment. Overall, the current remote environment benefits the construction industry and contractors in the local industry.

4.3 Industry Environment: Characteristics of Hong Kong Construction Industry

In view of traditional industrial organization economics, the industry structure determines the firms' conduct. On the other hand, the firms' performance is solely determined by their conduct (Bain, 1956). This concept was developed in further studies which focus on explaining the performance through an analysis of industry characteristics (Porter, 1981). Apart from the indirect influence of the remote environment, the industry environment has a direct influence on the firms' conduct and performance. Analyzing the industry's characteristic can help in understanding the behavior of firms performing in the said industry. The discussion on industry environment will be conducted by examining the following aspects.

4.3.1 Background of Hong Kong Construction Industry

Review of the background of Hong Kong construction industry is to help understand the development of the Hong Kong construction industry. The development of Hong Kong's construction industry underwent several stages. From the late 1850s up to the First World War, there were actually dramatic building and infrastructure developments in Hong Kong. In fact, several prominent institutional and commercial buildings and civil engineering infrastructures were completed during this period, such as the Clock Tower, the first City Hall, the first Hong Kong and Shanghai Bank Headquarters, Pokfulam Reservoir, Victoria Harbour, Peak Tramway, and Kowloon-Canton Railway. These infrastructure projects illustrate the initial developments in the Hong Kong construction industry.

Beginning from the 1920s to the late 1960s, Hong Kong's construction industry was already gearing towards the modern era by virtue of several important events. In 1933, the new headquarters of the Hong Kong and Shanghai Bank was commenced on site. This famous building was considered as the earliest example of construction management in practice. Meanwhile, the disastrous fire in Shek Kip Mei in 1953, caused considerable damage and many people lost their homes. In order to provide sufficient housing for people, the first new town, Tsuen Wan, was started in the 1950s. This also prompted the construction of new towns. In the public sector, the enormous Plover Cove Reservoir was built in the late 1960s.

From the 1970s until the present, Hong Kong's construction industry was transitioned into modern era. During this period, a number of infrastructure and public building projects were completed to meet the aim of becoming an international city. For illustration, the Mass Transit Railway's (MTR) underground system and the Eastern Harbour Crossing are two advancements in civil engineering infrastructure. In terms of the public building sector, the Housing Authority's programme is considered as the most impressive construction achievement. As a result, more than 1,100,000 flats have been built for rent or sale under the said programme. Furthermore, Hong Kong is known for its high-rising buildings typified by the Central Skyline. Nevertheless, the tallest building record is broken every several years. Currently, the tallest building in Hong Kong is the Two International Finance Centre which is 415 meters high. However, this record is expected to be broken in 2010 upon the completion of the International Commerce Centre.

4.3.2 Construction Industry's Contribution to GDP

An industry's GDP contribution represents its importance to the whole economy. The GDP contribution of the property and construction-related sectors is presented in Figure 4.4. Here, it is shown that the construction industry contributed around 5.0% to the GDP prior to 2002, with this value becoming less in recent years. When related sectors are considered, the contribution becomes significant. It can also be seen that the construction industry is a significant part of the GDP owing to its contributions from real estate, which are mainly shaped by the construction industry.

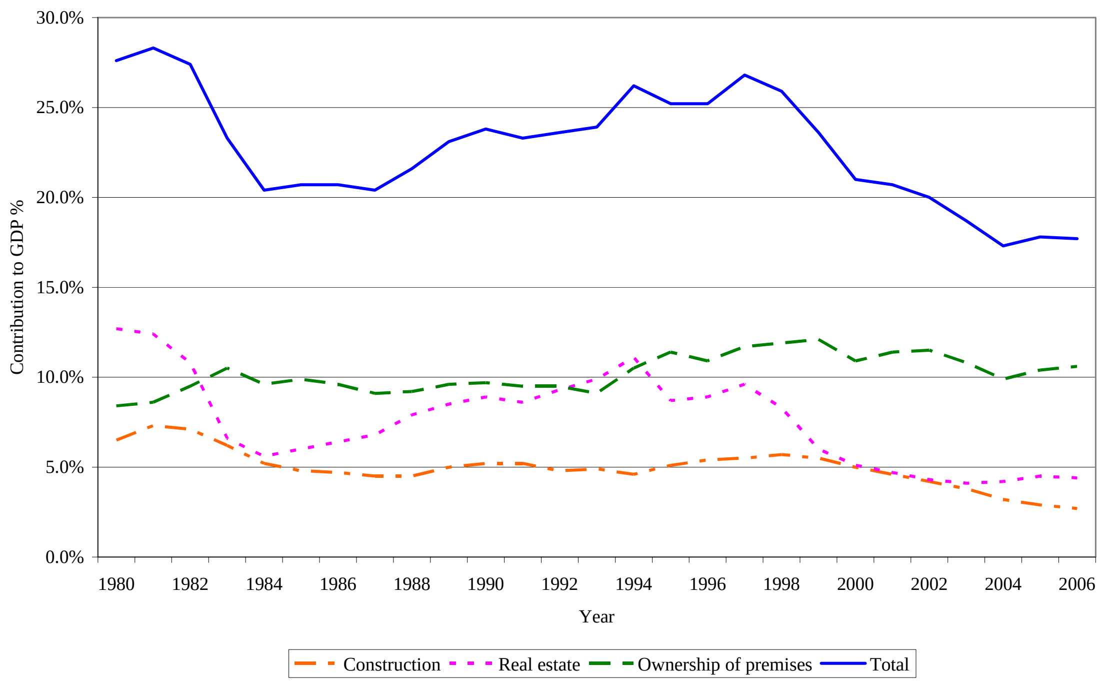

Figure 4.4 Contribution of activities related to the property and construction sector (at current factor cost): 1980 - 2006

Source: Census and Statistics Department, HKSAR Government..

Figure 4.4 clearly indicates that the construction and property related sectors play an important role in the Hong Kong economy. However, it remains as a traditional industry having a relatively low technology. On one hand, advanced technologies and modern construction management methods are employed in some projects, such as in the case of the Two International Finance Centre. On the other hand, there are several buildings which still employ traditional technology, such as the timber formwork. Thus, many contractors could not invest much on research and development initiatives, particularly for medium and small local firms. The major reasons behind this are:

- the ease of entry into the industry results in the proliferation of small firms, and the intense competition leads to the lack of financial resources for R&D investment; and
- the unpredictability of the market results in an uneven workload and lack of stability in companies. To illustrate, one can consider the number of building and civil engineering establishments which declined to approximately 10 percent in recent years (from 20,181 in 2000 to 17,985 in 2005).

4.3.3 Construction Market

As discussed above, the construction and property related sectors contribute great to the Hong Kong economy. However, the economy changes also influence the construction market. Analysis of the construction market can help contractors to forecast the future trend in the market and relevant competitive strategies will be developed. The ability of market forecast enables contractors to be the first mover in the market and obtain high returns. Therefore, market analysis is essential for contractors to strengthen their competitiveness in the market by taking effective strategies. The construction market of Hong Kong in last decade is discussed as follows.

Construction works are classified into various categories. The classification of construction work used by the Census and Statistics Department of Hong Kong SAR is presented in Table 4.2. As explained by a construction site in the "Report on Annual Survey of Building, Construction and Real Estate Sectors" (Census and Statistics Department, HKSAR) and the explanation of location in Table 4.2, work at construction sites can be viewed as the new construction work. Meanwhile, construction work at locations pertains to construction works which are done on erected buildings and structures, such as decorations, repairs, and maintenance.

Market fragmentation enables all contractors to find work since there is practically no competition between a small repair and maintenance builder and a large national contractor. For the latter, they have their own defined market areas and are capable of competing in all industry sectors. As for the former, they often devise strategic choices based on location, rather than on the type of work. Moreover, there are various risks existing in various market segments. Although the depressed times may be disastrous for large national contractors, it may not influence small repair and maintenance builders.

Table 4.2 Classification of construction work in Hong Kong

<table>
<tr><td colspan="2">At construction sites</td></tr>
<tr><td>(by broad end-use group)
Buildings
• Residential
• Commercial
• Industrial and storage
• Service
Structures and facilities
• Transport
• Other utilities and plant
• Environment
• Sports and Recreation</td><td>(by broad trade group)
Public sector construction sites

Private sector construction sites</td></tr>
<tr><td colspan="2">At locations other than the construction sites</td></tr>
<tr><td colspan="2">General trades
• General trades include decoration, repair and maintenance, and construction works at minor work locations, such as site investigation, demolition, and structural alteration and additional works.
Special trades
• Special trades include carpentry, electrical and mechanical fitting, plumbing and gas works, among others.</td></tr>
</table>

Source: Census and Statistics Department, HKSAR Government.

More statistical data for three areas, namely, buildings, structures and facilities, and construction work at locations, can be found in relevant statistical tables and on the Web site of the Census and Statistics Department reports. The gross value of the three areas for the last ten years is presented in Figure 4.5. As a major part of the construction market, the building sector has significantly declined since 1997. Specifically, it only has 29,680 HK$ million output in 2006 which is less than the value of the construction work at locations. Overall, the value of structures and facilities work was approximately 30,000 HK$ million in 1997. In the succeeding years, it was maintained at around 20,000 HK$ million but was then reduced in the recent two years. Construction work at locations is the only sector with a stable output and with steady increase in recent years. This indicates that the new construction work, especially in the building sector, has declined considerably since 1997. Much of its weakening can be attributed to the slow down in the Hong Kong economy during that period. However, it did not have much influence on construction work at locations. This implies that the difficult time for those contractors whose strategic choices are on the new building sector.

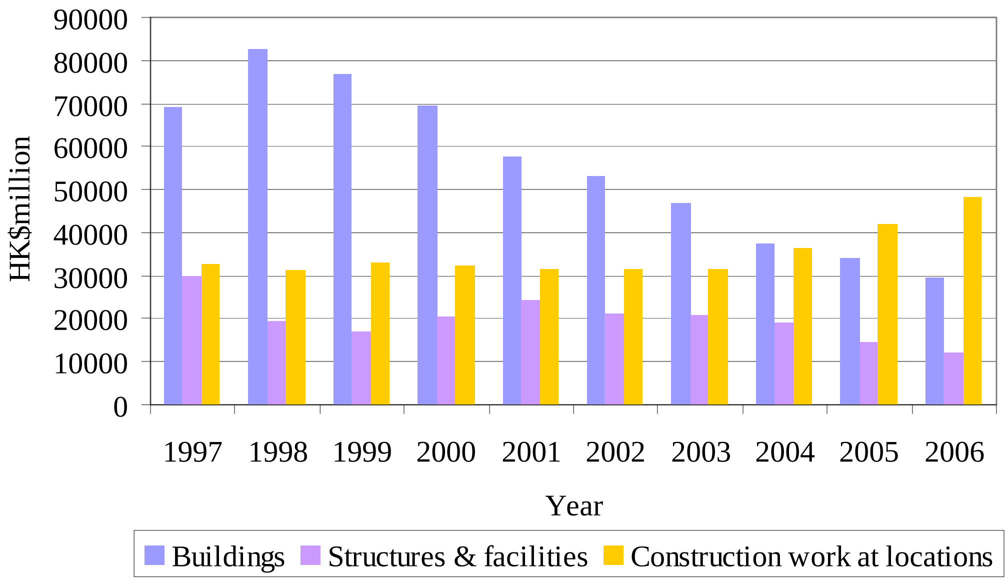

Figure 4.5 Gross value of construction work performed by main contractors (by end-use): 1997 - 2006
Source: Census and Statistics Department, HKSAR Government.

Buildings

A building area can also be divided into residential, commercial, industrial and storage, and service. The gross value of the different building types is shown in Figure 4.6. Specifically, residential buildings are the main contributors to building areas. In fact, there was an increase in terms of construction work in residential buildings from 1997 to 1999. This trend is a direct result of public housing construction under the Housing Authority's programme as indicated in Figure 4.7. However, the completion of public housing flats after 1999 led to a decline in construction work at the residential building segment. Compared with public residential buildings, the construction of private residential buildings remained stable and became a major contributor to the residential building segment after 2001. Figure 4.6 illustrates that the level of decline has slowed down in recent years. In other words, the residential building segment is expected to recover since the gradually increasing Hong Kong population requires more residential buildings. Unfortunately, it remains uncertain up to which level it will recover.

The second segment in the building sector pertains to commercial buildings. As an international financial centre, Hong Kong has many commercial buildings that provide offices for companies with different backgrounds. This segment was influenced to a great extent by the economic decline. As a matter of fact, the value of this segment was reduced from 18,726 HK$ million in 1998 to only 6,890 HK$ million in 2006. Such a situation also faced the challenges brought about by the rapid economic developments in China. As such, China's major cities such as Beijing and Shanghai can offer high level commercial buildings that meet diverse clients' needs. Moreover, it is quite convenient to establish the representative office in large cities in China. This is particularly true for foreign companies which tend to exploit the new market in China. Therefore, Hong Kong's commercial building segment confronts a substantial challenge in the future.

The industrial and storage, as well as the service segments are the last two for the buildings sector. Overall, the service segment is the most stable as evident in Figure 4.6. On the other hand, the industrial and storage segment was influenced by the economic decline and gained low output value after 1998. This segment is also the smallest among the four, and this is attributed to the fact that the industrial & storage building requirements can be met in mainland cities close to Hong Kong. The construction of such buildings in Hong Kong is for the purpose of meeting the basic needs of specific industries. Therefore, it is an unattractive segment in the Hong Kong construction market.

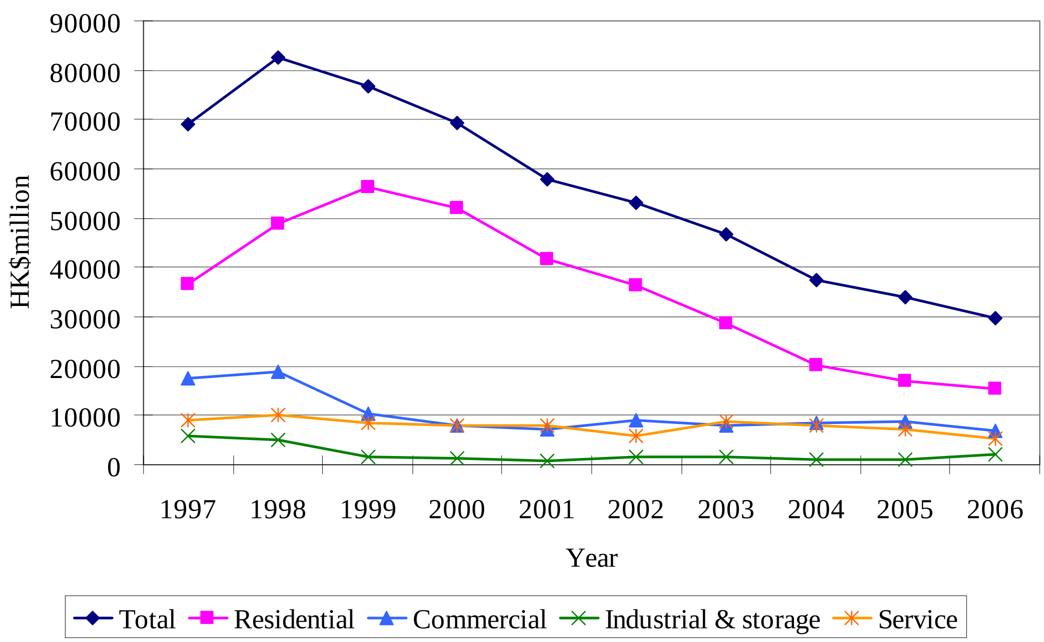

Figure 4.6 Gross value of building work performed by main contractors: 1997 - 2006
Source: Report on the Quarterly Survey of Construction Output 1997-2006
Census and Statistics Department, HKSAR Government.

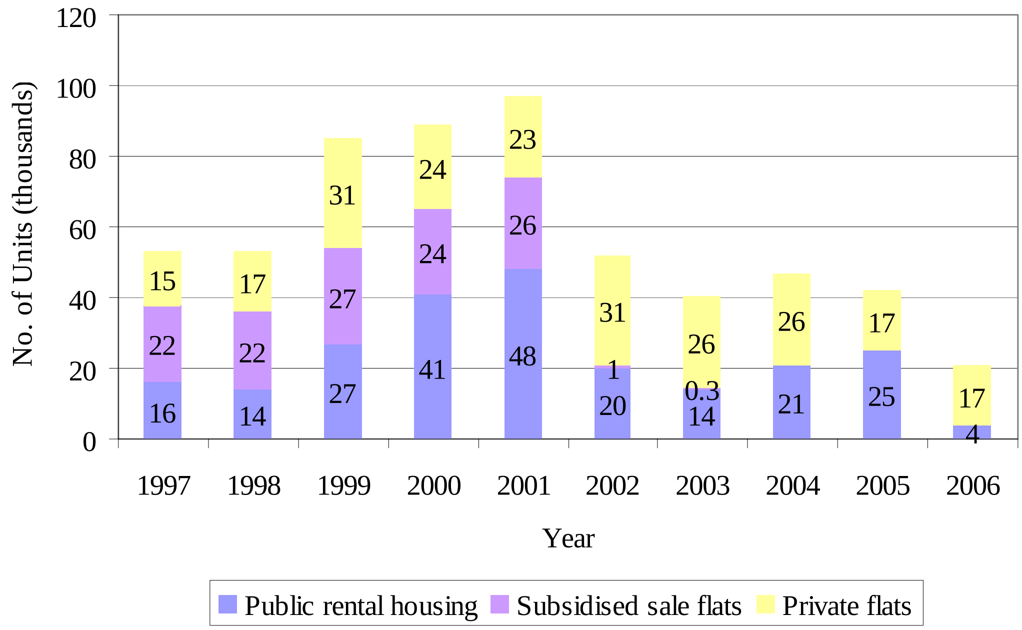

Figure 4.7 Production of permanent residential flats: 1997 - 2006
Source: Housing Authority, HKSAR Government

Structures and facilities

The structures and facilities area can be further divided into transport, other utilities and plant, environment, and sports and recreation. The trends of these four segments during the last ten years are shown in Figure 4.8. Here, it can be seen that the transport segment is a major contributor, since it takes about 77 percent of this area in 1997. However, this segment has declined significantly from in the ensuing years between 1997 and 1999. Generally, this can be attributed to the completion of the Airport Core Programme Highways Projects in 1997 and since there are no mega transport projects during these two years. However, the said segment recovered from 1999 to 2001 because of the new railway lines that went under construction in these years. Upon completion of these new railway lines in 2003, the transport segment went down along with the works value of 8,148 HK$ million in 2006. This figure is much less than the value in 1997. Since the population is projected to continuously increase in the future, the demand for a convenient transportation will definitely commence new transport projects. Moreover, under a reviewing mage project, the Hong Kong – Zhuhai – Macao Bridge will provide new opportunities for transport segment contractors.

Compared to transport segment, the other three segments take lesser shares in the structures and facilities area with their maximum proportion 39.5% in 1999. With the exception of the environment segment increase in 2001 to 2002, the values of the remaining three segments did not change much. Furthermore, the other utilities and plant segment suffers from a trend of decline. Meanwhile, the output of sports and recreation segment is stable annually, except in 2004 when there were several major facilities under construction, such as the Kowloon Bay Recreation Ground, Hammer Hill Road Park. Therefore, it is expected that the environment segment will increase along together with the demands for environment protection and sustainable development.

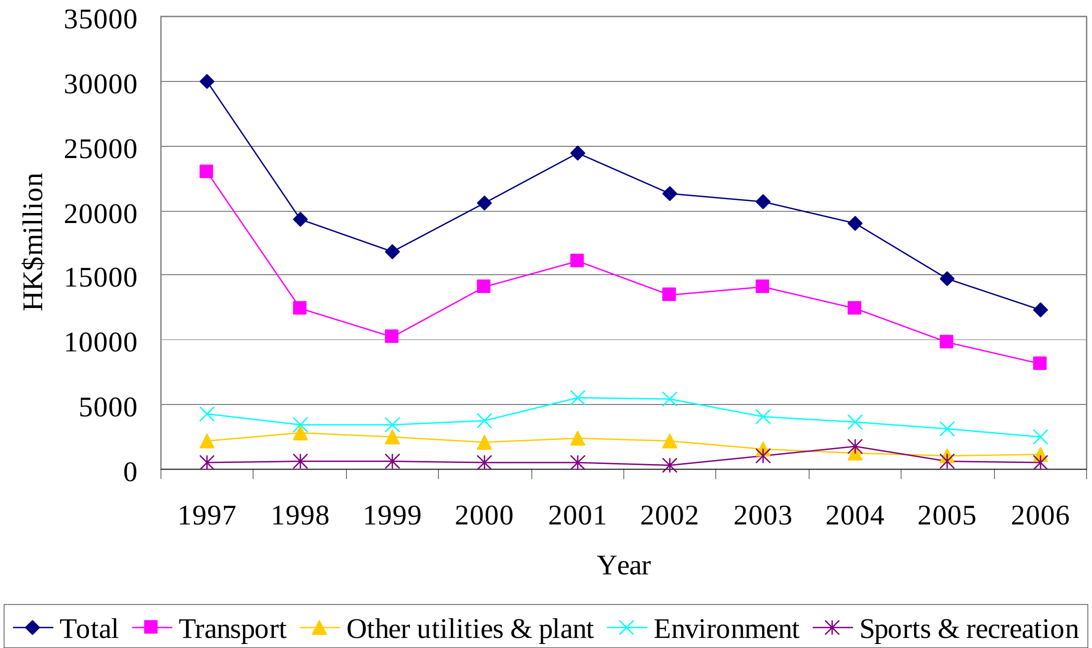

Figure 4.8 Gross value of structures and facilities work performed by main contractors: 1997 - 2006

Source: Report on the Quarterly Survey of Construction Output 1997-2006 Census and Statistics Department, HKSAR Government.

Construction work at Locations other than Construction Sites

Construction work at locations other than construction sites can be divided into general and special trades, and their trends in the last ten years are shown in Figure 4.9. Here, it can be seen that construction work at locations is the only one which is stable and increasing during those years. The major contributions in this area are general trades including decoration, repair and maintenance, as well as other minor works. It was able to demonstrate that the construction work at locations is stable since repair and maintenance are always needed regardless whether the economy is in good condition or not. In 2006, the gross value of construction work at locations performed by main contractors is 48,240 HK$ million which exceeds the sum of buildings and structures and facilities. This also implies that the inclusion of construction work at locations in business can be a strategy to avoid risks in recession.

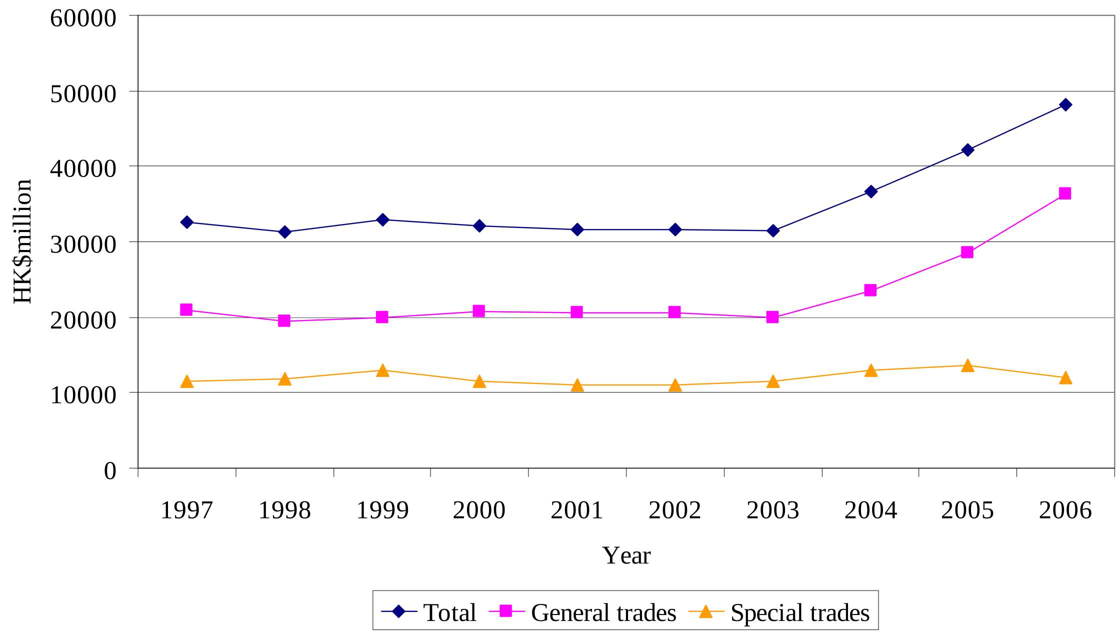

Figure 4.9 Gross value of construction work at locations other than construction sites performed by main contractors: 1997 - 2006
Source: Report on the Quarterly Survey of Construction Output 1997-2006
Census and Statistics Department, HKSAR Government.

The aforementioned analysis seems unoptimistic of the Hong Kong construction market. However, this concern would definitely not last too long. As shown in Table 4.3, the government actually proposed 10 major infrastructure projects in the 2007 to 2008 policy address in order to promote the construction industry and economic growth. Accordingly, a rough estimate of these projects' added value to the economy would be over $100 billion annually. In addition, it will create approximately 250, 000 additional jobs for the labor force. Evidently, there will be another growth period in the Hong Kong construction industry in the coming years.

Table 4.3 Ten major infrastructure projects for economic growth

Sector	**Project**
Transport Infrastructure	• South Island Line • The Sha Tin to Central Link • The Tuen Mun Western Bypass and Tuen Mun-Chek Lap Kok Link
Cross-boundary Infrastructure Projects	• The Guangzhou-Shenzhen-Hong Kong Express Rail Link • Hong Kong-Zhuhai-Macao Bridge • Hong Kong-Shenzhen Airport Co-operation • Hong Kong-Shenzhen Joint Development of the Lok Ma Chau Loop
New Urban Development	• West Kowloon Cultural District • Kai Tak Development Plan • New Development Areas (NDAs)

4.3.4 Industry Structure Analysis

The construction market analysis indicates that there are potential opportunities in the market. In order to grasp these opportunities, there is a need to take industry structure analysis for helping contractors to understand the competition conditions in local industry. And clearly understanding the competition conditions will help contractors take appropriate actions in competition, such as market segment selection, competitor identification. Therefore, industry structure analysis is an important part in strategy management for contractors.

There are five major forces which determine the industry’s structure and influence its potential profit (Porter, 1980):

- Threat of new entrants
- Competitive rivalry within industry

- Bargaining power of clients
- Bargaining power of suppliers
- Threat of substitute of products

Understanding these five forces including their joint influences is important for contractors to develop effective competition strategy in a particular construction industry. And these five forces will be discussed as follows.

Threat of New Entrants

Firms in all industries should be concerned about the likelihood of new firms penetrating their arena. This means that there will either be more competitors in the industry or otherwise. Most importantly, the threat of entry depends on both entry and exit barriers. As such, industries with high barriers can provide certain protection to its existing firms. Additionally, the presence of such barriers is related to the profit level of firms. Hence, low entry and exit barriers may make industries suffer low profit levels because of the emergence of many competitors.

It is often said that the construction industry is characterized by low entry and exit barriers (Seymour, 1987). This owes to the fact that the construction industry has low capital requirements and "know-how." Moreover, the stock-in-trade of a contractor can be easily obtained by hiring experienced professionals and laborers (Male, 1991). However, the situation is already changing since the clients who are pressing higher requirements on contractors, especially the international ones, are either exploiting new markets or creating demands. For instance, the clients' diverse requirements through new forms of services, such as construction management, design and build, and the Private Finance Initiative (PFI) push entry and exit barriers to higher levels. The capital requirement is important for a PFI consortia project and the need to convince clients of financial ability is likewise required. Most diversification strategies, such as diversifying from contracting into property development, building materials, are laying down various entry and exit barriers for construction companies (Langford and Male, 2001).

The same situation exists in Hong Kong construction industry. Low entry and exit barriers make the existing contractors face the threat from new entrants. As Hong Kong's economic freedom, contractors with different backgrounds can enter the market without any restrictions, and compete equally in the market. After the development of Hong Kong construction industry, major large international contractors have established their branch or have been localized in Hong Kong. Therefore, these large international contractors and localized contractors face few threats from new entrants. The small and medium contractors or specialist contractors, especially in building sector, have to face the threats of new entrants due to the low entry barriers.

Competitive Rivalry within Industry

The competitive rivalry and threat of entrants can be jointly considered since an increase in industry entrants eventually leads to an intense competition. There are two major factors determining the extent of competitive rivalry in an industry. One is the market concentration, another one is the degree of mutual interaction between competitors. The market concentration depends on the number of participants and their market share in a particular sector. High level market concentration will lead to intensive competition between competitors. Retaliatory strategic moves between competitors will lead to intensive competition between them. In contrary, strategic alliance between competitors will benefit both sides.

For the construction industry, its building sector normally has lower entry and exit barriers compared with the civil engineering sector. This situation is similar for the Hong Kong construction industry. Chiang et al. (2001) conducted a market concentration study of Hong Kong’s construction industry, and found that its large civil engineering sector has the most concentrated market. As such, technical complexity and capital requirements provide the sector with high entry and exit barriers. It is also believed that foreign contractors having an advanced technology and finance capability will continue dominating the civil engineering sector. In contrast, low entry and exit barriers in building sector lead to numerous contractors competing in this arena. Therefore, analyzing such barriers can help contractors understand market concentration in different market segments and help create new barriers to keep a high level profit.

Hong Kong construction industry has experienced a great decline in last decade. In order to keep sustainable development and high returns, contractors in Hong Kong tend to take strategic alliance instead of retaliatory strategic moves, such as joint venture, partnership, and especially in large construction projects. Strategic alliance can help enhance efficiency and exchange between participants and facilitate a healthy competition environment in industry. Therefore, it is necessary for contractors to analyze competitors' possible strategic moves and take relevant actions in competition. The best solution is to find a way to avoid competitive rivalry and benefit both sides.

Bargaining Power of Clients

Essentially, clients are important players in the construction industry since they are buyers of contractors' services. Generally, clients can be divided into public and private clients. Public clients prefer procuring a service or product through competitive tendering in order to show justice. Since public buildings, structures, and facilities provide different functions for the populace, tender price is not the sole consideration in tendering. Thus, other criteria, such as reputation and past performance will also be considered when selecting a contractor. It indicates that the public clients' bargaining power depends not only on price but also on other items. In Hong Kong, most private clients are real estate developers and their major project types are private buildings. Typically, private clients, particularly the large developers, have a high bargaining power in procurement. There are two major reasons behind this characteristic. First, the building sector's entry barrier is low and several contractors can also provide the same service and product. Second, the major developers in Hong Kong either have in-house contractors or long term relationships with some of them. Hence, there is only a small chance for general contractors who are neither in-house nor ‘inner-circle’ contractors of these developers to penetrate the private market (Chiang et al., 2001).

In order to weaken clients’ bargaining power, contractors can take the differentiation strategy or establish long-term relationship with clients. Providing client unique services enable contractors to have high bargaining power as there are few competitors. For example, building up reputation of high quality service will be a competitive advantage for contractors in competing for public works in Hong Kong. Clients pursuing high quality construction services have to sacrifice their bargaining power. Furthermore, establishing long-term cooperation with clients will benefit both clients and contractors. Clients and contractors can build up mutual trust through long-term cooperation and the efficiency of construction work will be improved accordingly. As a result, clients will offer contractors a reasonable price. Then, establishing good relationship with clients can improve contractors’ competitiveness.

Bargaining Power of Suppliers

As for main contractors, the primary providers are subcontractors and material suppliers. Since construction is a highly interconnected industry, it is a must for the main contractors to face various suppliers with different industry backgrounds. Also, the bargaining power of suppliers will depend on their industrial focus. Usually, the suppliers in a concentrated industry will possess a higher bargaining power than those in a less concentrated one. According to Chiang et al.’s (2001) research, some suppliers may have more bargaining power since they belong to relatively concentrated industries.

For public works, the following suppliers may have more bargaining power:

- Lift
- Landscape
- Supply and installation of E&M equipment

For private works, the following suppliers may have more bargaining power:

- Lift
- M & E works
- Supply and installation of curtain wall cladding
- Supply and installation of marble, granite and stone works
- Fitting and fixture
- Lighting
- Signage
- Supply and install of kitchen and sanitary equipment
- Supply and install of window louver

Similarly, establishing long-term cooperation or partnership with suppliers or subcontractors can also help contractors to improve their bargaining power and benefit both sides. Actually, large general contractors in Hong Kong have long-term cooperation with a group of subcontractors and suppliers which enable them to take quick actions in the market, reduce procurement cost and time, improve cooperation efficiency, and consequently strengthen their competitiveness .

Threat of Substitute of Products

Substitute products or services are not easily applicable to the construction industry. The key issue here is to identify what can be considered as suitable substitute products. According to Porter (1980), the substitute product must perform a function similar to the industry’s core product. Taken from an end-product perspective, potential substitute products or services in a construction industry may be refurbishment, repair and maintenance, and renovation (Langford and Male, 2001). The functional analysis of substitute products states that the main purpose of construction products is to provide facilities to clients in an optimal way. Therefore, clients may either opt to construct a new facility, or choose to renovate, refurbish, or maintain an existing facility.

In Hong Kong’s construction industry, the new construction work has suffered a threat from substitute products, including repair, maintenance, structural alteration, and addition works. The value of construction work performed at locations surpasses the work performed at construction sites, as shown in Figure 4.5. It may be explained that there are less investments on new construction projects due to the economy’s decline. However, the raising trend of construction work at locations indicates that substitute products will continue to dominate the market until a need for large scale new facilities arises.

4.3.5 Procurement, Subcontracting and Association

The above discussion on Hong Kong construction market and industry implies that Hong Kong construction market is an open and competitive market with opportunities and challenges, and the five forces in the industry have different impact on different contractors working in Hong Kong. Moreover, there is a need to take a further review on other characteristics of Hong Kong construction industry to help contractors have a fully understanding of the industry. Fully understanding of the industry can help contractors adapt their competition strategies to the environment efficiently. The project procurement process, assessment method for public works, subcontracting and professionals will be discussed in following sections.

Project Procurement Process

In Hong Kong, both competition and negotiation are the two major methods for selecting a contractor to undertake a project. As such, contractors can obtain tender notice from media sources, like newspapers, professional magazines, websites, (open tendering) and/or from invitations to submit tenders for a project contract (selective tendering). In a tender notice, contractors will apply for tender documents that are either free of charge or not. Subsequently, these contractors will examine documents in detail in order to prepare the tender. This task includes tender price estimation and technical proposal preparation. Finally, they will submit the tender to clients prior to its close date. The process of preparing and submitting a tender is also known in the business as bidding or tendering. A typical selective tendering procedure for public works in Hong Kong is illustrated in Figure 4.10.

For public works, contractors must be on the government's list to qualify as a tenderer. The potential bids will be solicited from contractors that are included on the list or from pre-qualified contractors. The relevant Government departments in Hong Kong normally adopt selective tendering in the procurement of public works. In this regard, only those contractors who are on the approved list for public works are invited to tender. Moreover, a pre-qualification will be used for some special situations (ETWB, 2004a):

- *it is envisaged that not many contractors currently on the relevant approved list would meet the additional qualification requirements and there is a need to invite those contractors who are not yet on that approved list to participate;*
- *the qualification process is time consuming and there is a need to conduct the qualification process in advance; and*
- *where the qualification requirements are so complex that some tenderers may not know exactly whether they are qualified or not and where the cost of preparing the tender is very high, prequalification of tenderers may be warranted.*

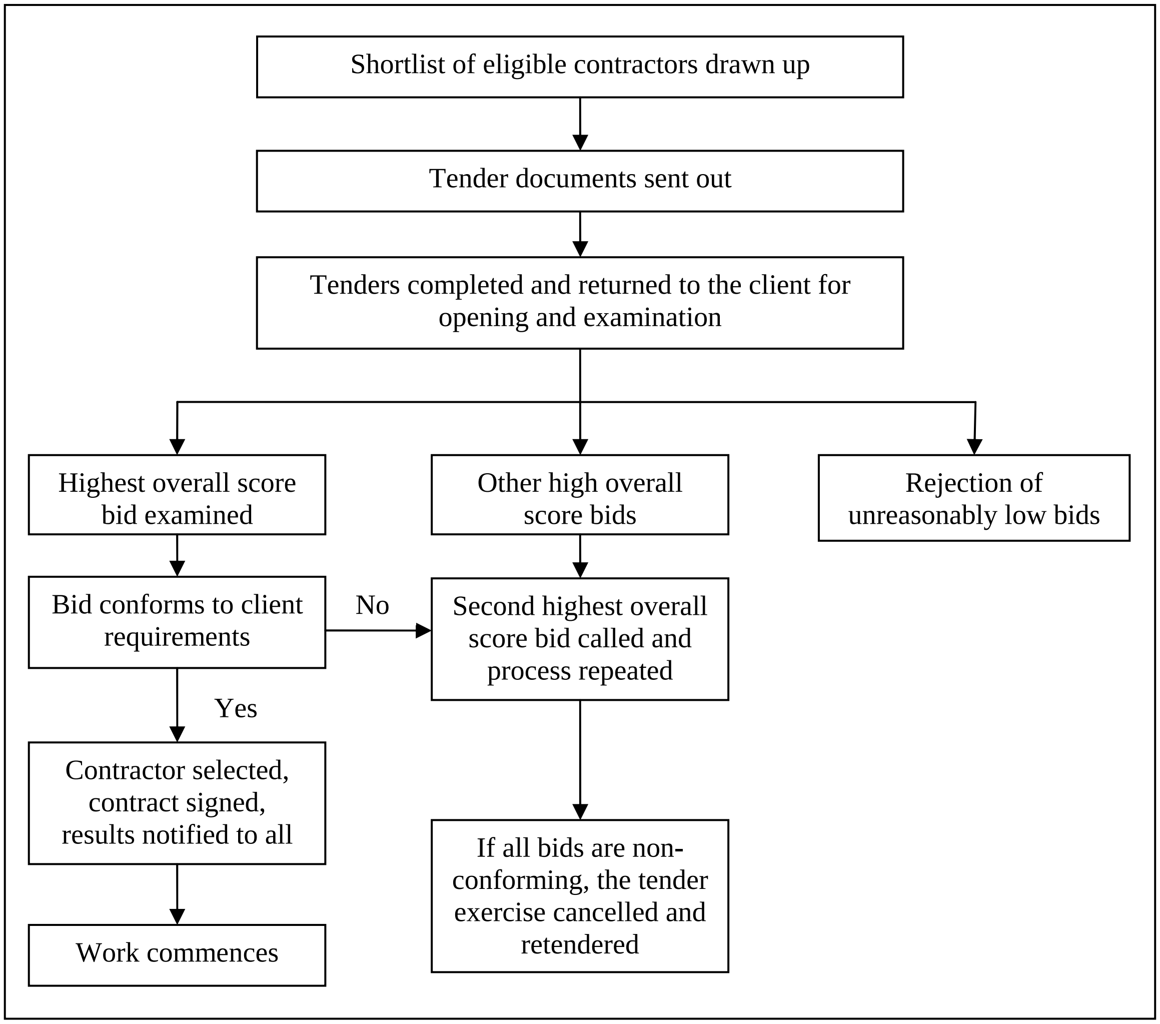

Figure 4.10 A typical selective tendering procedure for public works

Assessment Method for Public Works

Traditionally, the tender price appears to be the main criterion used by clients for awarding contracts. Unfortunately, this procurement practice has been increasingly blamed for the continuous existence of the non-compliant construction performance (Shen et al., 2001). A report by the Construction Industry Review Committee (CIRC, 2001) suggests that the local tendency to award contracts at the lowest price has resulted in low profit margins. Thus, contractors have only little incentives to exceed the minimum requirement. This report also identifies the typical shortcomings of the local industry performance, including substandard work, cost overruns, project delays, poor site safety record, unsatisfactory environmental performance, poor workmanship, and so on. Furthermore, the CIRC (2001) suggests that public sector clients should play a critical role in making the construction industry to improve its operations through quality-oriented procurement strategies. In this regard, the Works Branch of Development Bureau of the Hong Kong Government has introduced two methods, the Marking Scheme and the Formula Approach, for tender evaluation of public works contracts (ETWB, 2004b). By using these methods, a contractor's total competitiveness is assessed on a wider spectrum by collectively considering its tender price and performance attributes. Also, a combined price and performance score (CPPS) is used to assess a contractor's bid.

The Marking Scheme method is selected for the tender evaluations of public works contracts when the project's quality is the major consideration. To employ this scheme, the overall score for each tender is calculated by using the following formula:

$$60 \times \frac{\begin{array}{l}\text{the lowest tender price}\\ \text{among those conforming tenders}\end{array}}{\text{the tender price}} + 40 \times \frac{\text{the technical score}}{\begin{array}{l}\text{the highest technical score}\\ \text{among those conforming tenders}\end{array}}$$

Public clients can also define the weights distribution among various technical attributes. These attributes include the tenderer's experience, past performance, technical resources, and technical proposal quality. In this set-up, the tenderer's score on each technical attribute will be given, with reference to the marking standard set by the Branch.

The Formula Approach in a tender evaluation will be used to other work contracts that are not included in the Marking Scheme category. In addition, the Electrical and Mechanical Services Trading Fund (EMSTF) does not participate as a tenderer at this juncture (ETWB, 2004b). With respect to each conforming tenders, a CPPS (overall) will be determined in accordance with the formula below:

- For tenders with a price:

$$60 \times \frac{\begin{array}{l}\text{the lowest tender price}\\ \text{among those conforming tenders}\end{array}}{\text{the tender price}} + 40 \times \frac{\text{the tenderer's performance rating}}{\begin{array}{l}\text{the highest performance rating}\\ \text{among those conforming tenders}\end{array}}$$

- For tenders without a price (such as term contracts):

$$60 \times \frac{\begin{array}{l}100 + \text{the lowest value for tender analysis}\\ \text{among those conforming tenders}\end{array}}{\begin{array}{l}100 + \text{the value for tender analysis}\\ \text{of the tenderer}\end{array}} + 40 \times \frac{\text{the tenderer's performance rating}}{\begin{array}{l}\text{the highest performance rating}\\ \text{among those conforming tenderers}\end{array}}$$

The Circular suggests that using the Marking Scheme has significant staff resource implications which may not be warranted for contracts where service quality is not too demanding. Thus, the Formula Approach is designated not to take into account the other technical attributes. To apply this Approach, the tenderer’s past performance is assessed by taking into account factors of workmanship, progress, site safety, environmental pollution control, organization, general obligations, industry awareness, resources, design, attendance to emergency, and attitude to claims. The weights distribution among these factors has been designed by the Branch, and the score on each factor will be provided with reference to Branch guidelines.

Overall, both the Marking Scheme and Formula Approach are used to evaluate tenders by considering tender price and multiple performance attributes. They are valuable tools which assist public clients in choosing contractors who are competent and cost effective in terms of achieving multiple project objectives. Such aims include cost control, construction time control, quality conformance, safety standard, and environmental performance. In effect, these developments have ushered the demand for a contractor's 'total competitiveness' from public clients. Thus, contractors are now very keen to formulate a competition strategy which allows for a better total competitiveness.

Subcontracting

Subcontracting is very prevalent in construction industry. The subcontract work's proportion is in a high level, especially on building projects, as approximately 80 to 90% of construction works are performed by the subcontractors (Hinze and Tracey 1994). In this set-up, the main contractor will employ several subcontractors, which are sometimes nominated by consultants, to carry out a large part of the contract. According to government statistics, the value of subcontracted work constitutes about 70 percent of the total work done by all contractors. This figure is shown in Table 4.4.

Table 4.4 Proportion of subcontracted work in Hong Kong

Year	**GV (HK$Bn)**	**FSC (HK$Bn)**	**%**	**LSC&CE (HK$Bn)**	**%**	**TSC&CE (HK$Bn)**	**%**
1997	242.8	107.3	44	57.6	24	164.9	68
1998	240.7	111.4	46	57.0	24	168.4	70
1999	226.7	104.7	46	54.4	24	159.0	70
2000	208.0	93.0	45	53.0	25	146.0	70
2001	196.6	90.2	46	48.5	25	138.7	71
2002	184.8	86.1	47	45.2	24	131.3	71
2003	163.9	78.0	48	38.6	24	116.6	71
2004	148.8	68.4	46	34.4	23	102.8	69
2005	137.8	61.0	44	32.4	23	93.4	68
2006	138.3	62.0	45	32.8	24	94.8	69

GV: Gross value of work done by all contractors in Hong Kong
FSC: Value of work done by fee subcontractors
LSC&CE: Value of work done by labour-only subcontractors & Compensation of employees
TSC&CE: Total value of work done by all subcontractors & Compensation of employees

Source: Principal Statistics for All Building and Civil Engineering Establishments, Census and Statistics Department, HKSAR Government.

The practice of hiring subcontractors can be thought of as reaction to the complex and one-off nature characteristics of construction work and its volatility. Given that work load is unpredictable, contractors therefore could not commit to hold long-term resources such as owned plants and labour. Accordingly, subcontractors allow main contractors to be more flexible in meeting the changing environment. These subcontractors can acquire subcontract work from different main contractors in order to keep theie work load stable. The various benefits of a subcontracting system are also defined in other bodies of research. In this regard, Arditi and Chotihougs (2005) argued that "…*the economic facts have confirmed the subcontracting system to be efficient and economical in the use of available resources. The operations of the average general contractor are not sufficiently extensive to afford full-time* *employment of skilled craftsmen in each of the several trade classifications needed in the field, nor is it feasible for these companies to own, operate, and maintain specialized equipment that may have only limited use during a project. Another common reason for subcontracting is that qualified subcontractors are usually able to perform their work specialty more quickly and at a lesser cost than can the general contractor*."

The number of subcontract packages included in a particular project will depend on the individual main contractor's subcontracting policy. Thus, there are varying opinions regarding the number of subcontract packages. However, some argue that a less number of subcontractors will improve coordination and integration of the different components of a construction work. In contrast, others perceive that a lower price can be obtained by approaching a larger number of subcontract packages. Lai (1987) conducted a survey in the Hong Kong construction industry on subcontract work amounts within 17 contracts, and the result showed that the largest number of such packages on a construction project is 54 while the smallest is 17.

The Hong Kong Construction Association

Apart from the professionals, the Hong Kong Construction Association (HKCA) plays an important role in developing an effective construction industry. The association is established in 1920, when the association was still dubbed as the Building Contractors' Association (BCA). After several decades, the name was changed from BCA to its current name in 1989. Basically, this Association represents the building and civil engineering contractors which are based in Hong Kong, as well as the international large contractors from different countries. As of 31 October 2007, the Association has already a total of 312 member companies. Essentially, the Association's objective is to promote a healthy environment for its ongoing development of an effective industry. For this research, the Association's members are selected as the research targets.

4.4 Task Environment: Relationships with Various Parties

Like other organizations, construction companies are also involved in complex relationships with different parties, including relationship with clients, government departments, professional consultants, creditors, subcontractors, and suppliers. Clients offer contractors construction contracts. Government departments make relevant regulations. Professional consultants provide consulting services for clients. Creditors provide financial support for contractors. Subcontractors help contractors finish the construction work partially or specially. And suppliers provide contractors necessary materials and equipment for completing the construction work. It can be seen that these six parties have close relationships with contractors. Establishing good relationships with these parties enable contractors have more opportunities to obtain construction contracts and improve the efficiency of the construction work.

4.4.1 Relationship with Clients

Clients are among the most important actors in a construction industry. They may either come from the public or private sector, may be frequent or once. Typically, contractors establish relationships with clients by meeting their demands for a constructed facility. Contractors commonly utilize contract documents to address particular problems that may occur in the construction process. However, there are limitations to contract documents since these do not encompass the whole risks of the project. This is particularly true for those large projects which usually undergo a long period of time to finish (Clegg, 1992; Gardiner and Simmons, 1992; Kumrawasamy, 1998). Furthermore, contract documents could not totally solve the problem of bad faith since a dispute resolution process is inconvenient and costly for most clients (Dimaggio and Louch, 1998). Hence, this fact compels clients to be very careful in selecting contractors, and various qualification methods are used to prevent risks such as claims, disputes. Clients also collect information pertaining to contractors from their previous clients, designers, subcontractors, sureties, and their compliance with regulations. Therefore, developing and maintaining good relationships with different parties would not only enable contractors to efficiently carry out the current work, it also creates an opportunity for them to win more contracts in future.

In Hong Kong, there are restrict selection method for public works since public clients often have high requirement on quality. Contractors can build up their relationship with public clients through becoming the members on the approved list of contractors for public works and provide public clients high quality services. And large construction organizations develop their relationships with clients often through approaching higher level of contacts, producing high quality products and services, and cultivating corporate brand. It was revealed in the discussions that a major contractor in Hong Kong has a good reputation for providing clients high quality products and services. Accordingly, the contractor has developed good relationships with clients, particularly with public clients who often impose the priority to high quality standard.

Furthermore, Hong Kong has a large real estate market and world famous developers. In 2005, the real estate sector contributed 4.5% to the Gross Domestic Product of Hong Kong (Census and Statistics Department, HKSAR). The major investments in the real estate market are from the private sector. These private clients have different requirements on contractors in comparing with the public clients. Since private clients are benefit-driven in nature, they always expect contractors to complete projects on time and keep the construction costs in a low level. Private clients normally prefer to appoint a contractor by negotiation rather than to engage an open tendering process which consumes more both time and cost. The negotiation practice helps contractors to develop closer relationships with private clients. On the other hand, development of relationships between contractors and private clients will build up the trust between each other. Both sides will get benefit from better relationship and win-win results. This will happen particularly after several successful co-operations.

4.4.2 Relationship with Government Departments

Similarly, contractors have to establish relationships with relevant government departments not only because these departments enact relevant regulations, but they are also major clients in this industry. In Hong Kong's case, one major method in setting up relationships with these governmental departments is to be on the List compiled by various government departments. There are two lists in the Hong Kong Work Branch Development Bureau. These are the List of Approved Contractors for Public Works and the List of Approved Suppliers of Materials and Specialist Contractors for Public Works. There are two kinds of registered contractors in Hong Kong Building Department and they are the Registered General Building Contractors and the Registered Specialist Contractors.

The major relevant government departments are Development Bureau and the Transport and Housing Bureau. The Development Bureau consists of two Branches, namely, the Works Branch and Planning and Lands Branch. The Works Branch is chiefly responsible for the planning, management, and implementation of the public sector's infrastructure development and the works' programmes. On the other hand, the Planning and Lands Branch is responsible for effective land use planning and the optimum use of land resources.

The Works Branch consists of six departments:

- Architectural Services Department
- Buildings Department
- Civil Engineering and Development Department

- Drainage Services Department
- Electrical & Mechanical Services Department
- Water Supplies Department

The Planning and Lands Branch has three departments:

- Lands Department
- Lands Registry
- Planning Department

The Transport and Housing Bureau consists of five departments:

- Civil Aviation Department
- Highways Department
- Housing Department
- Marine Department
- Transport Department

These government departments are responsible for selecting appropriate contractors for the public works and make regulations in different public sectors. Establishing good relationships with these departments enables contractors to have the opportunities to get the information about future policies and improve the winning probability in competing for the public works. The possible methods to establish these relationships could be on the list of approved contractors for public works, keep good performance record in public works, and take an active support to these departments' work. Good relationship with government departments would be a competitive advantage in competition.

4.4.3 Relationship with Professional Consultants

The relationship between contractors and professional consultants may either be direct or indirect. Typically, professional consultants (architects, engineers, surveyors) act as the clients' agents which assist the latter to solve both technical and managerial problems in the construction process. In reality, this is an extension of the client-contractor relationship. For some cases, professional consultants provide consulting services to contractors and eventually develop into a direct association. Regardless on the kind of relationship between these two parties, it is quite obvious that a good relationship between them can significantly influence the project's outcome. Thus, successful transformation of the consultants' conceptual ideas into reality depends on the open communication and effective coordination between these two entities. Moreover, good relationships that were established in previous projects can become a contractor's competitive advantage when bidding for new projects. Nevertheless, it is important for contractors to efficiently deliver projects and obtain more contracts via the consultants' recommendation.

In the local construction industry, a large portion of professional consultants are actually qualified members of at least one of the following institutes:

- The Hong Kong Institute of Architects (HKIA)
- The Hong Kong Institution of Engineers (HKIE)

- The Hong Kong Institute of Surveyors (HKIS)
- The Hong Kong Institute of Planners (HKIP)
- The Hong Kong Institution of Engineering Surveyors (HKIES)

The roles of the professional consultants in Hong Kong are based on the United Kingdom. In the traditional procurement approach, architects are the designers and managers of a project and the civil engineers take the similar role for civil construction works. With the development of new procurement methods, such as management contracting, construction management, project management, and design and build, there are changes of the role of architects. And surveyors also expand their business by providing clients additional services, such as project management and value management. There is a trend that the services of different consultants would be overlapped in future. However, there is one thing never changed that the consultants are closely involved in the project and have more interaction with clients. Therefore, establishing good relationship with professional consultants would help contractors complete the construction project more efficiently and get new construction contracts by consultants' recommendation.

4.4.4 Relationship with Creditors

A harmonious association with creditors will improve contractors' financing capability. In fact, having enough capital is very crucial for certain kinds of projects, like in the case of a Private Public Partnership. In addition, contractors are obliged to find all possible ways to secure financial support during the competition process.

Likewise, the government's financial assistance plays an important role in developing a strong domestic industry and in improving contractors' competitiveness. A clear manifestation of this is the rise of Japanese contractors in the international market. Evidently, the Japanese government provides subsidized finance for their contractors (Raftery et al., 1998) when competing. In turn, the Japanese contractors finance host countries in order to secure the major market shares in Asia (Reina and Tulacz, 1998). This example illustrates that financial capability is a definitely a key factor for growth.

One way to strengthen the financial capability is to raise money in the stock market. However, the number of public-listed construction firms in Hong Kong remains relatively small. Chiang et al. (2001) gave the reason as *"Finance is another major barrier to entry. It is always difficult for domestic contractors to raise enough finance to improve and develop their technology. For those fewer contractors who managed to get public listing in the stock market, their costs of finance are much higher than property developers (Chiang and Yue, 2001). Local property development companies have long succeeded in tapping overseas capital markets with their issue of convertible bonds (AWSJ, 1993), but this way of financing for the contractors is still unheard of."*

Another way is to establish good relationships with creditors. Hong Kong is an international financial centre and many international banks provide many kinds of financial services for different clients, including contractors. However, it doesn't mean that contractors can get financial support from the banks easily. Contractors need to prove to the banks their profitability and the ability of repayment. Long-term cooperation will also help build up the mutual trust between contractors and creditors and make it easier to get financial support from creditors. Overall, having good relationships with creditors would enable contractors to receive adequate financial support to implement their competitive strategies, and consequently sustain their competitive advantage in the industry.

4.4.5 Relationship with Subcontractors

Due to an unstable construction market, it is quite impossible for large contractors to keep all resources, such as labour, equipments, and others under their control. Hence, they prefer to be flexible by delegating some of the burden to their subcontractors. As such, the relationship between contractors and subcontractors can be viewed in three dimensions: asset specificity, uncertainty, and frequency of exchange relationships. Essentially, these relationships involve high human asset specificity and a significant amount of uncertainty (Jones et al., 1997).

Both contractors and subcontractors are unlikely to terminate their long-term cooperation partners (Eccles, 1981). Usually, general contractors tend to hire only few subcontractors in each trade and they tend to establish long-term relationships with them. On the other hand, most subcontractors prefer to work with a small set of general contractors by which they also establish long-term and flexible relationships. Essentially, these long-term relationships allow them to learn from each other and overcome problems of newness liability like coordination problems, by developing trust and a communication route.

In effect, a good relationship between contractors and subcontractors can benefit both sides. As such, subcontractors can have more opportunities to acquire additional works and keep their business ongoing. Meanwhile, contractors can also subcontract works in reasonable but competitive prices. In most cases, subcontractors quote higher prices to contractors which they have limited work experience with compared to those whom they have worked with previously (Shash, 1998). Furthermore, such relationships enable contractors to improve coordination and communication efficiency among different parties. They can also deliver projects in high quality, which in turn gain competitive advantages for them.

In Hong Kong, the subcontractors can be divided into two types, labour-only subcontractors and fee subcontractors. Labour-only subcontractors provide only labour for a sum of money and the main contractors supply material and other resources. Fee subcontractors provide all resources necessary for completing the subcontracted work for a sum of money by tender or negotiation. Most construction work will be carried out by subcontractors. Therefore, it is necessary for main contractors to keep close connections with certain subcontractors. Establishing good relationship or partnership with certain qualified subcontractors will strengthen contractors’ competitiveness in industry.

4.4.6 Relationship with Suppliers

Construction materials are one of the major parts in a construction process. Contractors commonly procure these important resource inputs from materials suppliers, which eventually become a form of exchange relationships. During this exchange, contractors also face uncertainty since they would not be able to evaluate the suppliers' performance in terms of product and service quality. However, these relationships invariably have a great impact on contractors' performance. For example, a supplier's failure to comply with contractor requirements can cause deviation from previously set time, cost, and quality objectives. In this regard, there are a number of methods that address the uncertainties and problems of coordination. Stukhart (1995) pointed out that most contractors commonly have key suppliers which provide major materials. In addition, these contractors frequently hold meetings with the suppliers to improve the procurement process. As a result, this frequent cooperation enables both parties to learn how to effectively coordinate and to develop trust as well as communication routes. For the most part, such learning will improve contractors' performance for procuring materials in a more effective and efficient way.

Contractors can also reduce transaction cost by making the procurement process much more reliable and predictable. Thus, a harmonious relationship with suppliers provides extended credit terms, which actually reduces the excess demand of working capital requirements. Such relationship also diminished the amount of inventory which reduces construction costs as a consequence (Akintoye, 1995). In sum, developing and maintaining good associations with suppliers will benefit contractors in a great way.

Hong Kong construction industry depends heavily on imported materials. As Hong Kong is a free port and there are few import restrictions, there is a wide variety of sources and qualities of imported materials and the supplier may come from various countries. Selection of basic construction materials suppliers mainly depends on the logistical problems and suppliers from China could be one of the best choices. Selection of specialist suppliers will be more complex, such as the suppliers of lift. With the procurement methods, suppliers have been more involved in the construction process. Selecting appropriate suppliers becomes more important. Therefore, establishing long-term cooperation relationship with key suppliers can improve the efficiency of the construction work and improve contractors' competitiveness.

4.5 Summary

This chapter analyzed the external competition environment for construction businesses in Hong Kong. The external environment has a great impact on contractors' strategic decision. The Hong Kong economy has experienced hard times and the construction industry has been influenced significantly. Moreover, the construction market structure is altered more by construction work at locations rather than at construction sites. Establishing good relationships with various parties in this environment is one of the decisive factors during the competition process.

Contractors need to realize these external factors in order to improve competitiveness and to formulate competitive strategies to meet the demands of a changing environment. The analysis on external environment can serve as good reference for contractors to develop competitive strategies in particular markets.

CHAPTER 5 INTERNAL COMPETITION ENVIRONMENT

CHAPTER 5 INTERNAL COMPETITION ENVIRONMENT

5.1 Introduction

Business internal environment also has essential impact on contractors' performance. In this chapter, the resources and capabilities of construction firms are considered as the key parameters of the internal business environment, and will be focused for discussion. Having a high ranking economic autonomy, Hong Kong has much less restrictions on the entry of foreign contractors. Hence, many foreign contractors opt to operate in Hong Kong and even some of them become localized by setting up a new company through local contractors.

Hong Kong is geographically close to China and later became its special region upon the turnover from Britain in 1997. This initiated a number of large Chinese-based contractors to establish Hong Kong branches, to accumulate work experience in a different administrative system. In fact, various contractors with diverse backgrounds preferred to work in Hong Kong. An analysis of contractors operating in Hong Kong allows for a deeper understanding of the construction industry from a different perspective. Furthermore, contractors' internal resources and capabilities as well as their impact on contractors' competitiveness are examined in this chapter. Resources and capabilities are considered as the internal environment of contractors. These also provide a competitive edge to contractors. Meanwhile, the Goal Programming Optimal Bidding Strategy (GP-OBS) model demonstrates how internal resources impact contractors' competitiveness in bidding, showing that contractors' internal resources and capabilities are important for improving their competitiveness and for effectively formulating a competition strategy.

5.2 Contractors in Hong Kong

5.2.1 An Overview

The history of independent contractors in Hong Kong can be traced to as early as the 1840s. With the rapid development of the Hong Kong economy, the increase of the investments on buildings and civil engineering infrastructure projects provides opportunities for the development of contractors, including the general contractors and subcontractors. In 1999, the number of all buildings and civil engineering establishments reached its highest level by boasting 20,233 establishments. The statistics on the size of Hong Kong construction companies show that a mass of contractors comprise small companies while the rest cover the large ones. A similar situation occurred in other developed countries (Langford and Male, 2001). The distribution of all building and civil engineering establishments according to their added value is shown in Table 5.1.

Table 5.1 Size of contractors by average of number of employees (2006)

Value added	**Number of establishments**	**Number of persons directly engaged**	**Average number of persons directly engaged**
<5,000	17,977	70,186	3.9
5,000 - 9,999	687	18,621	27.1
10,000 - 24,999	198	10,209	51.6
25,000 - 49,999	99	8,547	86.3
50,000+	96	27,773	289.3
Total	19,057	135,337	7.1

Source: Report on 2006 Annual Survey of Building, Construction and Real Estate Sectors, Census and Statistics Departmen, HKSAR Government.

When contractors plan to tender for public works in Hong Kong, it is required for them to demonstrate a capability of successfully delivering projects. In addition, they should keep a good record of public construction projects, sufficient technical and financial capability, and an adequate amount of equipment and human resources. In Hong Kong, there are two lists of approved contractors which indicate those who are qualified to tender for different public works. The first one is the List of Approved Contractors for Public Works (the Regular List) and the other one is the List of Approved Suppliers of Materials and Specialist Contractors for Public Works (the Specialist List). Contractors on the Regular List are graded according to the following five construction work categories:

- Buildings
- Port Works
- Roads and Drainage
- Site Formation
- Waterworks

These listed contractors are also divided into three groups depending on the different contract size permission.

- Group A (contract value is up to $20 million)
- Group B (contract value is up to $50 million)
- Group C (any contract value exceeding $50 million)

The listed contractors, unless suspended, may tender for public works contracts only in works categories and groups for which they are approved. According to statistics, there are a total of 264 contractors in the list as of 28 February 2007. Categorically, 115 contractors work on more than one category, 54 on two categories, 30 on three categories, 13 on four categories, and 18 on five categories. The distribution of these contractors under different categories and groups is shown in Table 5.2.

Table 5.2. Number of approved contractors for public works (as of Feb. 28, 2007).

Group	Category / Status	Buildings	Port Works	Roads and Drainage	Site Formation	Waterworks
Group C	Confirmed	39	19	36	22	22
	Probationary	20	9	16	15	14
	Subtotal	**59**	**28**	**52**	**37**	**36**
Group B	Confirmed	18	5	15	6	2
	Probationary	27	4	33	39	9
	Subtotal	**45**	**9**	**48**	**45**	**11**
Group A	Confirmed	12	/	9	/	2
	Probationary	39	/	34	/	19
	Subtotal	**51**	**/**	**43**	**/**	**21**
Total		**155**	**37**	**143**	**82**	**68**

Source: Works Branch Development Bureau, HKSAR Government.

From Table 5.2, it can be observed that:

- There are more contractors in “Buildings” and “Roads and Drainage” than any other categories while the “Port Works” category has the smallest share of contractors;
- There are more contractors in Group C than other groups, except in the “Site Formation” category;
- In Groups A and B, the number of contractors under the probationary status is larger than those in the confirmed status, except for Group B within the “Port

Works" category and this situation is reversed in Group C.

The Specialist List consists of suppliers/specialist contractors who are approved to carry out works in one or more of the 49 specialist works categories. There are a total of 557 suppliers/specialist contractors in the special list as of the 28 February 2007. There are a number of suppliers and specialists working on highly technical items which have strict requirements on quality control. They are further categorized into different groups and classes according to the value of work and the type of service.

The Hong Kong Buildings Department also has lists of registered general and specialist contractors.

- Registered General Building Contractors
- Registered Specialist Contractors (Demolition Works)
- Registered Specialist Contractors (Foundation Works)
- Registered Specialist Contractors (Site Formation Works)
- Registered Specialist Contractors (Ventilation Works)
- Registered Specialist Contractors (Ground Investigation Field Works)

5.2.2 Contractors with Different Backgrounds

As shown in Table 5.1, there are only a small number of large contractors which contribute greatly to Hong Kong's construction industry. These large contractors can be classified into different groups according to their backgrounds.

- Local contractors such as Hsin Chong, Paul Y, and Shui On
- Chinese contractors, such as China State Construction Engineering Corporation, China Overseas Building Construction Ltd, and China Road Eng. & Investment Co. Ltd
- International contractor, such as Leighton, Nishimatsu, and Acciona Infraestructuras, S.A.
- Localised international contractors such as Gammon, Dragages, and Kumagai Gumi.

Aside from these large contractors, there are small and medium local and developers' ones. Examples of different contractors in the Hong Kong construction market are as follows:

Local Contractors

Along with the development of Hong Kong's construction industry, some of the local contractors became larger and later performed as industry leaders. As an example, Hsin Chong Construction Group Ltd. (HCCG) is currently one of the largest local contractors in Hong Kong. HCCG is also one of the few construction companies whose history and heritage are tied to Hong Kong's overall development both as a city and a community. Moreover, HCCG is one of Hong Kong's top five construction companies having an outstanding track record and a reputation for quality construction. Its business covers the following areas:

- Construction Services

- Civil Engineering
- Construction Management
- Electrical and Mechanical
- Integrated Facility Management

Also, Hsin Chong construction group is one of the subsidiaries of Hsin Chong Holdings (HK) Limited, and is listed in the Hong Kong Stock Exchange. As shown in Figure 5.1, it is a wide-ranged company which deals on property development and construction. Hsin Chong also has projects in other Southeast countries and it has established joint ventures with local partners.

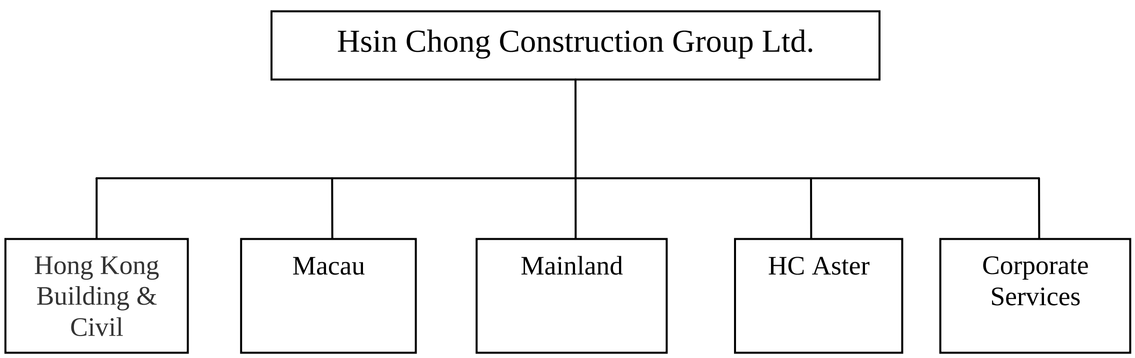

Figure 5.1 Organization chart of HCCG

Local contractors grew up with the development of the local construction industry. They have more knowledge about the local industry, culture and relevant regulations. Therefore, they have better understanding of the local clients' needs. Simple and flat organization structure enables local contractors to provide clients efficient services and easily expand their business into neighbour regions. As a major local contractor, HCCG provides construction services in Hong Kong, Macau and Mainland China, and also provides clients integrated services. For example, HCCG has established an integrated facility management (IFM) business model to support the development of Public Private Partnership procurement procedures for major government infrastructure programmes both in Hong Kong and Mainland China.

Chinese Contractors

There are several large construction companies in China, and the largest among them is China State Construction Engineering Corporation (CSCEC). These Chinese contractors entered into the Hong Kong construction market by the late 1970s, and are becoming increasingly noticeable in the industry. The Chinese contractors on the List of Approved Contractors for Public Works, as of 28 February 2007, are listed as follows:

- China Civil Engineering Construction Corporation
- China Geo-Engineering Corporation
- China Harbour Engineering Company Limited
- China International Water & Electric Corporation
- China Metallurgical Group Corporation
- China National Chemical Engineering Group Corp
- China Overseas Building Construction Limited
- China Overseas Civil Engineering Limited
- China Railway Construction Corporation
- China Railway Engineering Corporation
- China Resources Construction Company Limited

- China Road and Bridge Corporation
- China State Construction Engineering (HK) Ltd.
- Shanghai Urban Construction (Group) Corp
- Zhen Hua Engineering Company Limited
- Zhuhai International Economic & Technical Cooperation Corporation

The majority of these contractors belong to Group C. These companies moved to Hong Kong to earn foreign currency and accumulate experiences by entering a new market. During its early stages, these Chinese contractors were in the learning process. It includes the learning of new economic system realities and understanding the implication of different legal and contract systems. At present, Chinese contractors have grown and have taken a great portion of Hong Kong's construction industry.

For instance, China State Construction Engineering Corporation (CSCEC) is one of the world's largest construction companies. In 2007, CSCEC placed 18th in the Engineering News-Record's (ENR) Top 225 International Contractors by virtue of its US$2,956M international revenue for 2006 (Reina, 2007). China Overseas Holdings Ltd (COHL) is an independent subsidiary of CSCEC. In recent years, COHL took on a new development strategy and re-organized its business into three parts. They are property development, construction, and finance investment, as shown in Figure 5.2.

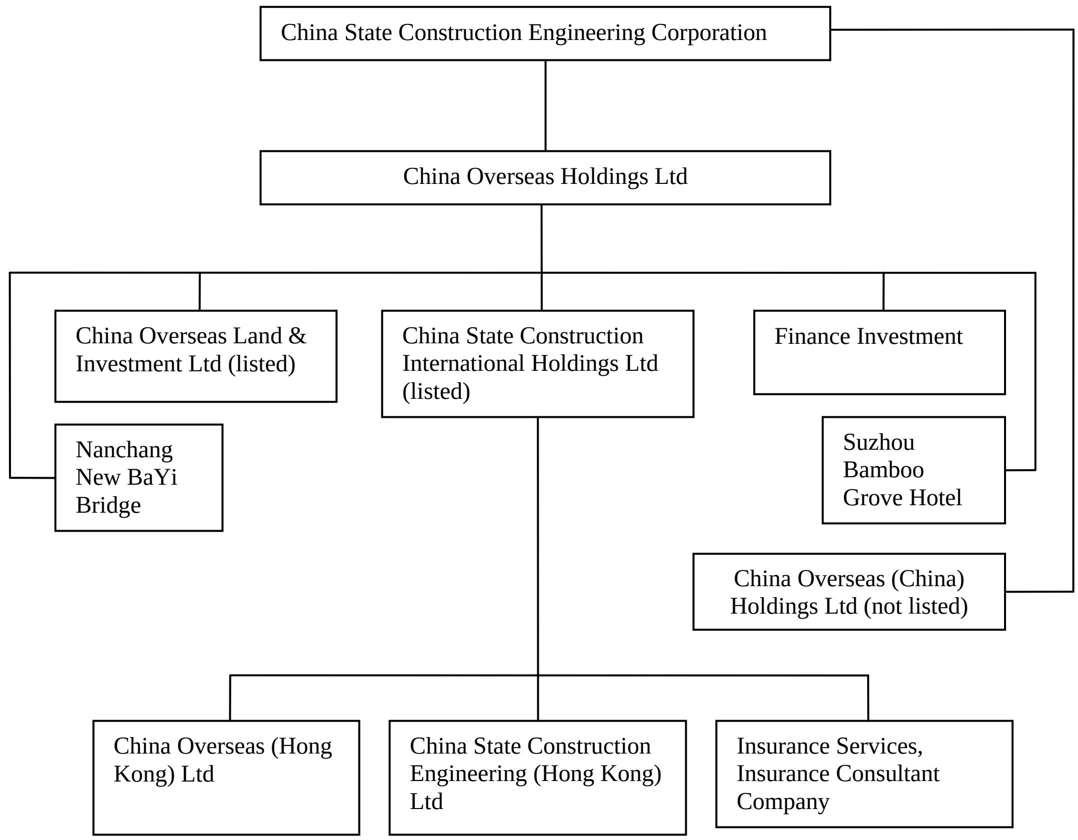

Figure 5.2 Corporate chart of CSCEC

These Chinese contractors normally have complex organization structure since they are multiple business organizations. They carry out their business in Hong Kong through subsidiary companies. For example, China State Construction Engineering (Hong Kong) Ltd and China Overseas (Hong Kong) Limited carry out the construction works in Hong Kong as the subsidiaries of China State Construction International Holdings Limited. With strong parent corporations, Chinese contractors have become important players in the Hong Kong construction industry with the benefits from the increasing coopration between Hong Kong and Mainland China.

International/Overseas Contractors

In general, Hong Kong's construction industry is open even to international contractors. Hence, this scenario has been exceptionally attractive to overseas contractors evidenced by Table 5.3 which shows the list of some contractors involved in Hong Kong's new airport core projects.

Table 5.3 International contractors involved in Hong Kong's airport core projects

Country	**Contractors**
Britain	Kier
	GPT(Exports)
	Tarmac
	GEC Alsthom
	John Laing International
	Balfour Beatty
	Amec
	Trafalgar House
	Costain
China	China Fujian
	CSCEC
France	GEC Alsthom
	CNIM
	GTM
	CFE
Germany	AEG
	Ed Zublin
Japan	Maeda
	Aoki
	Penta Ocean
	Mitsiu
New Zealand	Downer
Spain	Entrecanaies
	Cubiertas
	CAF

(Source: Walker, 1995)

As an example, Leighton Asia is a subsidiary of the Leighton Group, which is Australia's largest project development and contracting group. Moreover, Leighton Asia has been operating in Asia since 1975, and their combination of local knowledge and extensive international experience enabled it to become a regional international contractor. Besides Hong Kong, Leighton Asia operates in Macau, China, Mongolia, Taiwan, Korea, the Philippines, Guam, Thailand, Vietnam, Laos, and Cambodia. It also spans a number of specific market segments including civil and infrastructure, water, building, environmental services, rail, utility services, mining, facility and infrastructure management, marine, oil and gas, and telecommunications. The structure of the Leighton Group is shown in Figure 5.3.

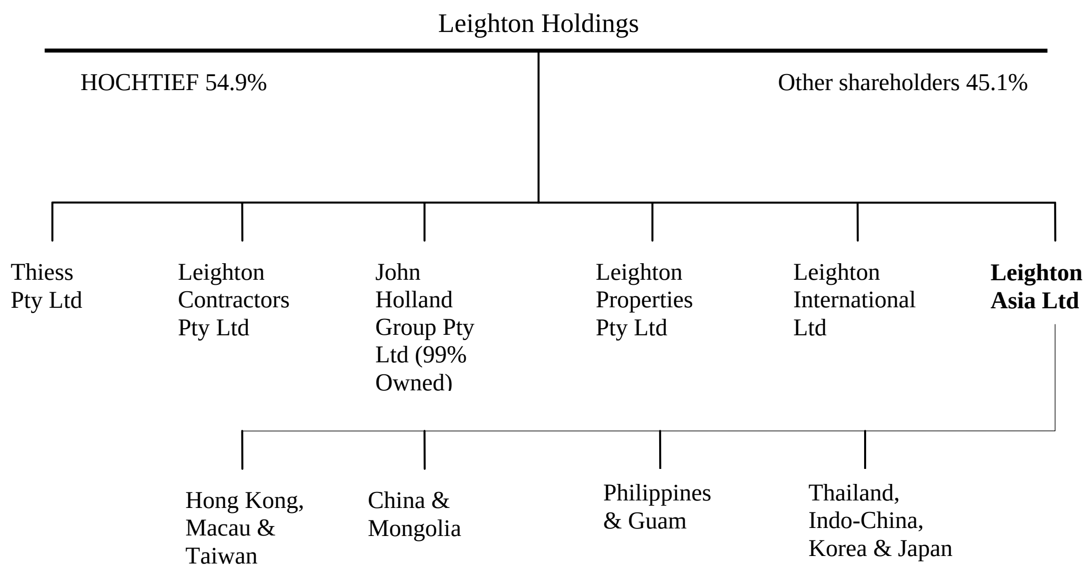

Figure 5.3 Structure of Leighton Group

Normally, international contractors consider Hong Kong as an important construction market in Asia. And Hong Kong market would be included in Asia subsidiary. For example, Hong Kong, Macau and Taiwan are grouped together in

Leighton Asia Ltd. The geographical closeness of the three regions makes it possible for Leighton Asia to improve the efficiency of management and resources allocation. Moreover, international contractors have competitive advantages in finance, technology and project management comparing with local contractors.

Localized Contractors

International contractors are deemed independent from their parent groups and localised after operating for a long time in the local construction market. These contractors have established firms based in Hong Kong which operate as a separate business entity. Compared with local and international contractors, they have an advantage since they can utilize resources from their parent groups back in their home country. In addition, they are capable of widening their local knowledge and making use of local expertise. In other words, they can take their advantage to both local and international positions. For the most part, these localised contractors are large and operate in all sectors, and they eventually capture a larger fraction of civil engineering works than local contractors. In terms of contract value, the localized foreign contractors only had 11% of the building market in public works contracts between 1992 and 1994. However, they performed much better in civil engineering sectors, wherein their market shares ranged between 31% and 75% (Chan, 1996).

Gammon is a private company that is jointly owned by Jardine Matheson, an Asian-based conglomerate with extensive experience in the region, and Balfour Beatty which is a world-class engineering, construction and services group. And its corporate structure is shown in Figure 5.4. Gammon's business covers many kinds of projects, namely:

- Commercial Development
- Residential Development
- Retail & Hotel Development
- Community Development
- Industrial Development
- Roads & Bridges
- Railways
- Tunnel
- Water & Waste Water
- Solid Waste Treatment

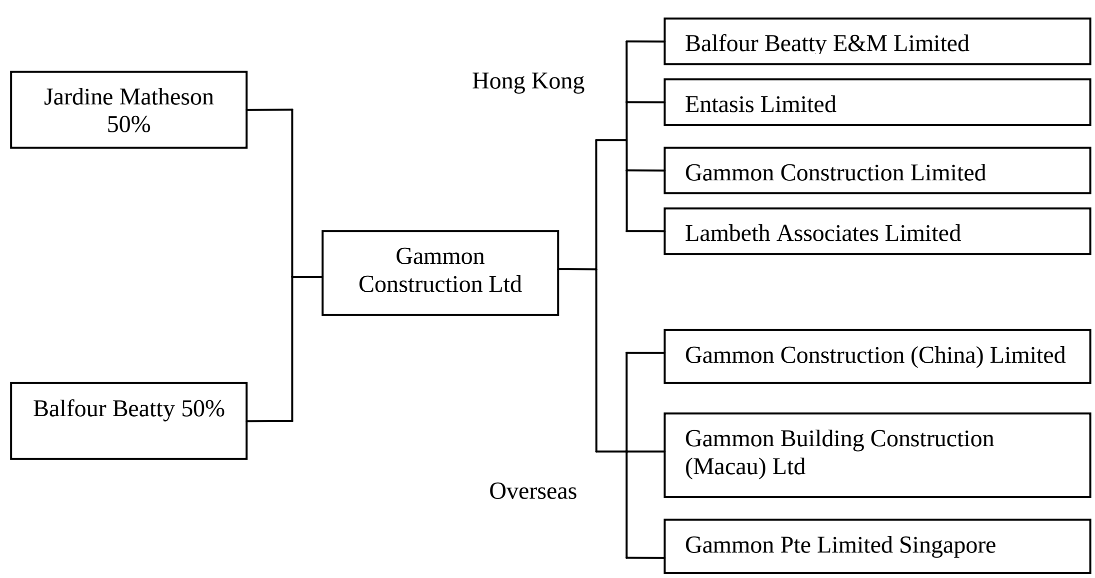

Figure 5.4 Gammon corporate structure (including major subsidiaries)

Gammon is a localised contractor of an international contractor (Balfour Beatty) combined with a local one (Jardine Matheson). Gammon is headquartered in Hong Kong and has subsidiaries in China, Macau and Singapore, as shown in Figure 5.4. With the support of the two owners, Gammon provides clients unique services with local experience, technical capability and financial strength. And Gammon has become a leading construction company in Hong Kong and established long-term relationships with its clients.

Small and Medium Local Contractors

The majority of local main contractors are small and medium sized, and are mostly family-owned companies operating in the market for several years. They engage in various kinds of works and most of them are on the lists for small or medium values of public works. Also, nearly all of them either work as property developers or developers themselves. As such, the number of these contractors will increase depending on the quantity of work. In contrast, their number will decrease if some will fall into bankruptcy. Chiang et al. (2001) conducted an analysis of the market structure of Hong Kong's construction industry. They found that large international and localized contractors dominate the civil engineering sector, most local small and medium contractors are left to intensively compete with each other in the private and public building sectors.

Developers' Contractors

Actually, there are large real estate developers based in Hong Kong. According to Business Week Online (2003), the three famous Hong Kong property firms, namely, Cheung Kong Holdings, Sun Hung Kai Properties, and Henderson Land Development, occupied the third, fourth, and eleventh positions of 18 Hong Kong firms placed on the Global 1000 list of largest firms. Generally, the major developers in Hong Kong have in-house or ‘inner-circle’ contractors. They are both vertically and horizontally integrated by virtue of being large firms. As Mintzberg (1979, 1981) argues, such large firms opt to produce for themselves rather than outsource. Besides, these large real estate firms have bargaining advantages. In fact, they have maintained long term business relationships with their small groups of contractors and such an association benefits developers and contractors both. As such, it saves the former’s time and cost for searching reliable contractors, while it facilitates the latter’s forward planning via some guarantee of workload (Chiang et al., 2001).

5.3 Internal Resources and Capabilities

An organization’s resource and how it is used are taken as an integral part in an internal environment analysis (Hunt, 2000). Thus, analyzing the internal resources and capabilities are critical for contractors to understand their competitiveness and develop their competitive strategy.

5.3.1 Corporate Image (Reputation)

An organization's reputation is established by the opinion of customers towards company products or services. Therefore, reputation management is increasingly becoming an important factor for business success (Griffin, 2002). In the construction industry, most construction firms display pictures of completed projects in their offices. Actually, this is used as an indirect mechanism to communicate their good reputation to clients and advisors. Generally, these projects are performing well in various aspects, namely, within budget, completed ahead of schedule, with high level of quality, and new technology or project management methods. Although pictures alone may convey images of impressive completed projects to clients, these are not enough to differentiate one firm from others in terms of reputation. They do not provide evidence on how the project was delivered differently by the firm. As for the clients and its advisors, the manner in which the project was executed to achieve its measurable objectives is important. Basically, reputation is built from the continued success of projects and has to be communicated in more explicit ways rather than just pictures or annual reports. Also, a good reputation can easily be squandered and it is much easier to lose than build. The properties of products and services that foster reputations can emerge through customer search activity, comparisons with other similar products or service, and immediate consumption or through long-term experience. Most of its added-value comes from market exchange relationships where judgments on quality are purely based on long-term experience. A reputation's value is also a source of distinctive capability, which determines the likelihood of a market's repeat business to continue once reputation has been built, maintained, and communicated. Hillebrandt et al. (1995) argues that firms have long standing interest with markets, and that reputation will certainly provide a distinctive capability.

5.3.2 Technology and Innovation

Innovation can also be another source of distinctive capabilities. Its process involves the complicated interactions between firms (Kay, 1993). However, it is often difficult to create a competitive advantage through innovation because it is costly and uncertain. Furthermore, it is hard to manage and secure rewards for firms through innovation alone. Thus, innovation will only be a competitive advantage when linked with other distinctive capabilities, particularly in organization structure. As a matter of fact, several innovations occur at the workface of large complex projects. Thus, organizational innovation, such as the offering of new services or repacking existing ones, is likely to happen when recessionary impacts affect a firm (Langford and Male, 2001).

Innovation in the construction industry has been examined by large number of researchers previously (Tatum, 1989; Slaughter, 1993; Nam and Tatum, 1997; Lampel et al., 1996; Bernstein, 1996; Larsson, 1996; Seaden and Manseau, 2001). And the drivers of innovation are also discussed in existing research. Bossink (2004) classified these drivers into four categories, namely, environmental pressure, technological capability, knowledge exchange, and boundary spanning. Such drivers are active at different levels in the cooperating organization network, which includes the industry, institutional and firm, and construction project levels. In this regard, Bossink (2004) also conducted an empirical research on the Dutch construction industry and found that drivers are used by managers of authorities, clients, architects, consultants, and contractors to stimulate and facilitate innovation processes. The research findings indicate that innovation in construction has become increasingly important in competition. On one hand, innovation would provide contractors an edge in competition. On the other hand, this would also be an important force that will propel the industry to evolve.

5.3.3 Financial Capability

Contractors' financial ability is considered as an important factor when competing for construction works. As such, financial capability is mostly deliberated during contractor pre-qualification and selection procedure (Lam et al., 2000; Wong et al., 2000; Hatush and Skitmore, 1997; Jennings and Holt, 1998). This aspect is also an important prerequisite for a successful development of privatized infrastructure projects, such as the Build-Operate-Transfer (BOT) type project. Zhang (2005) identified 35 financial criteria which measures the concessionaire's financial capability in four dimensions: "strong financial engineering techniques," "advantageous finance sources and low service costs," "sound capital structure and requirement of low-level return to investments," and "strong risk management capability."

In Hong Kong, a contractor's financial information is required by the Finance Unit of Environment, Transport and Works Bureau whenever they want to compete for public works contracts. As for contractors belonging on the Approved List, the following documents are needed (ETWB, 2004c):

(a) unconsolidated financial statements covering the period between the latest set of audited financial statements up to a date not earlier than 3 months before the date of submission;

(b) financial statements of Hong Kong Branch or Office covering period mentioned in (a) above, if the tenderer is not incorporated in Hong Kong;

(c) a list of current contracts held in hand with the Employer and the private sector including the Hospital Authority and the Housing Authority, both as main contractor or sub-contractor, with total and outstanding contract sums, contract period and time required to complete the outstanding portion of the contract; and

(d) bank letters or agreements on existing banking facilities such as term loans and overdraft.

5.3.4 Marketing Capability

There are many definitions for marketing. The Chartered Institute of Marketing has provided a detailed definition as "…*management function which organizes and directs all those business activities involved in assessing and converting purchasing power into effective demand for a specific product or service and in moving the product or service to the final customer so as to achieve the profit target or other* *objectives*" (CIM, 1973). Meanwhile, Woodruffe (1995) defined marketing as "… *identifying and satisfying the needs and wants of consumers by providing a market offering to fulfill those needs and wants through exchange processes profitably*". The central theme of these definitions emphasize on the management's process of identifying the customers' requirements, and for satisfying them while bringing profit to the company.

Typically, marketing plays a key role in a construction firm's strategic management, especially during times of recession. In effect, several bodies of research on the marketing and promotion of construction organizations have been conducted in recent decades (Fisher, 1986; Pearce, 1992; Fellows and Langford, 1993). In these studies, numerous construction firms were found to be purchasing, advertising, market research, and promotional design services (Preece and Male, 1997).

In reality, there are a number of complementary approaches to marketing, which have been developed in other industries as well. These approaches can be used as a reference for marketing in the construction industry and these are introduced as follows.

Marketing orientation

Marketing orientation is defined as an organization-wide intelligence generation, dissemination, and response to both current and future customer needs and preferences. In addition, most marketing oriented concepts focus its efforts on several factors, such as market focus, customer focus, and coordinated marketing (Langford and Male, 2001).

Relationship marketing philosophy

Morgan and Hunt (1994) characterized the relationship marketing philosophy as "*…all marketing activities directed towards establishing, developing and maintaining successful relational exchanges*". This concept emphasizes on generating relationships with customers based on a high degree of trust and commitment. Therefore, it states that long term relationships require 'mutuality of interest' among all parties (Blois, 1996). Moreover, a relationship marketing approach requires genuine commitment and continuous improvement (Christopher et al., 1991; Landeros et al., 1995).

Service quality and customer satisfaction

The basic objective of marketing orientation is to meet customer needs and requirements. Previous studies have developed various management models for achieving this objective, such as 'service quality', 'customer service', 'customer focus and orientation', 'customer satisfaction' and 'customer retention and loyalty'. When embedded in the company's culture, these methodologies can help sustain a firm's competitive advantage, increase customer loyalty, and improve company's performance. This culture would also compel all company employees to understand their responsibility in providing good service and meeting customer needs.

Internal marketing

As for service companies, employee relations are important since this can be reflected in customers' relations as well. The internal marketing concept reflects a supportive environment for employees, which in turn will be rewarded for giving a satisfactory service performance (Albrecht and Zemke, 1985; Rosenbluth and Peters, 1992). Rosenbluth and Peters (1992) likewise said that a company should primarily consider its employees if they hope to satisfy its customers fully. Basically, internal marketing mainly emphasizes on training and motivating both the management and employees to provide customers with high level of services (Heskett et al., 1990). An effective internal marketing can distinguish a service company from its competitors by consistently delivering high quality services to its customers (Baron and Harris, 1995).

Internal customer satisfaction

Who is the customer? Bowen (1986) suggests that:

"*… everybody should see himself as a customer of colleagues, receiving products, documents, messages, etc. from them, and he should see himself as a supplier to other internal customers. Only when customers are satisfied has a job been properly executed - it is the satisfied customer that counts irrespective of whether he is external or internal*".

Customer care

Customer care is all about "…*management of the total consumer experience of dealing with the producer…, …managing customer confidence…, … managing perceptions as well as realities*" (Cook, 1992). The related perceptions are the basic position which service quality can be improved from (Daniels, 1993). Clutterbuck (1988) asserts that this concept is a fundamental approach to service quality standards, and it covers every aspect of a company's operations. Furthermore, the customer care ideas have been widely used in manufacturing, service, and public sector industries, even in the construction industry (Smith and Lewis, 1989; Cook, 1992; Blackman and Stephens, 1993; Preece and Shafier, 1998). In view of this, customer care has since become an important approach for a customer-oriented company.

5.3.5 Project Management Skills

The construction performance relies extensively on project team work and problem solving at the site level. Hence, project management skills that are embedded to teams are important for the project's success.

The construction industry's business climate is becoming more dynamic since most contractors face increasing competition even in this declining market (Gretton, 1993). In such condition, several construction companies have begun questioning traditional project management philosophies and principles, which developed new demands for quality, productivity, and performance (Hayden, 1996). Project managers usually find themselves playing additional roles that have not been part of their responsibility ever since (Gilleard and Chong, 1996). In order to maintain its competitive advantage in the future, a construction firm has to focus more on adapting a project management function with reference to the changing industry conditions.

Evidently, there is an increasing demand for improving the performance of project management. A modern project management practice demands for additional knowledge that even extends beyond the technical aspects of traditional engineering areas. Such additional knowledge will include the following areas (Edum-Fotwe and McCaffer, 2000):

- Finance and accounting
- Sales and marketing
- Strategic planning
- Tactical planning
- Operational planning
- Organizational behaviour
- Personnel administration
- Conflict management
- Personal time management
- Stress management

5.3.6 Organization and Human Resources

Organization Structure

An organization structure is a formal framework by which organizational tasks are divided, grouped, and coordinated. The challenge is to design an appropriate organization structure that can facilitate employees to work effectively and efficiently. The primary aim of an effective organization structure is to achieve organization goals within the direction of a firm's strategy (Galbraith, 2002). Accordingly, structures vary among organizations in terms of strategy, size, technology, and environmental uncertainty (Lawrence and Lorsch, 1969). There are two generic organization designs, namely, mechanistic and organic designs. Mechanistic organizations are rigid, integrated, and tightly controlled with regard to standardization, extensive departmentalization, high formalization, and multi-layers management. In contrast, organic organizations are adaptive, differentiated, and flexible with the absence of standardization. For the latter, employees work in teams, having only little supervision and formalization, for solving various job-related problems (Sherman et al., 2006). An organization structure can either be one of the following:

For mechanistic organizations:

- Simple structure
- Functional structure
- Divisional structure

For organic organizations:

- Matrix structure
- Team-based structure and strategic business units
- Boundary-less/network organizations

The fitness between strategy, structure, and environment is significant for the achievement of organization objectives. Galbraith and Kazanjian (1986) and Sherman et al. (2006) proposed several guidelines for creating the fit between strategy, structure, and environment in their respective studies, which can be summarized as follows:

- Single-business and dominant-business companies should adopt a functional organization structure particularly in a stable market. This structure emphasizes specialization and operating efficiencies, while centralizing control and decision-making simulaneously.
- Related diversified organizations, especially in stable environments, should take a multidivisional form. An interrelated business should also be grouped to gain the advantages of operational and competency synergy. As such, corporate control should be minimized in areas where synergy exists and when diversity across business units is high.
- Unrelated diversified business, whether or not in stable or unstable environments, should assume a holding company (conglomerate) structure. Thus, functions such as finance, accounting, planning, legal, and others should be controlled at the corporate level where the staff acts to allocate capital and control corporate performance. In addition, operational decisions are decentralized within business units.
- Small and entrepreneurial firms should adopt a simple structure most especially in unstable markets. This structure emphasizes great flexibility, an all-hands philosophy, and minimizes indirect as well as overhead costs.

- Large firms in unstable markets should adopt networking structures. This allows them to gain competencies and to shed expense immediately. It also enables them to focus on developing their own core competencies while seeking superior partners and subcontractors.

Child (1984) argues that the fundamental requirements for the continuation of an organization's operations shall include allocation of responsibilities, the grouping of functions, decision making, coordination, control and reward. In most cases, a good structure can meet these requirements. Drucker (1990) argues that an appropriate organization structure design is important in determining an organization's performance. Specifically, an appropriate organization structure has to meet the following objectives (Saal and Knight, 1988):

- Economic and efficient organization performance and resource utilization
- Monitoring of the organization's activities
- Accountability for areas undertaken by groups and individual members of the organization
- Coordination of the various organization parts and areas of work
- Flexibility responding to developments and future demands, and in adapting to changing environments
- The social satisfaction of members working in an organization.

If an organization structure meets these objectives, their aims will be achieved with high performance. Otherwise, the organization will suffer from deficiencies, such as low motivation and morale, late and inappropriate decisions, conflict and lack of coordination, poor response to external changes, and low organization performance (Child, 1984).

Human Resource Management

Human Resource Management (HRM) plays a crucial role in organizations. An effective HRM could be one of the organization's competitive advantages (Amit and Belcourt, 1999). Generally, HRM can be considered as the core process of a project-oriented company. It affects the way an organization acquires and uses human resources, and how employees experience their employment relationship with the company (Huemann et al., 2007). However, there are specific HRM features in a project-oriented company. These features are:

- "Managing by projects" as the project oriented company's strategy;
- Temporary nature of projects;
- Dynamism;
- Project-portfolio resource and multi-role demands;
- Specific management paradigm.

Since all construction companies are project-oriented, they should consider HRM as a vital component in their strategic management. Additionally, the construction industry is knowledge-based and people-intensive. Thus, experienced employees are valuable resources for construction companies indeed. Moreover, effective training is likewise important in keeping human resource at a high quality. For instance, there is a localized general contractor based in Hong Kong famous for its training system, and its employees are very popular in the industry. Therefore, human resource is one of the most important internal resources which can provide a construction company its competitive edge.

5.4 Internal Resources and Their Embodied Competitiveness

Effective internal resource utilization can help contractors gain their competitiveness. Typically, in a bidding process, contractors can improve their competitiveness by allocating effectively their resources while meeting client's multiple objectives. Clients often define multiple project objectives in their tender documentation. Contractors then submit tenders in line with the documentation's specifications. Normally, an individual contractor will submit a competitive bid as much as possible. This bid represents the optimal allocation of a contractor's resources to meet the multiple objectives defined in the said document. Hence, it enables the contractor to present its own maximum total competitiveness. Goal programming (GP) technique can be used to assist contractors achieve the aim of maximizing their total competitiveness. GP is a quantitative tool which enables a decision-maker to possibly satisfy various goals (objectives) as well as the constraints in dealing with linear problems (Eppen et al., 1993).

5.4.1 A Goal Programming Model for Optimal Resource Allocation

In using GP technique, multiple objectives and resources constraints have to be defined. The project objectives may include construction cost, construction time, quality standard, safety performance and environment performance, denoted as $b_i, i = 1,2,...,m$. In a particular application, it is assumed that these objectives will be given with different priorities by the project client with considering the characteristics of the project concerned. For example, construction cost is generally considered as more important in implementing building projects. Construction time may be considered as more important for a public school building which may need to be completed before a new term. In general, client will award a contract to the contractor who can best achieve all project objectives with considering the priorities of the objectives. Therefore, a contractor needs to decide the optimal way of using his competence resources indicated by multiple attributes, such as technical ability, management skill, financial capability and human resource, denoted as $x_j, j = 1,2,...,n$. The way should allow the contractor to achieve to the largest extent the project multiple objectives specified by client if the contractor wishes to demonstrate his maximum competitiveness. The scenario of this type can be described as a GP type problem, where an optimal decision is pursued on how to use the available resources ($x_j, j = 1,2,...,n$) in committing a contract which is designed to complete multiple objectives $b_i, i = 1,2,...,m$ with different priority orders. The goal programming model of this optimal bidding problem can be built up through the following analysis.

Consider that a contractor works for achieving objective $b_i, i = 1,2,...,m$ by consuming his competence resources $x_j, j = 1,2,...,n$. This can be expressed as:

$$g_i(x_1, x_2,..., x_n) \cong b_i \qquad (for \quad i = 1,..., m) \qquad (5\text{-}1)$$

The left side of model (5-1) denotes the contractor's actual performance in contributing to the objective b_i by using competence resources $x_j, j = 1,2,...,n$. The right side is the client's specification on the objective. The inequality between the left and right indicates what a contractor can contribute to an objective may not be the same as the specified outcome. For example, the actual construction time in implementing a typical building project is often different (either longer or shorter) from the contract time (Shen et al., 2001).

On the other hand, the actual performance by the contractor is the output of consuming competence attributes. This can be written as:

$$g_i(x_1, x_2,..., x_n) = \sum_{j=1}^{n} \omega_{ij} x_j \qquad (for\ i=1,\ldots,m) \qquad (5\text{-}2)$$

where ω_{ij} is the contribution coefficient representing the contribution by consuming each unit of the resource attribute x_j to the implementation of the objective b_i. By integrating (5-1) and (5-2), the following can be obtained:

$$\sum_{j=1}^{n} \omega_{ij} x_j \cong b_i \qquad (for \quad i = 1,..., m) \qquad (5\text{-}3)$$

Model (5-3) can be converted into an equation by introducing two non-negative parameters, for example, u_i and v_i:

$$\sum_{j=1}^{n} \omega_{ij} x_j + u_i - v_i = b_i \qquad (u_i \geq 0, v_i \geq 0) \qquad \textit{(for i=1,…,m)} \qquad (5\text{-}4)$$

where u_i and v_i are exclusive, namely, when u_i carries a value, v_i will be zero; and *vice versa*. In model (5-4), if a value of u_i exists (implying that v_i is zero), there will be a relation $\sum_{j=1}^{n} \omega_{ij} x_j < b_i$. This indicates that the expected outcome of the objective b_i is underachieved. Otherwise, when v_i carries a value, there is the relation $\sum_{j=1}^{n} \omega_{ij} x_j > b_i$, indicating that the actual performance exceeds the specified outcome (objective) b_i.

Therefore, the difference between $\sum_{j=1}^{n} \omega_{ij} x_j$ and b_i, which is represented by u_i+v_i, can be used to indicate the level of a contractor's performance in contributing to the objective b_i. The smaller the value u_i+v_i is, the better the contractor's performance is. Therefore, a contractor's performance in achieving objective b_i can be considered of highest level if the minimum value ($u_i + v_i$) is obtained. In other words, the aim for a contractor to achieve his best performance in contributing to the objective b_i is to minimize the value ($u_i + v_i$), and this can be expressed as:

$$Z_i = Minimum(u_i + v_i) \qquad \text{(for } i = 1, \ldots, m) \qquad (5\text{-}5)$$

Assume that project client will impose a priority order among the major project objectives b_i ($i=1,\ldots,m$). A priority grade p_i is introduced to indicate the priority of the objective b_i. Therefore, a contractor should allocate his resources with considering the priorities of project objectives. This resource allocation plan should enable the contractor to present his best competitiveness by achieving minimum ($u_i + v_i$) to all objectives b_i ($i=1, \ldots, m$), and this can be expressed as:

$$Z = Minimum \sum_{i=1}^{m} p_i (u_i + v_i) \qquad \text{(5-6)}$$

where p_i assumes higher value if the project client gives higher priority to the implementation of objective b_i.

On the other hand, the limitation or availability of the contractor's resources should be considered when the contractor plans the performance level which he wishes to achieve. The resource limitation or availability can be expressed as:

$$x_j \leq x_j^0 \qquad (for\ j = 1, 2, \ldots, n) \qquad \text{(5-7)}$$

where x_j^0 represents the contractor's maximum capacity of the competence resource attribute x_j.

In summary, a contractor's optimal bidding strategy is to use his resources in a way that can enable the pursuance of model (5-6) whilst the resource contribution conditions in (5-4) and the resources constraints in (5-7) are met. This optimal bidding strategy can be expressed by a goal programming model:

$$Z = Minimum \sum_{i=1}^{m} p_i (u_i + v_i)$$

$$\begin{cases} \sum_{j \in 1}^{n} \omega_{ij} x_j + u_i - v_i = b_i \\ x_j \leq x_j^{\ 0} \\ u_i, v_i, b_i, p_i, \omega_{ij}, x_j, \geq 0 \\ i = 1, \ldots, m;\ j = 1, \ldots, n \end{cases} \tag{5-8}$$

where the component "$\sum_{j=1}^{n} \omega_{ij} x_j + u_i - v_i = b_i$" is called goal constraints, implying that the specified objectives (or goals) are achieved with allowing certain level of variations. The component "$x_j \leq x_j^{\ 0}$" represents the resources constraints which must be strictly met, called as system constraints. The solutions of x_j in the model formulate the optimal bidding strategy. And the model is called the goal programming model for optimal bidding strategy (GP-OBS). A hypothetical example will be used in the following sections to demonstrate the procedures of finding out the optimal bidding strategy from the model.

5.4.2 A Hypothetical Example

A hypothetical example is used here for demonstrating the formulation of the GP-OBS for a typical application. For simplicity, the example involves only three project objectives and two resource attributes, including the objectives of construction cost b_1, construction time b_2 and quality standard b_3, and the attributes of technical ability (TA) x_1 and management skill (MS) x_2. This hypothetical case concerns a high rising building project. The three project objectives defined by the client are: $2 million for the construction costs, 382 days construction time and level

8 quality standard (whereas level 10 indicates the highest quality standard). The client's priorities among the objectives are in the order of cost, time and quality. Assume that the contractor considering submitting a bid has the resource capacities amounted to $6 \leq x_1 \leq 10$ and $6 \leq x_2 \leq 10$. Level 6 capacity indicates the contractor's minimum strength by which he can achieve an acceptable level of performance standard, and level 10 indicates the contractor's maximum capacity. It is assumed that by using the contractor's basic competence (namely, when x_1=6 and x_2=6), the outcomes in implementing project objectives will be $2.21 million construction cost, 412 days construction time, and level 6 quality standard. It can be seen that the client's specifications on the project objectives are higher than the contractor's performance levels if the contractor only applies his basic competence. The differences can be noted in Table 5.4.

Table 5.4 Difference between client's specifications on project objectives and the basic performance by contractor in a hypothetical example

Project objective	**Client's specification**	**Basic performance by contractor**
Construction cost	$2millioin	$2.21million
Construction time	382 days	412 days
Quality standard	Level 8	Level 6

Nevertheless, contractor's performance can be improved by raising the input level of his competence resources, thus the distance in performance can be reduced. It is the contractor's goal to minimize the distance of his performance from the client's specification. This distance in performance becomes contractor's goal variable, equivalent to the goal variables b_i in GP-OBS model (5-8). Thus the contractor's goal variables can be specified as:

- Objective (goal) b_1 (cost reduction) : \$2.21million – \$2million = \$0.21(million)
- Objective (goal) b_2 (time reduction) : 412 days – 382 days = 0.3 (hundred days)
- Objective (goal) b_3 (quality improvement) : Level 8 – Level 6 = 2 (level)

The contractor's best bidding strategy in this case is to achieve the goal of minimizing distance in performance b_1, b_2 and b_3. To achieve this goal, the utilization of the resources (namely, technical ability x_1 and management capability x_2) needs to be raised. It is estimated that using each unit of increment of technical ability (x_1-6) can contribute to the objective b_1 (cost reduction) with \$30,000, to the objective b_2 (time reduction) with 5 days, and to the objective b_3 (quality improvement) with 0.25 level. Thus, the following contribution coefficients can be established:

- ω_{11} = 0.03 (million dollars reduction per unit of technical ability increment)
- ω_{21} = 0.05 (hundred days reduction per unit of technical ability increment)
- ω_{31} = 0.25 (level of quality improvement per unit of technical ability increment)

Similarly, it is estimated that using each unit of the increment of the management capability (x_2-6) can contribute to the objective b_1 (cost reduction) with \$40,000, to the objective b_2 (time reduction) with 5 days, and to the objective b_3 (quality improvement) with 0.25 level. Therefore, the following contribution coefficients are obtained:

- ω_{12} = 0.04 (million dollars reduction per unit of management skill increment)
- ω_{22} = 0.05 (hundred days reduction per unit of management skill increment)
- ω_{32} = 0.25 (level of quality improvement per unit of management skill increment)

By applying the above assumptions to model (5-8), the following goal programming model can be formulated:

$$
\begin{aligned}
Z &= Minimum \sum_{i=1}^{3} p_i (u_i + v_i) \\
&= Minimum\{p_1(u_1 + v_1) + p_2(u_2 + v_2) + p_3(u_3 + v_3)\}
\end{aligned}
$$

$$
\text{S. t.} \quad \begin{cases}
0.03(x_1 - 6) + 0.04(x_2 - 6) + u_1 - v_1 = 0.21 & \langle 1 \rangle \\
0.05(x_1 - 6) + 0.05(x_2 - 6) + u_2 - v_2 = 0.3 & \langle 2 \rangle \\
0.25(x_1 - 6) + 0.25(x_2 - 6) + u_3 - v_3 = 2 & \langle 3 \rangle \\
6 \le x_1 \le 10 & \langle 4 \rangle \\
6 \le x_2 \le 10 & \langle 5 \rangle \\
u_1, u_2, u_3, v_1, v_2, v_3 \ge 0
\end{cases}
$$

The above model can be rewritten as the following GP-OBS model:

$$
Z = Minimum\{p_1(u_1 + v_1) + p_2(u_2 + v_2) + p_3(u_3 + v_3)\}
$$

$$
\text{S. t.} \quad \begin{cases}
0.03x_1 + 0.04x_2 + u_1 - v_1 = 0.63 & \langle 1 \rangle \\
0.05x_1 + 0.05x_2 + u_2 - v_2 = 0.9 & \langle 2 \rangle \\
0.25x_1 + 0.25x_2 + u_3 - v_3 = 5 & \langle 3 \rangle \\
6 \le x_1 \le 10 & \langle 4 \rangle \\
6 \le x_2 \le 10 & \langle 5 \rangle \\
u_1, u_2, u_3, v_1, v_2, v_3 \ge 0
\end{cases} \qquad (5\text{-}9)
$$

5.4.3 Solution-finding by Using Graphical Method

To demonstrate the solution-finding to GP-OBS model (5-9), graphical method is used through the following procedures:

Step one

The solution-finding procedures in using graphical method will start from formulating the feasible region. This formulation will firstly consider the system constraints which must be met. By using the system constraints <4> and <5> in model (5-9), a feasible region (FR) can be identified, as shown by the shaded area ABCD in Figure 5.5. FR can be expressed analytically as:

$$\text{FR} \begin{cases} 6 \leq x_1 \leq 10 \\ 6 \leq x_2 \leq 10 \end{cases}$$

Step two

On the basis of the feasible region FR, consideration is given to the first priority goal constraint <1> in model (5-9), which corresponds to the first priority goal, namely, $Min\{u_1+v_1\}$. The solution for achieving the goal has to meet both the system constraint (FR) and the goal constraint <1>. Thus, the examination needs to be given to see if the constraint <1> and FR have a joint area. The results of incorporating the goal constraint <1> to FR can be discussed by referring to Figure 5.6.

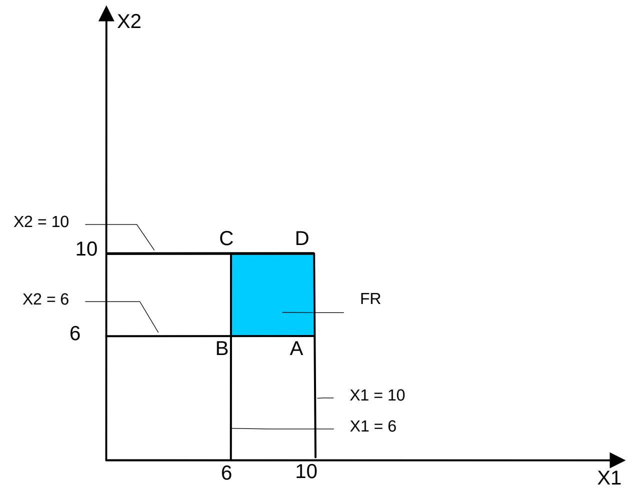

Figure 5.5 System Constraint (a hypothetical example)

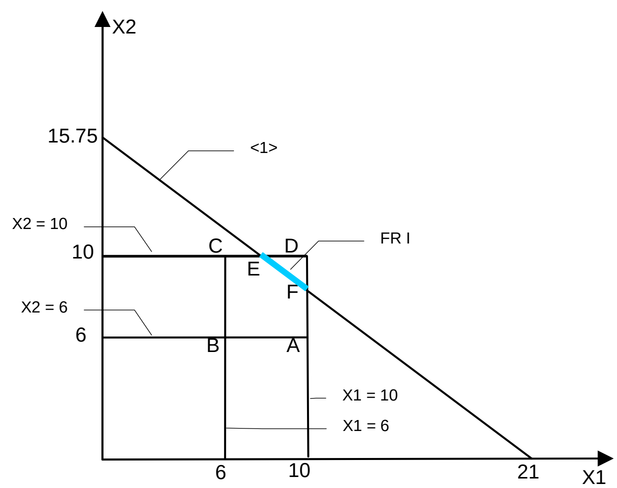

Figure 5.6 Feasible solutions for meeting the first priority goal (a hypothetical example)

In Figure 5.6, the goal constraint <1> can be described with a particular line when u_i and v_i assume specific values. Considering the goal $Min\{u_1+v_1\}$, it can be noted that the best result of the goal can be obtained when $u_1= 0$ *and* $v_1=0$. When $u_1= 0$ *and* $v_1=0$ are assumed, the goal constraint <1> becomes the line "$0.03x_1 +0.04x_2 =0.63$" , depicted in Figure 5.6. And it can be seen that this line meets the FR within the range EF. This indicates that all the solutions the area EF can satisfy both FR and the first priority goal constraint <1>. The area EF becomes a new feasible region, denoted as FR-I, which can be expressed analytically as follows:

$$\text{FR-I} = \begin{cases} \text{FR} \\ \\ 0.03x_1 + 0.04x_2 = 0.63 \end{cases} = \begin{cases} 6 \leq x_1 \leq 10 \\ 6 \leq x_2 \leq 10 \\ 0.03x_1 + 0.04x_2 = 0.63 \end{cases}$$

<u>*Step three*</u>

On the basis of the results obtained from step two, the next consideration is given to the second priority goal, namely, $Min\{u_2+v_2\}$ by incorporating the second goal constraint <2> into the feasible area FR-I. For achieving the best result of the goal, it is assumed that $u_2 = 0$ *and* $v_2 = 0$. This makes the goal constraint <2> become the line "$0.05x_1 + 0.05x_2 = 0.9$", depicted in Figure 5.7. It can be seen that the line <2> meets the FR-I (EF) at the point "O". Therefore, the point "O" becomes the feasible region, denoted as FR-II, satisfying both FR-I and the second priority goal constraint <2>. FR-II can be expressed analytically as follows:

$$\text{FR-II} = \begin{cases} \text{FR-I} \\ \\ 0.05x_1 + 0.05x_2 = 0.9 \end{cases} = \begin{cases} 6 \leq x_1 \leq 10 \\ 6 \leq x_2 \leq 10 \\ 0.03x_1 + 0.04x_2 = 0.63 \\ 0.05x_1 + 0.05x_2 = 0.9 \end{cases}$$

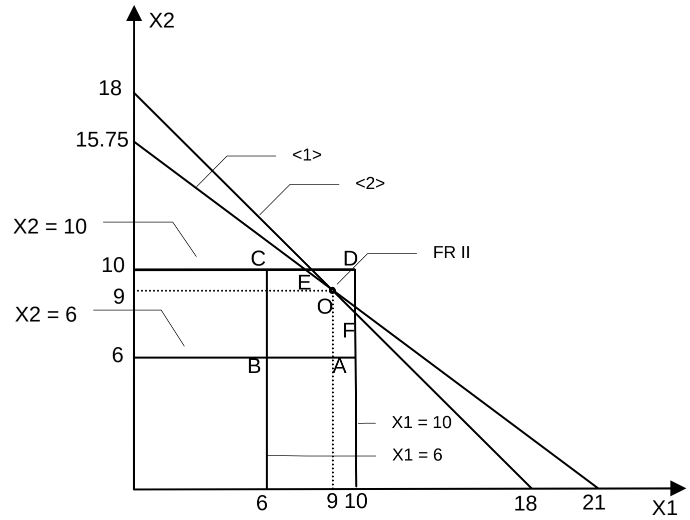

Figure 5.7 Feasible solutions for meeting first & second priority goals (a hypothetical example)

Step four

This step is to incorporate the third priority goal, *Min*$\{u_3+v_3\}$, by incorporating the third priority goal constraint <3> in model (5-9) to the feasible region FR-II. When the assumption of $u_3= 0$ *and* $v_3=0$ is given, the line <3> $0.25x_1 + 0.25x_2 = 5$ can be formulated, as shown in Figure 5.8. However, this line does not meet the feasible area FR-II (the point "O"). In order to meet FR-II, the line has to move towards the left-down direction by a distance. It can be found that when u_3 assumes a value of 0.5, the goal constraint <3> becomes the line "$0.25x_1 + 0.25x_2 + 0.5= 5$", and this line will meet the point "O". The point "O" is the feasible solution satisfying the following constraints:

$$\text{"O"} = \begin{cases} \text{FR-II} \\ 0.25x_1 + 0.25x_2 + 0.5 = 5 \end{cases} = \begin{cases} 6 \le x_1 \le 10 \\ 6 \le x_2 \le 10 \\ 0.03x_1 + 0.04x_2 = 0.63 \\ 0.05x_1 + 0.05x_2 = 0.9 \\ 0.25x_1 + 0.25x_2 = 5 - 0.5 \end{cases}$$

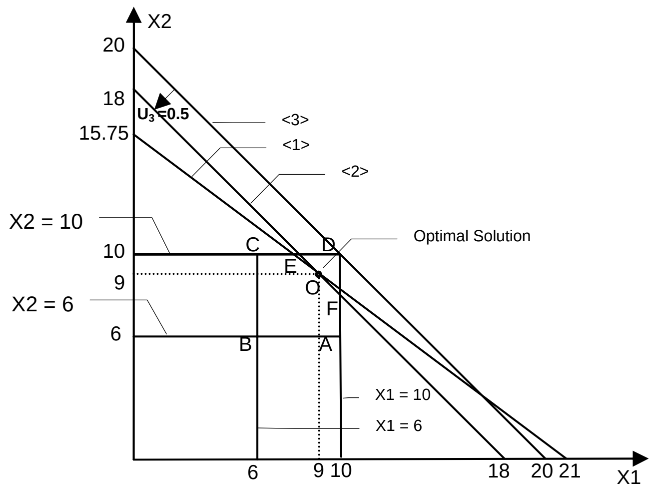

Figure 5.8 Feasible solutions for meeting all goals (a hypothetical example)

By completing the above four steps, the solution of model (5-9) is identified graphically as the point "O" in Figure 5.8. This point (solution) is measured by x1=9; x2=9; u3=0.5; u1= u2= v1= v2= v3=0. It indicates that the contractor's best plan in bidding for the project is to use level-9 of his technical ability and level-9 of his management capability, which will enable him to present his maximum competitiveness. By this plan, the contractor will be able to complete the project with the costs of $2 million and construction time of 382 days, which are same as the client's specifications. In other words, with the optimal plan, the contractor can fully meet the first and second priority objectives defined by the project client. The contractor can achieve a reasonably good quality standard, grade 7.5, whilst the client's specification on quality standard is grade 8. Namely, the contractor can meet the client's third priority objective (quality standard of grade 8) with a shortage of 0.5 grade.

Obviously, the above example is a simplified hypothetical sample. In a real application, a GP-OBS can become too sophisticated to analyze by using graphical method. The major limitation of using graphical method is that the technique can only be applicable when there are only two decision variables. However, applications of goal programming technique usually include more than two variables. When more decision variables are incorporated, computing package will be employed.

Overall, the GP-OBS model demonstrates how internal resources affect a contractor's competitiveness and competition strategy. Although only a hypothetical example was used for discussing the development of the GP-OBS model, its principle was proven effective. The GP-OBS model provides a new approach for contractors to present their maximum competitiveness in competition.

5.5 Summary

Hong Kong contractors have diverse backgrounds and can be further divided into four, namely the local, Chinese, international, and localized international contractors. This chapter presented the characteristics of these contractors with demonstration of some examples. It provides useful information for both existing contractors as well as the new entrants to analyze their potential competitors in the industry.

The organization structure of different contractors is analyzed and its importance is likewise discussed. A good structure would make an organization operate both effectively and efficiently, and can also contribute to its superior performance. Internal resources are also considered important for organizations during the process of formulating their competitive strategy. In addition, a contractor's internal resources can be analyzed from six facets, including reputation, technology and innovation, marketing, financial capability, project management skills, and human resource. Overall, these resources could be a source of the firm's competitive advantage while an identification of competitive resources would bring about the formulation of competitive strategies for those competing within the typical market segmentation.

The development of GP-OBS model provides contractors with an alternative method to allocate their resources in an optimal way and to maximize their competitiveness. It also demonstrates that a diverse resource allocation presents varying competitiveness levels. Therefore, internal resources can be employed to present contractors' competitiveness and shall be discussed in next chapter.

CHAPTER 6 CONTRACTOR COMPETITIVENESS

CHAPTER 6 CONTRACTOR COMPETITIVENESS

6.1 Introduction

Competitiveness is a comparative concept reflecting the ability and performance of a firm, an industry, or a country. Improving competitiveness has been the concern of many entities, and this is particular the case in the construction industry. In this chapter, a competitiveness indicator system is established and the key competitiveness indicators (KCIs) are identified for measuring contractors' competitiveness. With the identified KCIs, a fuzzy competitiveness rating method is introduced to assess contractors' competitiveness.

6.2 Contractor Competitiveness and Measurement System

Factors affecting organizational competitiveness have close association with the structure and practice of an industry. Porter (1980) suggested five major forces determining the competition practice within an industry, namely, industry competitors, potential entrants, suppliers, buyers, and substitutes. In the construction industry, competitiveness is generally used for ranking contractors in a bidding process. Previous studies have presented several methods for assessing contractor competitiveness in prequalifying and short-listing tenders. The study by Flanagan and Norman (1982), for example, suggests measuring a bidder's competitiveness by the bidder's previous success rate, which is calculated by a percentage of the bidder's successful contract value to its total bids within a certain period. Drew and Skitmore (1993) defined contractor bidding competitiveness as a percentage of the difference between the concerned contractor's bid and the lowest bid among all bidders to the lowest bid. Shen et al. (1999) developed an optimal bid model to help contractors in determining an optimal level of tender price and contract time to maximize its overall competitiveness.

In another study, Li et al. (2002) introduced a multilevel parameter model for assessing contractor's competitiveness after analyzing the construction business environment in China. Based on the study by Li et al. (2002), Shen et al. (2003) developed a Windows-standard decision support system called the Contractor's Competitiveness Assessment Scoring System (C-CASS) used for assessing contractors' total competitiveness value in the context of China's construction industry. In a further study, Shen et al. (2004) identified the model adopted to award construction contracts on a multi-criteria basis in China by taking into account both a contractor's competitiveness and the defined project objectives. This model presented a comprehensive list of competitiveness parameters.

As an extension to the study by Shen et al. (2004), a competitiveness indicator system for measuring contractors' competitiveness in the Hong Kong construction industry will be established. An index value is used for measuring the significance of individual competitiveness indicators by which the KCIs are to be identified. Data used in the analysis were collected through a survey to the construction industry in Hong Kong. The research results provide insights into the practice of what affects contractors' competitiveness in the Hong Kong construction market. The identified

KCIs are considered important to help contractors understand their strengths and weaknesses, thus improve the effectiveness of formulating competitive strategies in competition. The research findings from studying the local construction industry are valuable references for examining competition practice of construction industries in other countries or regions.

6.3 Contractor Key Competitiveness Indicators (KCIs)

6.3.1 Contractor Competitiveness Indicators

The identification of contractor competitiveness indicators has been extensively examined in previous studies. For example, the study by Holt et al. (1994) classified competitiveness indicators under five groups: contractor's organization, financial considerations, management resource, past experience, and past performance. Each group includes various specific indicators. Hatush and Skitmore (1997) proposed a set of alternative criteria classified into five categories for assessing contractor competitiveness: financial soundness, technical ability, management capability, health and safety, and reputation. The study by Lam et al. (2000) presented an artificial neural network as a decision support tool for prequalifying contractors through the examination of the multiple contractor competitiveness variables including technical strength, financial status, and others. The study by Shen et al. (2003) has presented a more comprehensive set of contractor competitiveness indicators in the development of a model for calculating a contractor's total competitiveness value (TCV). The TCV model incorporates contractor competitiveness indicators classified under six categories, namely, social influence, technical ability, financing ability and accounting status, marketing ability, management skills, and organizational structure and operations.

However, the applicability of these indicators introduced in previous studies to the Hong Kong construction industry has not been examined. The examination on the existing studies and the local construction industry leads to the formulation of an alternative list of competitiveness indicators. The validity of the list for application in the Hong Kong construction industry was tested through a number of selected professional interviews in the local construction industry. The interviewees were invited to review the list and gave their comments and suggestions. The researcher gave relevant explanations when interviewees had many question. With their valuable comments and suggestions, relevant modification has been made to the list. The interviews helped in improving the clarity and readability of the indicators. And the preliminary list of indicators for measuring contractors' competitiveness is identified as presented in Table 6.1.

Table 6.1 Preliminary list of indicators for measuring contractors' competitiveness

Section I : Indicators Measuring Corporate Image	
I-1	Recognized grading for company (e.g., Category A, B, or C)
I-2	Professional qualifications of project manager
I-3	Business coverage and market share (by region)
I-4	Business coverage and market share (by industrial sectors)
I-5	Business specialism (design, construction, etc.)
I-6	Organization's credibility
I-7	Bank credibility rating
I-8	Project quality awards
I-9	Project safety performance records
I-10	Project environment and hygiene performance records

I-11	Corporate identity
I-12	Compatibility with the local culture
I-13	Social conscience and responsibility
Section II : Indicators Measuring Technology and Innovation	
I-14	Capacity of construction equipment and plant
I-15	Capacity of construction equipment and plant per staff
I-16	Proportion of advanced construction equipment and plant
I-17	Utilization efficiency of equipment and plant
I-18	Equipment/plant depreciation rate
I-19	Establishment of research unit and strength of research staff
I-20	Level of investment on Research & Development
I-21	The rate of applying the new technology developed internally
I-22	Level of external dissemination of the new technology
I-23	Number of the technical patents owned by the organization
I-24	Number of technical patent transfers
I-25	Number of professional staff
I-26	Number of technical staff
I-27	Adequacy of administrative staff
I-28	Standing of technology advancement within the industry
I-29	Extent of applying information technology
I-30	Conversant with the local practice
Section III : Indicators Measuring Financial Capability	
I-31	Credibility grade certified by relevant financial bodies
I-32	The value of annual loans obtained
I-33	Knowledge about financial policy
I-34	Effectiveness of communication with banker and financial institutions
I-35	Organizational assets status
I-36	Organizational profit status
I-37	Organizational debt status
I-38	Growth rate of the organizational total assets
I-39	Growth rate of the organizational profit
I-40	Growth rate of gross output
I-41	Capability of loan repayment
I-42	Payment to subcontractors/suppliers on time
Section IV : Indicators Measuring Marketing Capability	
I-43	Geographical regions of business activities
I-44	Scope of business activities

I-45	Ability and facilities for managing market information
I-46	Ability to forecast the changes of market conditions
I-47	Past success rate in prequalification exercises
I-48	Past success rate in the final bidding stage
I-49	Value of annual contract works
I-50	Membership in relevant government advisory committees
I-51	Relationship with government departments
I-52	Relationship with private sector developers
I-53	On the tender list for government works
I-54	On the tender list for private sector developers
I-55	Relationship with news media
I-56	Relationship with subcontractors and suppliers
I-57	Relationship with the public
Section V : Indicators Measuring Project Management Skills	
I-58	Availability and effectiveness of quality management system
I-59	Performance during the warranty period
I-60	Number of quality awards and punishments
I-61	Number of major accidents over the past three years
I-62	Effectiveness of time management
I-63	Previous records about construction delays
I-64	Proportion of liquidated damage to project total value
I-65	Effectiveness of cost control methods
I-66	Establishment of contract administration system
I-67	Availability and competence of contracts manager
I-68	Effectiveness in settling contract dispute through negotiation
I-69	Ratio of successfully committed contracts
I-70	Number of contract disputes
I-71	Ratio of dispute settlement cost to contract sum
I-72	Effectiveness of coordination with subcontractors
I-73	Effectiveness of site management
I-74	Effectiveness of site safety management
I-75	Effectiveness of financial management
I-76	Knowledge about the local construction law
I-77	Effectiveness of accident settlement process
I-78	Effectiveness of environmental protection measures
I-79	Availability and effectiveness of risk management system
Section VI : Indicators Measuring Organization and Human Resources	

I-80	Ratio of technical and professional staff in the organization
I-81	Staff salary scale relative to those of other organizations within the industry
I-82	Career prospect within organization
I-83	Availability of resources and programs for training
I-84	Appropriateness of organizational structure
I-85	Appropriateness of personnel structure
I-86	Mechanism for staff recruitment
I-87	Mechanism of distributing benefits and reward
I-88	Existence of strategies for human resources development

6.3.2 Data Survey

Based on the preliminary list of indicators, a questionnaire survey was conducted to collect the data for identifying the KCIs during the period of November 2004 to February 2005. All 338 contractors included in the Hong Kong Construction Association List (2004/2005) were approached through mailed questionnaires, which were addressed to the General Manager of the individual firms. Thus, 338 questionnaires were distributed. The questionnaire was designed to collect the judgmental opinion from practitioners on the value of the relative significance of each competitiveness indicator. Respondents were invited to provide their opinion by indicating a particular grade against each indicator. Table 6.2 shows a sample portion of the questionnaire. For improving the response rate, a reminder letter with the questionnaire is sent to those non-respondents after the deadline in the initial mailings. It is proved that the reminder letter can effectively improve the response rate of a questionnaire survey. Finally, there were 81 valid replies, giving a response rate of 24 percent (81/338).

Table 6.2 A sample portion of the questionnaire table in the survey

A Survey on Improving Contractors' Competitiveness in Hong Kong	
INSTRUCTION	
A preliminary list of indicators is included in this questionnaire for assessing contractors' competitiveness with particular reference to the Hong Kong construction industry. We are going to identify the Key Competitiveness Indicators (KCIs) based on professional opinion. There may be other indicators not included on this list. Please identify them as you go through the list. Please indicate the degree of importance of each indicator for measuring contractors' competitiveness by selecting one of the five alternatives: 5-Extremely important; 4-Important; 3-Average; 2-Less important; 1-Negligible	
Section I: Indicators Measuring Corporate Image	
I1 Recognized grading for company	□ 5 □ 4 □ 3 □ 2 □ 1
I2 Professional qualifications of project manager	□ 5 □ 4 □ 3 □ 2 □ 1
I3 Business coverage and market share (by region)	□ 5 □ 4 □ 3 □ 2 □ 1
I4 Business coverage and market share (by industrial sectors)	□ 5 □ 4 □ 3 □ 2 □ 1
I5 Business specialism (design, construction, etc.)	□ 5 □ 4 □ 3 □ 2 □ 1
……	……

6.3.3 Test of the Internal Consistency

The internal consistency is the key issue to assure the quality of the data collected from the questionnaire survey and it is one of the most important issues in social science study. The internal consistency tests whether the indicators in each section assess the same aspect of competitiveness. The redundant indicators will be deleted if the internal consistency is low. Cronbach's alpha is the most commonly used measure of internal consistency. It was originally derived by Kuder and Richardson (1937) for dichotomously scored data (0 or 1) and later generalized by Cronbach (1951) to account for any scoring method. Cronbach's alpha measures how well a set of items (or variables) measures a single factor. When these items measure the factor in multiple dimensions, Cronbach's alpha will be low. The following is the formula for calculating Cronbach's alpha:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{s_i^2}{s_T^2}\right) \qquad (6\text{-}1)$$

where k: number of items;

s_i^2 : variance of the ith items;

s_T^2 : variance of the total score formed by summing all the items.

The Cronbach's alpha coefficient (α) has a value within the range from 0 to 1, where higher values indicate the higher internal consistency of scales. There are different criteria for evaluating the internal consistency of a scale (Nunnally, 1994; Van de Ven and Ferry, 1980). Conventionally, a lenient cut-off of 0.60 is common in exploratory research; alpha should be at least 0.70 or higher to retain an item in an "adequate" scale; and many researchers require a cut-off of 0.80 for a "good scale." Nunnally (1994) argued that increasing reliabilities beyond 0.80 in basic research is often a waste of time and money.

The calculation of alpha values is conducted by using SPSS. The means, standard deviations, and Cronbach's alpha coefficients of the six sections are shown in Table 6.3. In this table, all sections have a good internal consistency with their Cronbach's alpha coefficients above or very close to 0.80. The test of internal consistency shows that the preliminary indicator list for each section is reliable.

Table 6.3 Means, standard deviation, and Cronbach alpha coefficient of the six sections

	Mean	**Std. Deviation**	**Cronbach's alpha coefficients**
Section I: Corporate Image	3.7160	0.7665	0.7904
Section II: Technology and Innovation	3.2527	0.8727	0.9168
Section III: Financial Capability	3.5628	0.8264	0.9330
Section IV: Marketing Capability	3.5235	0.8606	0.8945
Section V: Project Management Skills	3.7705	0.7616	0.9077
Section VI: Organization and Human Resources	3.5089	0.7150	0.8887

6.3.4 Relative Importance of Competitiveness Indicators

Relative importance value (RIV)

The level of importance among individual competitiveness indicators listed in Table 6.1 can only be measured relatively; thus, an index value called the relative importance value (RIV) is adopted. Relative index technique has been used extensively in research particularly for analyzing the data collected from structured questionnaire survey based on individual judgments. For example, Olomolaiye et al. (1987) established relative index rankings from investigating the productivity performance of joiners, bricklayers, and steel-fixers. Bubshait and AI-Musaid (1992) established relative importance indexes to illustrate the degree of involvement by construction owners/clients during the construction process. Shash (1993) identified the important factors influencing contractors' tendering decisions by building a relative index ranking. Using the relative index method, Kometa et al. (1994) ranked the construction clients' fundamental needs and examined the client-related attributes affecting the construction consultants' performance.

The value RIV for each individual competitiveness indicator is obtained from calculating a weighed average using the surveyed data through the following formula:

$$RIV = 100 \times \frac{\sum aX}{5N} \tag{6-2}$$

where

X: the frequency of the responses for a specific grade;

a: the weighting value (ranging from 1 to 5, where 1 is negligible and 5 is extremely important) corresponding to a specific grade;

N: total number of responses.

Calculating the RIV

An indicator with a higher RIV value suggests that the indicator has a higher effect on contractors' competitiveness. The rankings of individual indicators were established according to their RIV. Using the data collected from the survey, calculations were conducted according to formula (6-2). The full results are presented in Table 6.4.

Table 6.4 RIV of indicators measuring contractor competitiveness

Indicators		**Distribution between different grades (%)**			**RIV**
		≥4	3	≤2	
Section I : Indicators Measuring Corporate Image					
I-6	Organization's credibility	88.75	11.25	0.00	83.50
I-1	Recognized grading for company	85.00	13.75	1.25	81.25
I-9	Project safety performance records	70.00	28.75	1.25	77.25
I-7	Bank credibility rating	70.00	27.50	2.50	76.75

I-5	Business specialism (design, construction, etc.)	65.00	32.50	2.50	76.00
I-2	Professional qualifications of project manager	67.50	32.50	0.00	75.00
I-8	Project quality awards	63.75	30.00	6.25	74.25
I-10	Project environment and hygiene performance records	60.00	32.50	7.50	72.50
I-11	Corporate identity	57.50	40.00	2.50	72.00
I-4	Business coverage and market share (by industrial sectors)	47.50	45.00	7.50	70.50
I-3	Business coverage and market share (by region)	50.00	42.50	7.50	70.25
I-12	Compatibility with the local culture	40.00	52.50	7.50	67.25
I-13	Social conscience and responsibility	41.25	46.25	12.50	66.50
Section Average					74.08
Section II : Indicators Measuring Technology and Innovation					
I-17	Utilization efficiency of equipment and plant	60.00	31.25	8.75	72.00
I-26	Number of technical staff	58.75	37.50	3.75	71.75
I-14	Capacity of construction equipment and plant	58.75	32.50	8.75	71.75
I-30	Conversant with the local practice	53.75	42.50	3.75	71.00
I-25	Number of professional staff	57.50	35.00	7.50	70.75
I-16	Proportion of advanced construction equipment and plant	50.00	41.25	8.75	70.00
I-28	Standing of technology advancement within the industry	55.00	30.00	15.00	68.25
I-21	The rate of applying the new technology developed internally	41.25	36.25	22.50	64.75
I-15	Capacity of construction equipment and plant per staff	30.00	60.00	10.00	64.50
I-29	Extent of applying information technology	36.25	48.75	15.00	64.00
I-22	Level of external dissemination of the new technology	33.75	41.25	25.00	62.00
I-27	Adequacy of administrative staff	27.50	53.75	18.75	62.00
I-19	Establishment of research unit and strength of research staff	35.00	32.50	32.50	61.00
I-18	Equipment/plant depreciation rate	22.50	48.75	28.75	59.25
I-20	Level of investment on Research & Development	25.00	41.25	33.75	58.25
I-23	Number of the technical patents owned by the organization	22.50	43.75	33.75	55.75
I-24	Number of technical patent transfers	20.00	42.50	37.50	54.50
Section Average					64.79
Section III : Indicators Measuring Financial Capability					
I-42	Payment to subcontractors / suppliers on time	73.75	18.75	7.50	77.25
I-31	Credibility grade certified by relevant financial bodies	65.00	28.75	6.25	75.50
I-37	Organizational debt status	61.25	32.50	6.25	73.00
I-36	Organizational profit status	61.25	31.25	7.50	72.75
I-41	Capability of loan repayment	57.50	37.50	5.00	72.50
I-34	Effectiveness of communication with banker and financial institutions	55.00	38.75	6.25	70.50
I-35	Organizational assets status	55.00	38.75	6.25	70.25

I-32 The value of annual loans obtained	55.00	36.25	8.75	70.50
I-40 Growth rate of gross output	48.75	41.25	10.00	68.25
I-39 Growth rate of the organizational profit	47.50	42.50	10.00	69.00
I-33 Knowledge about financial policy	43.75	50.00	6.25	68.25
I-38 Growth rate of the organizational total assets	42.50	45.00	12.50	66.25
Section Average				71.17
Section IV : Indicators Measuring Marketing Capability				
I-53 On the tender list for government works	77.50	20.00	2.50	81.00
I-52 Relationship with private sector developers	81.25	15.00	3.75	80.50
I-56 Relationship with subcontractors and suppliers	67.50	28.75	3.75	77.00
I-54 On the tender list for private sector developers	65.00	31.25	3.75	76.75
I-46 Ability to forecast the changes of market conditions	65.00	30.00	5.00	74.25
I-51 Relationship with government departments	57.50	31.25	11.25	70.75
I-44 Scope of business activities	50.00	45.00	5.00	69.75
I-49 Value of annual contract works	50.00	40.00	10.00	69.25
I-48 Past success rate in the final bidding stage	48.75	37.50	13.75	69.00
I-45 Ability and facilities for managing market information	50.00	40.00	10.00	68.75
I-47 Past success rate in prequalification exercises	48.75	40.00	11.25	68.75
I-43 Geographical regions of business activities	37.50	51.25	11.25	65.25
I-50 Membership in relevant government advisory committees	32.50	52.50	15.00	64.50
I-57 Relationship with the public	30.00	48.75	21.25	61.50
I-55 Relationship with news media	20.00	50.00	30.00	57.25
Section Average				70.28
Section V : Indicators Measuring Project Management Skills				
I-73 Effectiveness of site management	93.75	6.25	0.00	83.50
I-72 Effectiveness of coordination with subcontractors	91.25	8.75	0.00	83.00
I-65 Effectiveness of cost control methods	82.50	16.25	1.25	81.50
I-62 Effectiveness of time management	80.00	17.50	2.50	80.25
I-74 Effectiveness of site safety management	78.75	21.25	0.00	79.75
I-75 Effectiveness of financial management	81.25	17.50	1.25	79.00
I-67 Availability and competence of contracts manager	75.00	25.00	0.00	79.00
I-76 Knowledge about the local construction law	75.00	23.75	1.25	78.00
I-58 Availability and effectiveness of quality management system	72.50	27.50	0.00	77.25
I-79 Availability and effectiveness of risk management system	65.00	31.25	3.75	75.75
I-61 Number of major accidents over past 3 years	68.75	25.00	6.25	75.50
I-69 Ratio of successfully committed contracts	63.75	33.75	2.50	75.50
I-68 Effectiveness in settling contract dispute through negotiation	67.50	31.25	1.25	75.00

I-66 Establishment of contract administration system	62.50	37.50	0.00	75.00
I-63 Previous records about construction delays	63.75	30.00	6.25	74.50
I-64 Proportion of liquidated damage to project total value	52.50	38.75	8.75	70.75
I-59 Performance during the warranty period	53.75	37.50	8.75	70.25
I-78 Effectiveness of environmental protection measures	51.25	42.50	6.25	70.25
I-60 Number of quality awards and punishments	52.50	41.25	6.25	69.25
I-77 Effectiveness of accident settlement process	50.00	40.00	10.00	68.75
I-70 Number of contract disputes	48.75	38.75	12.50	68.75
I-71 Ratio of dispute settlement cost to contract sum	37.50	48.75	13.75	65.25
Section Average				75.26
Section VI : Indicators Measuring Organization and Human Resources				
I-82 Career prospect within organization	60.00	38.75	1.25	72.75
I-80 Ratio of technical and professional staff in the organization	60.00	35.00	5.00	72.25
I-84 Appropriateness of organizational structure	58.75	40.00	1.25	73.25
I-83 Availability of resources and programs for training	57.50	35.00	7.50	72.50
I-85 Appropriateness of personnel structure	56.25	37.50	6.25	71.50
I-81 Staff salary scale relative to that of other organizations within the industry	51.25	42.50	6.25	70.00
I-87 Mechanism of distributing benefits and reward	41.25	52.50	6.25	68.50
I-88 Existence of strategies for human resources development	35.00	52.50	12.50	65.75
I-86 Mechanism for staff recruitment	30.00	61.25	8.75	64.50
Section Average				70.11

6.3.5 Identification of KCIs

The indicators in Table 6.1 are ranked according to their RIV values in Table 6.4. As there are no standard selection criteria, the KCIs are selected as those with RIV values above the section average value, and they are scored with a grade of 4 or 5 by more than 50 percent of respondents. The selection criteria ensure the important indicators will be included and there will be enough indicators in each section. As a result, a preliminary list of key competitiveness indicators ia selected as shown in Table 6.5.

Table 6.5 Preliminary selected key competitiveness indicators

Section I Corporate Image	
I-1 Recognized grading for company	I-7 Bank credibility rating
I-2 Professional qualifications of project manager	I-8 Project quality awards
I-5 Business specialism	I-9 Project safety performance records
I-6 Organization's credibility	
Section II Technology and Innovation	
I-14 Capacity of construction equipment and plant	I-26 Number of technical staff
I-16 Proportion of advanced construction equipment and plant	I-28 Standing of technology advancement within the industry
I-17 Utilization efficiency of equipment and plant	I-30 Conversant with the local practice
I-25 Number of professional staff	
Section III Financial Capability	
I-31 Credibility grade certified by relevant financial bodies	I-37 Organizational debt status I-41 Capability of loan repayment
I-36 Organizational profit status	I-42 Payment to subcontractors/suppliers on time
Section IV Marketing Capability	
I-46 Ability to forecast the changes of market conditions	I-54 On the tender list for private sector developers
I-51 Relationship with government departments	I-56 Relationship with subcontractors and suppliers
I-52 Relationship with private sector developers	
I-53 On the tender list for government works	
Section V Project Management Skills	
I-58 Availability and effectiveness of quality management system	I-72 Effectiveness of coordination with subcontractors
I-61 Number of major accidents over past 3 years	I-73 Effectiveness of site management
I-62 Effectiveness of time management	I-74 Effectiveness of site safety management
I-65 Effectiveness of cost control methods	I-75 Effectiveness of financial management
I-67 Availability and competence of contracts manager	I-76 Knowledge about the local construction law I-79 Availability and effectiveness of risk
I-69 Ratio of successfully committed contracts	management system
Section VI Organization and Human Resources	
I-80 Ratio of technical and professional staff in the organization	I-84 Appropriateness of organizational structure I-85 Appropriateness of personnel structure
I-82 Career prospect within organization	
I-83 Availability of resources and programs for training	

6.3.6 Validation of KCIs

To confirm the validation of the calculated KCIs, a workshop was conducted, organized and led by the researcher. The workshop on "Understanding competitiveness for contractors in the Hong Kong construction industry" was held on 25 February 2006 in the Hong Kong Polytechnic University. The participants were invited from the response list used in the questionnaire survey. Forty-six invitation letters were sent out; 15 replied and 8 delegates (all holding top positions in the company) actually attended the workshop. To ensure each delegate fully involved in the discussion, the eight delegates were divided into three groups with each group having one convener to facilitate the group discussion. The workshop started with the introduction by the researcher to explain the research background, the preliminary findings of the questionnaire survey, and the main tasks of the workshop. Group discussions were then held and facilitated by the three conveners. The delegates were invited to discuss the appropriateness and validity of the preliminary KCIs identified in Table 6.5. In the end, feedbacks were collected from each group. Constructive discussions were conducted during the workshop, leading to the generation of comments and suggestions, which are summarized in Table 6.6, for the modification of the previously selected KCIs.

Table 6.6 Summary of the group suggestions from the workshop

Group	Suggestions
①	✓ The key indicators identified are suitable to the local construction industry. ✓ Competitiveness should cover maintenance field. ✓ A good relationship with the architects/consultants is also important in marketing.
②	✓ "Organization's credibility" (I-6) is subjective and not easy to evaluate. ✓ "Compatibility with local culture" (I-12) should be a key factor especially for new entrants. ✓ Indicators I-14, I-15, and I-17 can be grouped together. ✓ Indicators I-36 and I-37 can be grouped together. ✓ Indicators I-47 and I-48 should be key indicators particularly for Housing Authority Works. ✓ The indicator "Effectiveness of site management" (I-73) is too broad. ✓ Indicators I-62, I-65, and I-67 can be grouped together. ✓ "Mechanism of distributing benefits and reward" (I-87) should be a key indicator.
③	✓ The identified KCIs are proper, but there are still other very important indicators such as retention of core staff, training, group work, and problem-solving ability.

The suggestions from the workshop provided valuable references for modifying the KCIs in Table 6.5. With incorporating the suggestions, the modified KCIs have been produced accordingly as shown in Table 6.7. Most suggestions were incorporated in the modification of KCIs. "Organization's credibility" (I-6) and "Effectiveness of site management" (I-73) were kept since they can be evaluated by using certain selected benchmark. And several indicators are combined together with minor changes for making the KCIs concise and reliable. For example, "Project quality awards" (I-8) and "Project safety performance records" (I-9) were grouped together and the environment performance was also included. And "Number of professional staff" (I-25) and "Number of technical staff" (I-26) were grouped together as "Capability of technical and professional staff".

Table 6.7 Key competitiveness indicators (KCIs) based on workshop

Section I Corporate Image	
KCI-1 Organization's credibility	**KCI-4** Banking credibility rating
KCI-2 Recognized grade of the company	**KCI-5** Business specialism
KCI-3 Project quality/safety/environment performance	**KCI-6** Professional qualifications of project manager
Section II Technology and Innovation	
KCI-7 Capacity of construction equipment and plant	**KCI-10** Proportion of advanced construction equipment and plant
KCI-8 Capability of technical and professional staff	**KCI-11** Standing of technology advancement within the industry
KCI-9 Conversant with the local practice	
Section III Financial Capability	
KCI-12 Payment to subcontractors/suppliers on time	**KCI-14** Organization's financial status
KCI-13 Credibility grade certified by relevant financial bodies	**KCI-15** Capability of loan repayment
Section IV Marketing Capability	
KCI-16 On the tender list for government works	**KCI-19** Relationship with subcontractors and suppliers
KCI-17 Relationship with public/private sector	**KCI-20** Ability to forecast the changes of market conditions
KCI-18 Relationship with architects/consultants	
Section V Project Management Skills	
KCI-21 Effectiveness of site management	**KCI-26** Knowledge about the local construction law
KCI-22 Effectiveness of coordination with subcontractors	**KCI-27** Availability and effectiveness of quality management system
KCI-23 Effectiveness of contract administration system	**KCI-28** Availability and effectiveness of risk management system
KCI-24 Effectiveness of site safety management	**KCI-29** Number of major accidents over the past three years
KCI-25 Effectiveness of financial management	**KCI-30** Ratio of successfully committed contracts
Section VI Organization and Human Resources	
KCI-31 Appropriateness of organizational and personnel structure	**KCI-34** Availability and effectiveness of resources and programs for training
KCI-32 Career prospect within organization	**KCI-35** Retention of core staff
KCI-33 Ratio of technical and professional staff in the organization	**KCI-36** Effectiveness of group work and problem solving

6.3.7 Analysis on the KCIs

The identified KCIs for measuring contractors' competitiveness in the Hong Kong construction industry provide important references for both researchers and professionals in the local construction industry to understand the practice of assessing contractors' competitiveness in the local construction market. The implication of the KCIs can be elaborated as follows.

Corporate Image

The organization's credibility is considered a key indicator for corporate image in the survey. It is an invisible but essential resource that helps gain the trust from clients, public, or partners. High credibility can increase contractors' opportunities to win contracts. Contractors' good quality, safety, and environment performance contribute directly to their corporate image. This has also been addressed by the Hong Kong construction industry (CIRC, 2001) that more concern should be given to improve contractors' quality, safety, and environmental performance.

Technology and Innovation

In Hong Kong, it is well noted that a wide gap exists in technical ability between local and foreign contractors. Walker (1995) noted that only a few local contractors could compete with technologically and financially superior foreign contractors. Localized foreign contractors have become successful in the Hong Kong construction industry especially in the civil engineering sector. Their success illustrates the important role of technology in gaining and sustaining competitive advantages over international contractors. However, technology seems not being given priority in the Hong Kong construction business sector. For example, the survey shows that the indicator "Level of investment on Research and Development" is not considered a key indicator in the local construction industry, showing the lower technology sense of the local contractors. This finding is also echoed by another study (Raftery et al., 1998).

Financial Capability

Subcontractors and suppliers play an especially active role in the Hong Kong construction industry. The value of subcontracted work constitutes over half of the total value of work done by all contractors (including both main and subcontractors). Without abundant natural resources, the Hong Kong construction industry has to depend on imported materials such as cement, steel, and wood, and even labors. Therefore, for a general contractor, the ability and credibility to pay the subcontractors and suppliers is essential, which is considered a key competitiveness indicator in the survey. If the payment is deferred, the construction schedule will be affected, the contractor's credibility will be lost, and its competitiveness will be reduced as a consequence.

Marketing Capability

Contractors' good relationship with clients, architects, consultants, subcontractors, and suppliers can help contractors to have more information and opportunity to obtain construction contracts. The government is one of the single largest clients in the Hong Kong construction industry and is responsible for all public buildings such as hospitals and schools, and all the major infrastructure projects including roads, tunnels, sewers, bridges, and others. Therefore, the inclusion of a contactor on the tender list for government works is considered an important indicator of good competence. Nevertheless, the data from the Census and Statistics Department (C&SD, 2006) show that the value of private sector work has surpassed that of the public sector in recent years. Thus, establishing a good partnership with private clients is also considered an important competitiveness indicator.

Project Management Skills

Project management skills reflect a contractor's ability to provide clients with high-quality products or services. The site progress management, coordination with subcontractors, contract administration system, quality management, safety management, and risk management are all considered key indicators for measuring contractors' project management skills as shown in Table 6.7. Good management skills help contractors to maintain and improve their operation effectiveness and have the competitive advantage in bidding. This is evidenced by the fact that foreign contractors who have better management experience are more successful in the Hong Kong construction industry especially in the civil engineering sector that requires contractors with better management skills (Raftery et al., 1998).

Organization and Human Resources

The construction industry is a project-based industry. An appropriately organized structure within the contractor enables the company to make optimum use of resources and improve the quality and frequency of communication. For example, an effective training system plays an important role in improving contactors' human resource strength as suggested in the workshop, suggesting that a well-established training system can certainly have the advantage in attracting good human resources. It contributes largely to the improvement of a contractor's competitiveness as the retention of core staff is one of a contractor's competitive advantages.

6.4 Fuzzy Competitiveness Assessment

The identified KCIs can be used to assess contractors' competitiveness. Competitiveness assessment is important in the organization strategic management. It can help contractors to find their positions in a specific market and to identify their strengths and weaknesses. A fuzzy approach for competitiveness assessment is introduced in this study. Fuzzy theory has been widely used for assisting in decision making where fuzziness exists in defining variables (Eldukair and Ayyub, 1992; Feng and Xu, 1999; Tah and Carr, 2000; Seo et al., 2004). The specification of decision attributes and decision makers' opinion involves fuzziness, and so it is intended to apply fuzzy theory to assist contractors in assessing their competitiveness or assist clients in selecting proper contractors.

6.4.1 The Principle of Fuzzy Theory

Basic Fuzzy Theory

There are many definitions of fuzzy theory principles and the typical definitions, which will be used in this study, are as follows.

Definition 6-1. (Zimmermann, 2001). If X is a collection of objects denoted generically by x, then a fuzzy set $\tilde{A}$ in X is a set of ordered pairs: $\tilde{A} = \{(x, \mu_{\tilde{A}}(x)) | x \in X\}$. $\mu_{\tilde{A}}(x)$ is a value assigned to represent the membership of x in $\tilde{A}$.

For example, if there are 5 fuzzy members in a fuzzy set $\tilde{A}$, namely, x_1, x_2, x_3, x_4, x_5, and their membership values are defined respectively as 0.4, 0.7, 0.5, 0.8 and 0.1, then, we can write the fuzzy set as $\tilde{A} = \{(x_1, 0.4), (x_2, 0.7), (x_3, 0.5), (x_4, 0.8), (x_5, 0.1)\}$, where x_4 mostly belongs to the fuzzy set, as it assumes the value of 0.8 mostly closing to the maximum value 1.

Definition 6-2. (Zimmermann, 2001). A fuzzy set $\tilde{A}$ is convex if

$\mu_{\tilde{A}}(\lambda x_1 + (1-\lambda)x_2) \geq \min\{(\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)\}, x_1, x_2 \in X, \lambda \in [0,1]$.

Where $\mu_{\tilde{A}}(x_1), \mu_{\tilde{A}}(x_2)$ are the membership values of x_1, x_2 belonging to fuzzy set $\tilde{A}$ and λ is a real number, $\lambda \in [0,1]$.

Definition 6-3. (Zimmermann, 2001). For a triangular fuzzy number with member p, denoted by $\tilde{P}(p^{(1)}, p^{(2)}, p^{(3)})$, the membership function of the member p is defined as:

$$\mu_{\tilde{P}}(p)=\begin{cases}0, & p\le p^{(1)},\\ (p-p^{(1)})/(p^{(2)}-p^{(1)}), & p^{(1)}\le p\le p^{(2)},\\ (p^{(3)}-p)/(p^{(3)}-p^{(2)}), & p^{(2)}\le p\le p^{(3)},\\ 0, & p\ge p^{(3)}.\end{cases} \tag{6-3}$$

where $p^{(1)}, p^{(2)}, p^{(3)}$ stand for the left bound value, mean value, and right bound value respectively in the distribution of a triangular fuzzy number, as shown in Figure 6.1.

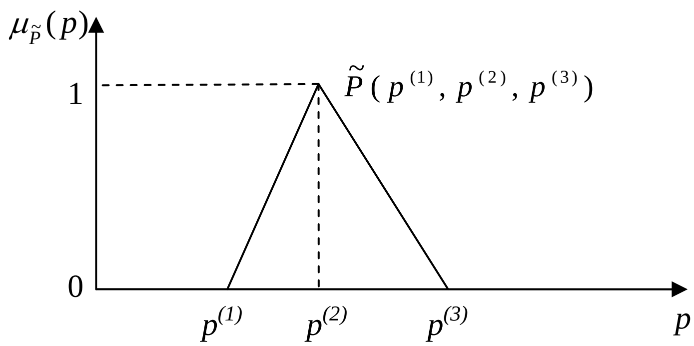

Figure 6.1 Distribution of a triangular fuzzy number $\tilde{P}$

According to Definition 6-2, the triangular fuzzy number $\tilde{P}$ is convex. It should be noted that triangular fuzzy numbers can be defined easily and often used in practice.

Definition 6-4. (van Laarhoven, 1983). Let $\tilde{x}=[x_l, x_m, x_u]$ and $\tilde{y}=[y_l, y_m, y_u]$ be two triangular fuzzy numbers, then

$$\begin{aligned}&(a)\tilde{x}\pm\tilde{y}=[x_l\pm y_l, x_m\pm y_m, x_u\pm y_u];\\ &(b)\tilde{x}\times\tilde{y}=[x_l y_l, x_m y_m, x_u y_u];\\ &(c)\tilde{x}/\tilde{y}=[x_l/y_u, x_m/y_m, x_u/y_l];\\ &(d)\mu\tilde{x}=[\mu x_l, \mu x_m, \mu x_u], \mu>0.\end{aligned} \tag{6-4}$$

Definition 6-5. (Heilpern, 1997) Let $\tilde{x}=[x_l, x_m, x_u]$ and $\tilde{y}=[y_l, y_m, y_u]$ be two triangular fuzzy numbers, the distance between $\tilde{x}$ and $\tilde{y}$ is defined as:

$$d(\tilde{x},\tilde{y})=\begin{cases}\left(\frac{1}{3}\left(\left|x_l-y_l\right|^p+\left|x_m-y_m\right|^p+\left|x_u-y_u\right|^p\right)\right)^{1/p}, & 1\le p<\infty \\ \max\left(\left|x_l-y_l\right|,\left|x_m-y_m\right|,\left|x_u-y_u\right|\right), & p=\infty\end{cases} \tag{6-5}$$

When p=2, the formula (6-5) is similar to the Euclidean distance measurement and it is most commonly used, reasonable and practicable for distance measurement of fuzzy triangular numbers.

Linguistic Terms

Generally, the decision making problem such as bidding for construction contracts is made under uncertainties, vagueness, fuzziness, risk, time pressure, and some information is incomplete or missing. For example, it is difficult for decision makers (contractors) to give an exact value to express their opinion on company’s capability. Instead, they are able to describe their feeling in the linguistic term of “good”, “fair”, or “poor” etc. For attribute weighting, decision makers can use linguistic terms such as “very important”, important”, “moderate”, “low”, “very low” to express their opinion. Each linguistic term is associated with a fuzzy set defined by a membership function. The triangular fuzzy number is used most frequently for expressing linguistic terms in research (Chen, 2000; Deng, 2006).

In a fuzzy decision-making problem, selecting appropriate linguistic terms can help decision makers to give right judgments on decisions. The linguistic terms and corresponding membership functions can be elicited from expert assessment and past data, and can be modified to incorporate individual situations. And a linguistic term set with seven linguistic terms is commonly used for describing the ratings and weightings of decision attributes by researchers (Chen, 2000; Lin and Chen, 2004; Li et al., 2007). Therefore, two linguistic terms sets with seven linguistic terms are used for expressing decision makers' judgment on ratings and weightings of competitiveness attributes, as shown in Table 6.8 and Figure 6.2.

Table 6.8 Linguistic terms describing the ratings and weightings of attributes

Linguistic terms for attribute rating	**Linguistic terms for attribute weighting**	**Corresponding triangular fuzzy numbers**
Very Poor (VP)	Very Low (VL)	(0,0,0.1)
Poor (P)	Low (L)	(0,0.1,0.3)
Fairly Poor (FP)	Fairly Low (FL)	(0.1,0.3,0.5)
Fair (F)	Fair (F)	(0.3,0.5,0.7)
Fairly Good (FG)	Fairly High (FH)	(0.5,0.7,0.9)
Good (G)	High (H)	(0.7,0.9,1.0)
Very Good (VG)	Very High (VH)	(0.9,1.0,1.0)

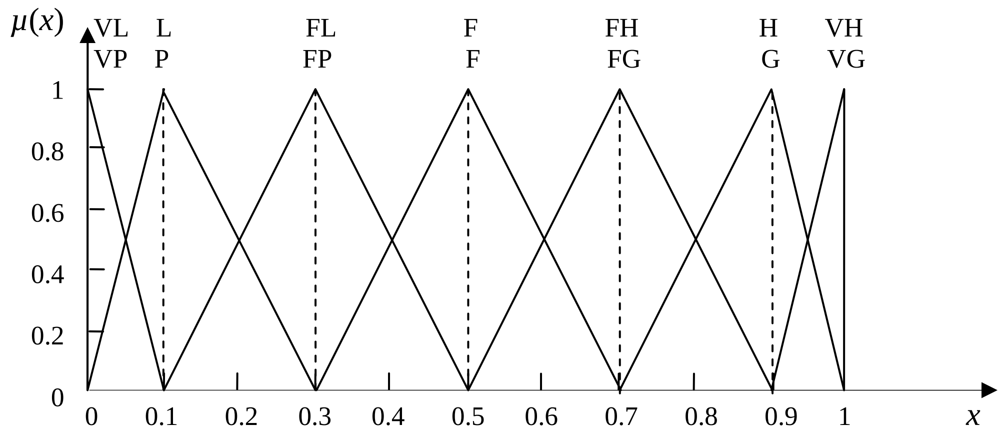

Figure 6.2 Distribution of linguistic terms for ratings and weightings of attributes

6.4.2 Fuzzy Competitiveness Rating

As the competitiveness assessment process involves the assessment on uncertainties, thus the assessment is associated with complexity and uncertainty. Hence, fuzzy multiple attribute decision analysis is considered suitable for making the competitiveness assessment.

Competitiveness is usually assessed by a group of professional members based on their knowledge and experience. Assume that there are *t* assessment panel members, denoted as $D = \{d_1, d_2, ..., d_t\}$. The KCIs are selected as the competitiveness attributes for measuring contractors' competitiveness, including six main attributes and thirty-six sub-attributes (with reference to Table 6.7). And assessment panel members will assess the competitiveness attributes' rating and weightings by selecting an appropriate linguistic term. Referring to Table 6.8 and Figure 6.2, the corresponding fuzzy ratings and fuzzy weightings of the competitiveness attributes are identified, denoted as $\tilde{r}_i^{(k)}$ and $\tilde{w}_i^{(k)}$, i = 1,2,…,n; k = 1,2,…, t. In order to aggregate the assessment panel members' opinion, the average fuzzy ratings and average fuzzy weightings are used to pool their opinions. Referring to previous studies (Chen, 2000; Lin and Chen, 2004; Xu and Chen, 2007), the average fuzzy ratings and average fuzzy weightings can be obtained by following formula:

$$\begin{aligned} \tilde{r}_i &= \frac{1}{t}[\tilde{r}_i^1 \oplus \tilde{r}_i^2 \oplus \ldots \oplus \tilde{r}_i^t],\ i = 1,2,\ldots,n \\ \tilde{w}_i &= \frac{1}{t}[\tilde{w}_i^1 \oplus \tilde{w}_i^2 \oplus \ldots \oplus \tilde{w}_i^t],\ \ i = 1,2,\ldots,n \end{aligned} \tag{6-6}$$

Referring to existing studies (Chen, 2001; Li et al., 2007), a fuzzy competitiveness rating (FCR) method is introduced to measure a contractor' competitiveness. This method consolidates the fuzzy ratings and fuzzy weightings of sub-attributes under each main attribute to represent the competitiveness of each main attribute; and six main attributes to represent the overall competitiveness. The higher a contractor's FCR, the stronger competitiveness of the contractor. The fuzzy competitiveness rating can be obtained by:

$$FCR = \sum_{i=1}^{n} \tilde{w}_i \otimes \tilde{r}_i \tag{6-7}$$

According to (6-7), the value of FCR is also a triangular fuzzy number, denoted as $FCR = (a_l, a_m, a_u)$. In order to keep the value of FCR in the range of [0, 1], a normalization method is needed. According to existing studies (Chen, 2000; Li et al., 2007), the common method is to use the maximum a_u, denoted as a_u^*, to divide

$FCR = (a_l, a_m, a_u)$. When there is only one contractor, the a_u^* can be obtained by setting all attributes' fuzzy ratings set as the maximum rating (0.9,1,1), and the maximum FCR will be obtained as $FCR^* = (a_l^*, a_m^*, a_u^*)$ with the maximum a_u. And the normalized fuzzy competitiveness rating (NFCR) can be calculated by following formula:

$$NFCR = FCR \big/ a_u^* = (\frac{a_l}{a_u^*}, \frac{a_m}{a_u^*}, \frac{a_u}{a_u^*}) \tag{6-8}$$

According to formula (6-7) and (6-8), the normalized fuzzy competitiveness rating can be obtained. And this rating can be further matched to an appropriate linguistic term, which can represent the same meaning of the NFCR, from a natural language expression set. The natural language expression set includes a set of linguistic terms for expressing decision makers' opinion on contractors' competitiveness level. An effective natural language expression set has been introduced in previous studies (Lin and Chen, 2004; Li et al., 2007), as shown in Table 6.9, and this set is used in this research as well.

Table 6.9 The natural language expression set

Extremely Low (EL)	(0, 0.1, 0.2)
Very Low (VL)	(0.1, 0.2, 0.3)
Low (L)	(0.2, 0.3, 0.4)
Fairly Low (FL)	(0.3, 0.4, 0.5)
Fair (F)	(0.4, 0.5, 0.6)
Fairly High (FH)	(0.5, 0.6, 0.7)
High (H)	(0.6, 0.7, 0.8)
Very High (VH)	(0.7, 0.8, 0.9)
Extremely High (EH)	(0.8, 0.9, 1.0)

(Source: Lin and Chen, 2004)

There are several methods for matching a fuzzy competitiveness rating to a linguistic term from the natural language expression set (Schmucker, 1985; Lin and Chen, 2004). The Euclidean distance, in intuitive form, incorporates subjective perception of proximity and is mostly used by researchers (Chaudhuri and Rosenfeld, 1996; Groenen and Jajuga, 2001). Therefore, the Euclidean distance is used in this study for matching the fuzzy competitiveness ratings to the natural language expression set. The distances between NFCR and each member in the natural language expression set can be calculated by using formula (6-5). Then, contractors' competitiveness level can be identified by a linguistic term from the natural language expression set which has the minimum Euclidean distance.

6.4.3 An Example

Assume that a local general contractor, ABC, is conducting an internal competitiveness assessment by using the fuzzy competitiveness rating method. The competitiveness assessment process is as follows:

Step 1: Forming an assessment panel

Three top managers from major departments are invited for undertaking this assessment.

Step 2: Briefing session

Before starting the assessment, a briefing session is conducted for facilitating the panel members to have a holistic understanding of the situation. Relevant information and data will be introduced to panel members for helping them to take proper judgment on their company's competitiveness.

Step 3: Assessing the ratings and weightings

After the briefing session, the panel members are invited to measure the ratings and weightings of attributes based on their understanding of their company. The ratings and weightings of attributes (KCIs listed in Table 6.7) can be expressed by using the linguistic terms proposed in Table 6.8. For example, the rating of attribute "KCI-29 Number of major accidents over the past three years" could be "very good" if there are "zero" major accidents over the past three years; the rating of attribute "KCI-16 On the tender list for government works" could be "very good" if the company is on the list. With the provided data and information, the panel members can give their judgment on each attributes. The panel members' judgments on the weightings and ratings of the competitiveness attributes are shown in Table 6.10.

Table 6.10 Panel members' judgments on the weightings (W) and ratings (R) of competitiveness attributes

Main and sub-attributes (KCIs)	**Member 1**		**Member 2**		**Member 3**	
	W	**R**	**W**	**R**	**W**	**R**
Section I Corporate Image	FH		H		FH	
KCI-1 Organization's credibility	FH	FG	FH	FG	FH	G
KCI-2 Recognized grade of the company	F	FG	F	FG	F	FG
KCI-3 Project quality/safety/environment performance	FH	FG	H	FG	FH	FG
KCI-4 Banking credibility rating	F	FG	F	FG	F	FG
KCI-5 Business specialism	F	FG	FH	FG	FH	FG
KCI-6 Professional qualifications of project manager	FH	FG	FH	FG	FH	FG
Section II Technology and Innovation	H		H		H	
KCI-7 Capacity of construction equipment and plant	FH	G	FH	FG	FH	G
KCI-8 Capability of technical and professional staff	FH	G	H	G	H	G

KCI-9 Conversant with the local practice	FH	G	FH	FG	H	G
KCI-10 Proportion of advanced construction equipment and plant	FH	FG	F	FG	FH	G
KCI-11 Standing of technology advancement within the industry	F	FG	F	FG	F	F
Section III Financial Capability	FH		FH		H	
KCI-12 Payment to subcontractors/suppliers on time	FH	FG	FH	FG	H	FG
KCI-13 Credibility grade certified by relevant financial bodies	H	FG	FH	FG	FH	FG
KCI-14 Organization's financial status	FH	F	FH	F	FH	FP
KCI-15 Capability of loan repayment	FH	F	FH	F	FH	FG
Section IV Marketing Capability	H		H		H	
KCI-16 On the tender list for government works	FH	VG	FH	VG	FH	VG
KCI-17 Relationship with public/private sector	H	G	FH	FG	FH	FG
KCI-18 Relationship with architects/consultants	FH	FG	FH	FG	FH	FG
KCI-19 Relationship with subcontractors and suppliers	FH	FG	FH	FG	FH	F
KCI-20 Ability to forecast the changes of market conditions	F	F	FH	F	FH	F
Section V Project Management Skills	H		H		FH	
KCI-21 Effectiveness of site management	FH	FG	FH	F	FH	FG
KCI-22 Effectiveness of coordination with subcontractors	FH	FG	F	FG	FH	FG
KCI-23 Effectiveness of contract administration system	FH	FG	FH	FG	FH	G
KCI-24 Effectiveness of site safety management	FH	FG	FH	G	FH	G
KCI-25 Effectiveness of financial management	FH	F	FH	F	F	F
KCI-26 Knowledge about the local construction law	FH	F	FH	F	FH	FG
KCI-27 Availability and effectiveness of quality management system	FH	FG	FH	FG	FH	F
KCI-28 Availability and effectiveness of risk management system	FH	F	F	F	FH	F
KCI-29 Number of major accidents over the past three years	FH	VG	FH	VG	H	VG
KCI-30 Ratio of successfully committed contracts	F	FG	F	FG	FH	G
Section VI Organization and Human Resources	FH		FH		H	
KCI-31 Appropriateness of organizational and personnel structure	FH	FG	H	FG	FH	FG
KCI-32 Career prospect within organization	FH	FG	FH	FG	FH	F
KCI-33 Ratio of technical and professional staff in the organization	H	FG	FH	FG	H	FG
KCI-34 Availability and effectiveness of resources and programs for training	FH	F	FH	F	FH	F
KCI-35 Retention of core staff	FH	F	H	FG	H	FG
KCI-36 Effectiveness of group work and problem solving	FH	F	H	F	H	F

Step 4: Aggregating panel members' opinions

According to Table 6.8, the panel members' opinions in Table 6.10 can be transformed to triangular fuzzy numbers and aggregated by using formula (6-6). The average fuzzy ratings and fuzzy weightings of the competitiveness attributes are obtained, as shown in Table 6.11.

Table 6.11 Average fuzzy ratings and fuzzy weightings of competitiveness attributes

Main and sub-attributes (KCIs)	**Average fuzzy weightings**	**Average fuzzy ratings**
Section I Corporate Image	(0.57,0.77,0.93)	
KCI-1 Organization's credibility	(0.50,0.70,0.90)	(0.57,0.77,0.93)
KCI-2 Recognized grade of the company	(0.30,0.50,0.70)	(0.50,0.70,0.90)
KCI-3 Project quality/safety/environment performance	(0.57,0.77,0.93)	(0.50,0.70,0.90)
KCI-4 Banking credibility rating	(0.30,0.50,0.70)	(0.50,0.70,0.90)
KCI-5 Business specialism	(0.43,0.63,0.83)	(0.50,0.70,0.90)
KCI-6 Professional qualifications of project manager	(0.50,0.70,0.90)	(0.43,0.63,0.83)
Section II Technology and Innovation	(0.70,0.90,1.00)	
KCI-7 Capacity of construction equipment and plant	(0.50,0.70,0.90)	(0.63,0.83,0.97)
KCI-8 Capability of technical and professional staff	(0.63,0.83,0.97)	(0.70,0.90,1.00)
KCI-9 Conversant with the local practice	(0.57,0.77,0.93)	(0.63,0.83,0.97)
KCI-10 Proportion of advanced construction equipment and plant	(0.43,0.63,0.83)	(0.57,0.77,0.93)
KCI-11 Standing of technology advancement within the industry	(0.30,0.50,0.70)	(0.43,0.63,0.83)
Section III Financial Capability	(0.57,0.77,0.93)	
KCI-12 Payment to subcontractors/suppliers on time	(0.57,0.77,0.93)	(0.30,0.50,0.70)
KCI-13 Credibility grade certified by relevant financial bodies	(0.57,0.77,0.93)	(0.30,0.50,0.70)
KCI-14 Organization's financial status	(0.50,0.70,0.90)	(0.23,0.43,0.63)
KCI-15 Capability of loan repayment	(0.50,0.70,0.90)	(0.37,0.57,0.77)
Section IV Marketing Capability	(0.70,0.90,1.00)	
KCI-16 On the tender list for government works	(0.50,0.70,0.90)	(0.90,1.00,1.00)
KCI-17 Relationship with public/private sector	(0.57,0.77,0.93)	(0.57,0.77,0.93)
KCI-18 Relationship with architects/consultants	(0.50,0.70,0.90)	(0.50,0.70,0.90)
KCI-19 Relationship with subcontractors and suppliers	(0.50,0.70,0.90)	(0.43,0.63,0.83)
KCI-20 Ability to forecast the changes of market conditions	(0.43,0.63,0.83)	(0.30,0.50,0.70)
Section V Project Management Skills	(0.63,0.83,0.97)	
KCI-21 Effectiveness of site management	(0.50,0.70,0.90)	(0.43,0.63,0.83)
KCI-22 Effectiveness of coordination with subcontractors	(0.43,0.63,0.83)	(0.50,0.70,0.90)

KCI-23 Effectiveness of contract administration system	(0.50,0.70,0.90)	(0.57,0.77,0.93)
KCI-24 Effectiveness of site safety management	(0.50,0.70,0.90)	(0.63,0.83,0.97)
KCI-25 Effectiveness of financial management	(0.43,0.63,0.83)	(0.30,0.50,0.70)
KCI-26 Knowledge about the local construction law	(0.50,0.70,0.90)	(0.37,0.57,0.77)
KCI-27 Availability and effectiveness of quality management system	(0.50,0.70,0.90)	(0.43,0.63,0.83)
KCI-28 Availability and effectiveness of risk management system	(0.43,0.63,0.83)	(0.30,0.50,0.70)
KCI-29 Number of major accidents over the past three years	(0.57,0.77,0.93)	(0.90,1.00,1.00)
KCI-30 Ratio of successfully committed contracts	(0.37,0.57,0.77)	(0.57,0.77,0.93)
Section VI Organization and Human Resources	(0.57,0.77,0.93)	
KCI-31 Appropriateness of organizational and personnel structure	(0.57,0.77,0.93)	(0.50,0.70,0.90)
KCI-32 Career prospect within organization	(0.50,0.70,0.90)	(0.43,0.63,0.83)
KCI-33 Ratio of technical and professional staff in the organization	(0.63,0.83,0.97)	(0.50,0.70,0.90)
KCI-34 Availability and effectiveness of resources and programs for training	(0.50,0.70,0.90)	(0.30,0.50,0.70)
KCI-35 Retention of core staff	(0.63,0.83,0.97)	(0.43,0.63,0.83)
KCI-36 Effectiveness of group work and problem solving	(0.63,0.83,0.97)	(0.30,0.50,0.70)

Step 5: Calculating the FCR and NFCR

According to (6-7) and (6-8), the FCR and NFCR for each main attribute can be calculated. For the main attribute "Corporate image", the calculation process is demonstrated as follows:

$FCR_{(1)} = (0.50,0.70,0.90)\times(0.57,0.77,0.93) + (0.30,0.50,0.70)\times(0.50,0.70,0.90) +$

$(0.57,0.77,0.93)\times(0.50,0.70,0.90) + (0.30,0.50,0.70)\times(0.50,0.70,0.90) +$

$(0.43,0.63,0.83) \times(0.50,0.70,0.90) +(0.50,0.70,0.90)\times(0.43,0.63,0.83) = (1.30, 2.66, 4.44)$

$FCR^{*}_{(1)} = (0.50,0.70,0.90)\times(0.90,1.00,1.00) + (0.30,0.50,0.70)\times(0.90,1.00,1.00) +$

$(0.57,0.77,0.93)\times(0.90,1.00,1.00) + (0.30,0.50,0.70)\times(0.90,1.00,1.00) +$

$(0.43,0.63,0.83) \times(0.90,1.00,1.00) +(0.50,0.70,0.90)\times(0.90,1.00,1.00) = (2.34, 3.80, 4.97)$

$NFCR_{(1)} = FCR_{(1)} /4.97 = (1.30, 2.66, 4.44) /4.97 = (0.26, 0.54, 0.89)$

Similarly, the FCR and NFCR of other five main attributes can be calculated and the results are as follows:

Technical ability: FCR $_{(2)}$ = (1.49, 2.77, 4.10), NFCR $_{(2)}$ = (0.35, 0.64, 0.95);

Financing ability: FCR $_{(3)}$ = (0.64, 1.47, 2.57), NFCR $_{(3)}$ = (0.17, 0.40, 0.70)

Marketing ability: FCR $_{(4)}$ = (1.37, 2.54, 3.91), NFCR $_{(4)}$ = (0.31, 0.57, 0.88)

Project management skills: FCR $_{(5)}$ = (2.41, 4.68, 7.47), NFCR $_{(5)}$ = (0.28, 0.54, 0.86)

Organization and human resources: FCR $_{(6)}$ = (1.43, 2.86, 4.57), NFCR $_{(6)}$ = (0.25, 0.51, 0.81)

With the results of six main attributes, the FCR and NFCR of contractor's overall competitiveness can be calculated by the same method:

FCR $_{(O)}$ = (1.04, 2.68, 4.94), NFCR $_{(O)}$ = (0.18, 0.46, 0.85).

Step 6: Matching the NFCR to linguistic terms

With the results in previous step, each NFCR can be matched to an appropriate linguistic term in the natural language expression set for representing contractor's competitiveness level. According to formula (6-5), the distance between NFCR $_{(O)}$ and each member in the natural language expression set (see Table 6.9) can be calculated as follows:

$$d(NFCR_{(O)}, EL) = \left\{ \frac{1}{3}[(0.18-0)^2 + (0.46-0.1)^2 + (0.85-0.2)^2] \right\}^{\frac{1}{2}} = 0.44$$

$$d(NFCR_{(O)}, VL) = 0.35 \qquad d(NFCR_{(O)}, L) = 0.28$$

$$d(NFCR_{(O)}, FL) = 0.22 \qquad d(NFCR_{(O)}, F) = 0.19$$

$$d(NFCR_{(O)}, FH) = 0.22 \qquad d(NFCR_{(O)}, H) = 0.28$$

$$d(NFCR_{(O)}, VH) = 0.36 \qquad d(NFCR_{(O)}, EH) = 0.45$$

The competitiveness level of contractor ABC can be identified by the linguistic term which has the minimum distance to the NFCR. In above calculation result, the minimum distance is $d\,(NFCR_{(O)}, F) = 0.19$. Therefore, the overall competitiveness level of contractor ABC can be expressed as **"fair"**. Contractor ABC's competitiveness level can also be illustrated in Figure 6.3.

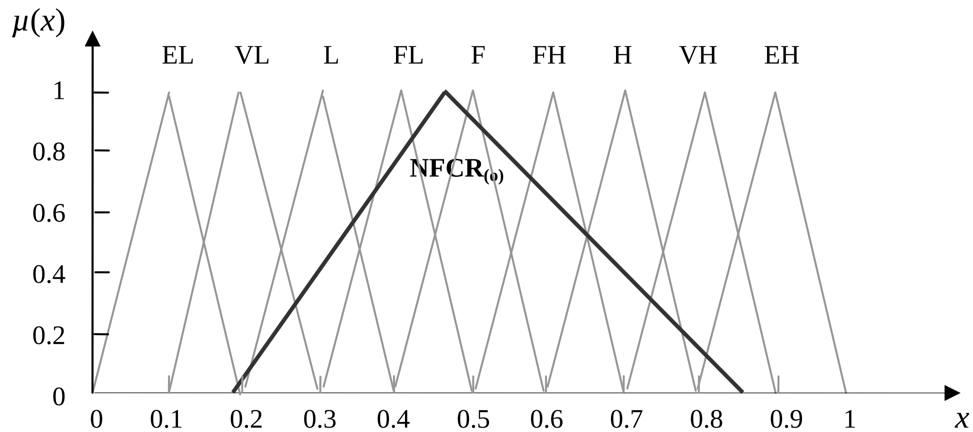

Figure 6.3 Match $NFCR_{(O)}$ to the natural language expression set

By using the same method, the distances between main attributes' NFCR and the natural language expression set can be calculated and the results are shown in Table 6.12. With the results in Table 6.12, contractor ABC's competitiveness of six main attributes can be expressed as:

- Corporate image is **"fairly high"**;
- Technology and innovation is **"fairly high"**;
- Financial capability is **"fairly low"**;
- Marketing capability is **"fairly high"**;
- Project management skills are **"fairly high"**;
- Organization and human resources is **"fair"**.

Table 6.12 Distances between NFCR and the natural language expression set

Competitiveness Levels	**NFCR $_{(O)}$**	**NFCR $_{(1)}$**	**NFCR $_{(2)}$**	**NFCR $_{(3)}$**	**NFCR $_{(4)}$**	**NFCR $_{(5)}$**	**NFCR $_{(6)}$**
(EL)	0.44	0.50	0.57	0.35	0.51	0.49	0.45
(VL)	0.35	0.40	0.48	0.26	0.42	0.39	0.36
(L)	0.28	0.32	0.38	0.18	0.32	0.30	0.27
(FL)	0.22	0.24	0.30	**0.14**	0.24	0.22	0.19
(F)	**0.19**	0.19	0.22	0.16	0.17	0.17	**0.15**
(FH)	0.22	**0.18**	**0.17**	0.22	**0.15**	**0.16**	0.17
(H)	0.28	0.22	0.172	0.31	0.19	0.21	0.23
(VH)	0.36	0.30	0.22	0.40	0.26	0.29	0.31
(EH)	0.45	0.38	0.30	0.50	0.35	0.37	0.40

The results can be further used to take the strengths and weaknesses analysis. The competitiveness levels of six main attributes of contractor ABC can be illustrated in Figure 6.4. From Figure 6.4, we can see that the contractor's strengths may come from corporate image, technology, marketing and project management, and its weakness from financing.

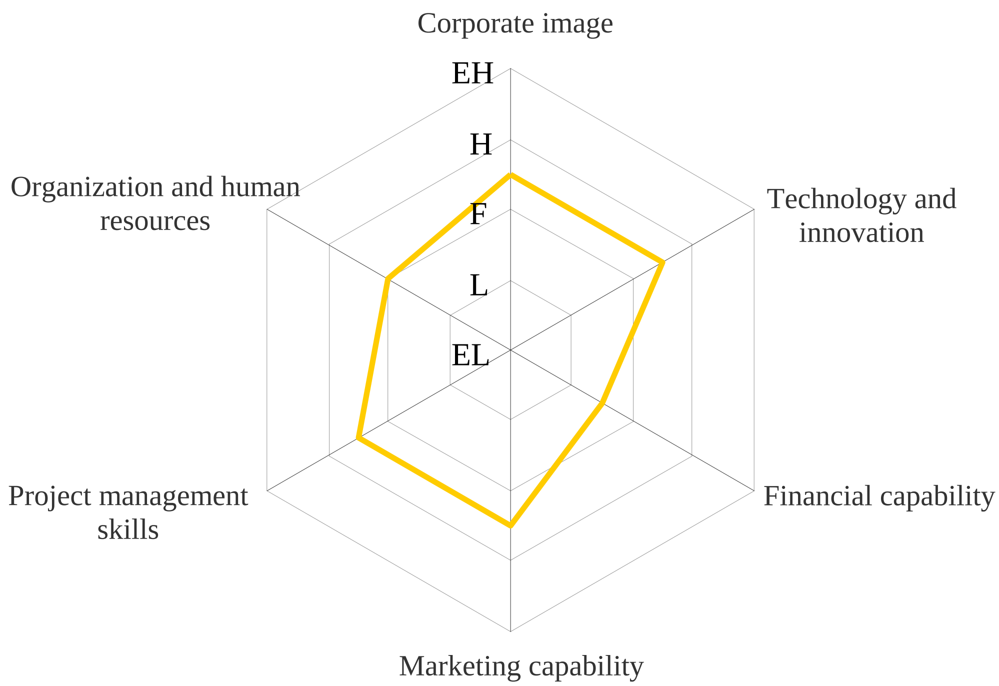

Figure 6.4 The competitiveness level of the six main attributes

With the identified KCIs, The fuzzy theory is used for helping contractors to conduct competitiveness assessment. And the linguistic terms are used for simplifying the decision makers' judgment on ratings and weights of competitiveness attributes. The results provide contractors valuable references for understanding their competitiveness level in the market and their internal strengths and weaknesses. Except the internal competitiveness assessment, the fuzzy competitiveness rating method can also be used to rank contractors in a typical market or to help clients select contractors with maximum overall competitiveness.

6.5 Summary

Assessing and building up competitiveness are key parts of the strategic management for construction businesses. However, revenue is commonly used as an only major indicator for reflecting contractors' competitiveness in the market. For example, the Engineering News Record (ENR) ranks contractors based on their revenues. The competitiveness indicator system established in this chapter provides a mechanism to assess contactors' competitiveness from six aspects: corporate image, technology and innovation, financing, marketing, project management skills, and organization and human resources. Based on the questionnaire survey and workshop, the KCIs have been identified. Considering the existence of vagueness in assessing the competitiveness indicators, a fuzzy competitiveness rating method is introduced to assess contractors' competitiveness. The results provide useful references for contractors to understand their competitiveness in a particular market.

CHAPTER 7 CONTRACTOR COMPETITIVE STRATEGY

CHAPTER 7 CONTRACTOR COMPETITIVE STRATEGY

7.1 Introduction

Porter's five forces model (1980) suggests that sustainable competitive advantage can be discovered by proper industrial analysis. The collective strength of these forces determines the ultimate profit potential in an industry. Furthermore, Porter (1980) also introduced three generic competitive strategies, cost leadership, differentiation and focus. These three strategies are commonly referred in developing organizational strategies. There are studies addressing competitive strategy in alternative perspectives. Barney (1995) argued that sustainable competitive advantage is not the product of a correct position in the external environment but is derived from the firm's internal resources. Understanding on these theories has led to the development of the competitive strategy model in Chapter 2. The relationships proposed in the model will be investigated and validated in this chapter. Data used for the discussion in this chapter also comes from a questionnaire survey conducted in the local construction industry. Using the survey data, a cluster analysis is conducted to classify contractors into four clusters according to their different strategic orientations.

7.2 Identification of Competitive Strategy

Strategies for a "multiple business" firm typically contain three levels, namely, corporate, business, and functional (Pearce and Robinson, 2003). For a "single business" firm, the strategies are either at the business or functional levels. The competitive strategies discussed here are at the corporate and business level.

Previous studies have presented various strategies for business. Porter (1980) proposed three generic competitive strategies: cost leadership, differentiation, and focus. Miles and Snow (1978) earlier suggested four strategic types, namely, defenders, prospectors, analyzers, and reactors. Vesper (1979) identified four major types of strategies: protection of present market, expansion of production, specialization in products or services, and liquidation. Pearce and Robinson (2003) identified a number of principal (grand) strategies to guide a firm's major actions. These are concerned with the expansion of existing products, innovation, integration, diversification, liquidation, joint ventures, strategic alliances, and consortia.

Furthermore, other researchers have investigated strategy management specifically in the construction industry. Hasegawa (1988) suggested several competitive strategies for Japanese contractors, including international expansion, new business development, integrated engineering construction, development project, technology development, and financial strategies. Cannon and Hillebrandt (1990) introduced four methods for gaining product differentiation in construction: offering different project management methods, extending from construction into design, extending into financial packages, and extending forward into commission and facilities management. Joint ventures reduce the level of exposure to risk or get around protectionist barriers (Andrews, 1987). Merger and international cooperation are also considered by some large construction companies. They treat the world as a single market and gear their business toward solving clients' problems and needs, thereby adding greater value to their services (Rashid, 1991). Warszawski (1996) analyzed the application of Porter's three generic strategies in construction industry and introduced typical growth strategies to the construction industry. One of the growth strategies is engaging in new types of activities including development of real estate, design, operation, maintenance, and others.

From existing studies (e.g. Porter, 1980; Hasegawa, 1988; Betts and Ofori, 1992; Warszawski, 1996; Langford and Male, 2001) and the examination of the local construction industry, typical competitive strategies, which have been addressed in chapter 2, can be identified as shown in Table 7.1.

Table 7.1 Competitive strategies for contractors

Cost leadership	**Differentiation**	**Focus**	**Growth Strategy**
• Standardization of products or services • Superior training of personnel • Effective control of labor and materials • Careful selection of subcontractors /suppliers • Technological advancement • Incentive programs for productivity improvement or resource saving	• Building company's reputation • Offering higher quality of product • Faster project completion • Innovative financing methods • Innovative project management methods • Sustainable practice and social responsibility • Offering additional services to clients	• Offering a certain type of projects • Operating in a particular region • Serving a certain type of clients	• Entry into new locations or regions • Entry into new types of construction projects (highways, tunnels, and others) • Engaging in new businesses (real estate, design, operation, maintenance, and others) • Expanding by acquisition or merger

These strategies are adopted for testing the competitive strategy model introduced in chapter 2. The application of these competitive strategies will be discussed and validated through the data collected from a questionnaire survey. Under each competitive strategy, the relevant strategic behaviors are identified, and discussions on these behaviors are presented in following sections.

7.2.1 Cost leadership Strategy

Standardization of products or services

Standardization is the process of establishing a technical standard. The standardization of product or services involves the development of high-quality and low-cost product or service. Relevant research has proven that the use of standardized products can improve company performance (Waheeduzzaman and Dube, 2002). In the construction industry, a contractor can use standardized products to improve the efficiency of the design and construction, and consequently save costs, and gain competitive advantage.

Superior training of personnel

The training of personnel can improve work efficiency and reduce errors. Since the construction industry is a labor-intensive industry, the high-quality training of the personnel can improve productivity, save time, and eliminate waste in the construction process, consequently reducing the costs. An effective training system can make a contractor achieve cost leadership in the industry.

Effective control of labor and materials

The cost of labor and materials forms a significant percentage of most projects. Normally, construction materials take 30 percent to 60 percent of the project total cost (Thorpe and McCaffer, 1991). Since the cost of owning labor resources is usually greater than that paid directly to the employees, usage of labor-only subcontractors can reduce the cost of labor. Furthermore, the just-in-time management of material can reduce the storage fee in construction sites. Therefore, the control of labor and materials needs to have a series of tight control methods so that any deviation can be identified immediately and the corresponding actions can be taken, and competitive cost advantage can be gained accordingly.

Careful selection of subcontractors/suppliers

The construction industry is characterized by the practice of multi-level subcontracting system, and materials and services supplied by suppliers from various other industries. Therefore, establishing long-term cooperation with certain subcontractors and major suppliers can reduce the transaction cost and enable main contractors to have more bargaining power. Nevertheless, there are few subcontractors or suppliers for some special projects, and they have higher bargaining power. In this case, main contractors need to grant some advantages (in quality purchased and payment terms) to subcontractors or suppliers in order to obtain a price discount. These methods usually bring contractors with significant cost reduction, leading to cost advantage.

Technological advancement

New technology is a major means to improve the productivity within an industry. Relevant research reveals that changes in technology are significantly and positively correlated with improvements in labor productivity (Goodrum and Haas, 2004). New construction methods, new materials, and application of information technology in construction are therefore always pursued in order to improve construction efficiency and save time and labor, consequently leading to cost reduction.

Incentive programs for productivity improvement or resource saving

Incentive programs for productivity improvement or resource saving enable a company to use its resources more effectively, which can lead to cost savings. Incentive programs can be in the form of employee participation programs and group-based pay incentives tied to performance. It has been reported that employee participation programs and group-based pay generally have positive, modest, and independent effects on company performance (Cooke, 1994). Since construction industry is project based, group-based incentives are more effective in improving productivity, consequently resulting in cost savings and competitive advantages.

7.2.2 Differentiation Strategy

Building company's reputation

Reputation conveys a company's positive information to customers, and its influence and function goes beyond the measurable characteristics of a construction product. The added value of a contractor's reputation comes from the market exchange relationships with key customers, and the judgments on quality are also based on customers' long-term experience. Therefore, building a good reputation brings contractors with more advantages in competition. Contractors can build up their reputation by providing high-quality products and services, hiring experienced and educated employees, and cultivating a corporate brand. It is essential to keep in mind that it is easier to lose a reputation than build it.

Offering higher quality of product

The report by the Construction Industry Review Committee (CIRC, 2001) suggests that the local tendency to award a contract at the lowest price has resulted in low profit margins; thus, contractors often have little incentive to do more than the minimum requirement at the expense of quality. Nevertheless, offering higher quality is a distinct advantage over the competition. For example, a major contractor in Hong Kong has a good reputation for providing clients with high-quality products and services. And it enables the contractor to win many public works and establish good relationships with public clients who often impose the priority on high quality standard.

Faster project completion

Fast project completion often benefits the end users or owners. For example, for commercial projects, clients always expect that the project could be completed faster so their investment in the project could be returned earlier. Therefore, having a management approach and technique for a faster project completion can be a distinct advantage in competing particularly for commercial projects. The fast-track method can be one method for achieving the faster completion of a project. Properly managed fast-track construction offers project owners the potential for significant time and cost savings. The key to the success of this process is the proper scheduling and management of the design effort to allow contract documents to be released on a phased basis before the entire design has been completed (Geller, 1993).

Innovative financing methods

The stronger a company's financial position is, the better its capability to carry out projects using innovative financing methods. Therefore, a company's financial capability can be a distinct advantage in competition. For example, new procurement methods such as private-public partnership system require contractors to be more involved in finance and share risks. Contractors with sound ability in finance management and innovation have the competitive advantage to win these kinds of projects in competition.

Innovative project management methods

The changing construction environment imposes additional requirements on contractors' competition strategy. These changes are typically characterized by globalization of the marketplace, interplay of economic forces, increases in project complexity, adoption of new procurement practices, and client sophistication. There is a demand for new project management methods in meeting these challenges and improving the efficiency of project management, thus bring contractors with advantage in competition. For example, the web-based project management system has been studied by many researchers (Alshawi and Ingirige, 2003; Nitithamyong and Skibniewski, 2004; Chan and Leung, 2004). This indicates that integrating new technology into project management can lead to innovation in project management practice.

Sustainable practice and social responsibility

The construction industry has significant environmental and social impacts. Reducing its impacts and contributing to sustainability practice are becoming very important in the construction industry. As the main actor in the industry, contractors have the obligation to reduce the impacts on the environment and society by incorporating the principles of sustainable development into their business. Environmental and social accountability, auditing, and reporting have been considered more and more important by the government, the public, and the industries. Therefore, it will soon become a distinct advantage for contractors to integrate sustainable practice and social responsibility into construction processes, by which contractors can gain both competitiveness and reputation.

Offering additional services to clients

Normally, contractors provide clients services by delivering the completed projects as specified in the contracts. However, providing additional services to clients helps contractors convey a good image to clients, and it can be a distinct advantage in competition. There are various ways for contractors to extend their services such as providing advice in feasibility analysis at various design stages, assisting with financing for a project, and planning the operation and maintenance of a project. Expanding services enables contractors to integrate their internal resources and explore new opportunities in the market.

7.2.3 Focus Strategy

The focus strategy can be applied by offering a particular type of project, operating in a particular region, or serving a particular type of client.

Offering a certain type of project

A contractor can focus on building a certain type of project such as residential buildings, hospitals, or schools. This enables the contractor to develop the best experience in applying designs, materials, planning procedures, and construction techniques for that particular type of project. Therefore, the contractor can deliver this particular type of project more efficiently than its competitors and gain the competitive advantage in competing for this particular type of project. Bauml (1997) suggests that "… *higher rated E/C (engineering and construction) companies tend to focus their activities on rather larger niches within the industry where they can add value through the application of specialized technical or managerial capabilities*."

Operating in a particular region

When a contractor carries out its business in a particular region, it can establish better and closer relationships with local clients, suppliers, and authorities, and be familiar with the local construction practice. These relationships enable contractors to get sufficient work, and gain local knowledge, which will in turn enable them to offer better service for clients in this region than their competitors. Therefore, good local relationship and experience bring contractors competitive advantages.

Serving a certain type of client

Contractors may choose to provide services for certain types of clients, and therefore have better knowledge of the clients' particular needs and preferences. Understanding the clients' needs enables the contractors to offer better quality services and add values to clients. This can attract the clients' interests to maintain long-term business relationships with contractors and retain exclusive service from them, thus illustrate contractors' competitive advantages.

7.2.4 Growth Strategy

Entry into new locations or regions

A contractor can build up new competitiveness by entering into new locations or regions where it has not been active in business before, thus to achieve growth in contracts. There are several reasons for construction firms to expand their business into new markets, such as stagnant existing markets, booming of new markets, and competitive use of resources (Langford and Male, 2001). For example, many contractors from developed countries take this opportunity to enter into developing countries where there is a huge need for new infrastructure and buildings. Comparing to the local contractors, they have better technology and advanced management methods, thus have competitive advantages.

Entry into new types of construction projects (highways, tunnels, and others)

Another common approach for business growth in construction is to engage new types of construction projects. The reasons for this include possibly the decline in current projects, potential increase in new types of construction projects, high profit in new types of projects, risk sharing in different types of projects, and effective use of resources. Since new types of projects require different technology and management skills, contractors should be careful when selecting this strategy.

Engaging in new business (real estate, design, operation, maintenance, and others)

Contractors can also achieve business growth by entering into other new businesses (related or unrelated). The main reasons for contractors to engage in new businesses include that risks can be shared in diversified business, and that business can grow by taking new opportunities. For example, a contractor may expand its business to real estate, or design, or operation, and or maintenance. In fact, some large contractors in Hong Kong have started their new business in real estate field, and significant growth has been achieved (Rowlinson and Walker, 1995).

Expanding by acquisition or merger

Contractors can enter into new markets, new projects, or new businesses by themselves, or by purchasing another company (acquisition) or combining with another one (merger). The reasons for an acquisition or a merger are multiple, for example, increasing revenue/market share, economies of scale, resource transfer, diversification, and reducing risks involved in expansion. Except acquisition and merger, strategic alliances such as joint ventures and partnerships are other common approaches for business growth. Strategic alliances can provide contractors an effective way to overcome internal deficiencies and access to multiple markets (Abdul-Aziz, 1994).

7.3 Data Survey

A separate questionnaire survey was conducted to validate the competitive strategy model established in Chapter two. The procedures and methods used for this survey are same as those adopted in the survey addressed in Chapter six. In the competitive strategy model, there are four main components, including external environment, internal resources and capabilities, competitive strategy and performance. The model suggests that there are close relationships among these components, as shown in Figure 7.1.

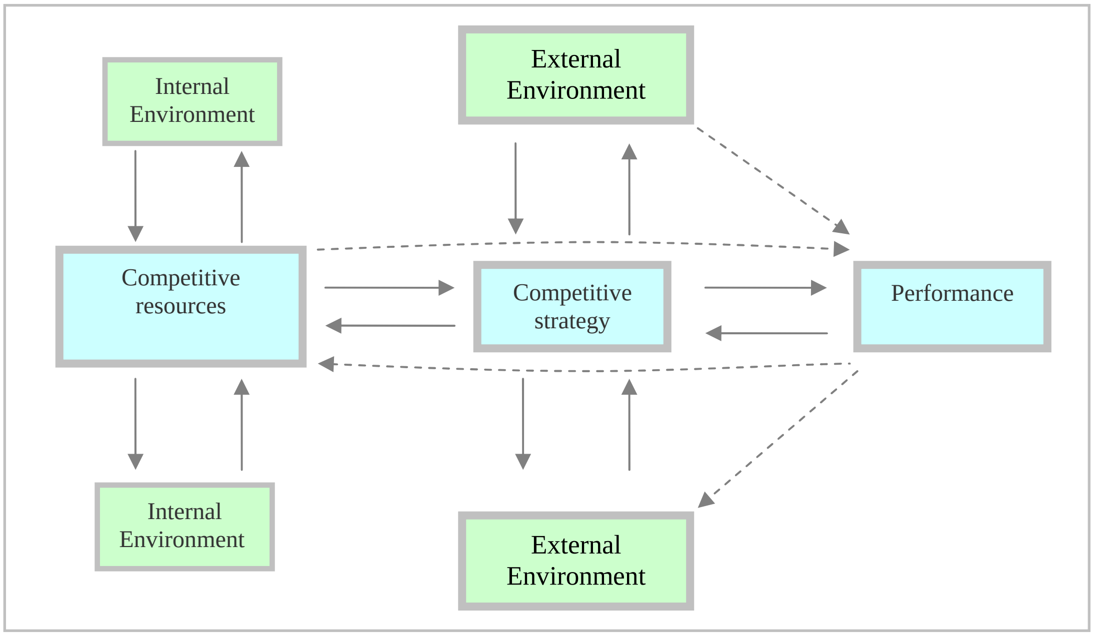

Figure 7.1 The competitive strategy model proposed in chapter two

The collected data in this survey will be used to validate the following relationships suggested in the competitive strategy model:

- Relationship between external environment and performance
- Relationship between external environment and competitive strategy
- Relationship between internal resources and capabilities and performance
- Relationship between internal resources and capabilities and competitive strategy
- Relationship between competitive strategy and performance

Furthermore, the collected data will be used to classify contractors into different groups according to their different strategic orientations.

The questionnaire includes five parts (See Appendix B). The first part is designed to collect the respondents' general information. The second part addresses the external environment including industrial environment and task environment. Porter's five forces are used for describing the industrial environment. And the relationships with various project participants are used for describing the task environment. The third part is about internal resources and capabilities, in terms of key competitiveness indicators. The fourth part concerns the competitive strategies identified in Table 7.1. The final part is concerned with the company's performance including growth of contract award and profit.

The formulation of the questionnaire was accompanied by carrying out of six interviews with professionals in the Hong Kong construction industry. In the interviews, the researcher gave an introduction of the research firstly, including the objectives of the research, design of the questionnaire, and the expected outcomes. Then, the interviewees were invited to review the questionnaire and gave their comments and suggestions. And the researcher gave relevant interpretations if the interviewees had any question. With the valuable suggestions contributed by the interviewed practitioners, the questionnaire was improved by making the questions more suitable and clear.

The questionnaire survey was conducted from November 2007 to January 2008 to collect data to identify the construction firms' business/corporate strategies with reference to the Hong Kong construction industry. The targeted respondents were directors or managers from contractors on the member list of the Hong Kong Construction Association (2007/2008). A total of 312 questionnaires were distributed and a reminder was also used to improve the response rate. Finally, 61 replies were received. Sixty replies were valid after the examination of collected data, representing a response rate of 19.2 percent.

7.4 Data Analysis

In the survey, the first part is designed to collect the general information of contractors including the company size, work experience, and main business segment. Table 7.2 shows that most contractors have more than 10 years of work experience in Hong Kong, and 73.3 percent of the respondents have more than 20 years experience. Table 7.3 shows the responding contractors have different company size. Table 7.4 shows that all responding contractors, except one, are on the list of the approved contractors for public works or registered contractors, indicating that most contractors are qualified for public works in Hong Kong. Table 7.5 shows the main work of the responding contractors. The results indicate that about 27 percent of the respondents are only involved in building-type construction and only about 13 percent in civil engineering construction. No contractor is only involved in maintenance construction. The rest contractors engage in combinations of these three types of projects or are specialist contractors and suppliers.

Table 7.2 Work experience of the respondents

Work experience	**Number of respondents**	**Percentage**
6 – 10 years	1	1.7%
10 – 20 years	15	25.0%
Over 20 years	44	73.3%
Total	60	100%

Table 7.3 Company size of the respondents

Company size (number of full time employees)	Number of respondents	Percentage
Less or equal 50	22	36.7%
51 – 200	17	28.3%
Over 200	20	33.3%
NA	1	1.7%
Total	60	100%

Table 7.4 Contractor type of the respondents

Contractor Type	Number of respondents	Percentage
On the List of Approved Contractors for Public Works	42	70.0%
On the List of Approved Suppliers of Materials and Specialist Contractors for Public Works	8	13.3%
Registered General Building Contractors	7	11.7%
Registered Specialist Contractors	2	3.3%
Others	1	1.7%
Total	60	100.0%

Table 7.5 Work types of the respondents

Work type	Number of respondents	Percentage
Building	16	26.7%
Civil	8	13.3%
Maintenance	—	—
Building and civil	9	15.0%
Building and maintenance	11	18.3%
Civil and maintenance	1	1.7%
Building, civil and maintenance	3	5.0%
Specialist work, material supply	11	18.3%
Total	60	100%

In order to ensure the reliability of the collected data, the internal consistency analysis is conducted by using Cronbach's alpha method, which has been adopted as well in Chapter 6. The means, standard deviations, and Cronbach's alpha coefficients of the research variables are shown in Table 7.6. The results indicate that the reliability for most variables is "adequate," with most of Cronbach's alpha coefficients above 0.7. Since Porter's five forces describe the industry from different angles, the "Industrial environment" has the lowest coefficient, indicating that its subscales are very broad.

Table 7.6 Mean, Standard Deviation and Cronbach's Alpha Coefficients of research variables

Variables	**Mean**	**Standard Deviation**	**Cronbach's Alpha Coefficients**
External environment			
Industrial environment	3.4200	1.0867	0.2211
Task environment	3.7639	0.6441	0.8114
Internal resources & capabilities			
Corporate image	3.9333	0.6218	0.7371
Technology and innovation	3.3458	0.8970	0.7781
Financial capability	4.0168	0.7114	0.8708
Marketing capability	3.5649	0.7635	0.8094
Project management skill	3.7583	0.6420	0.8586
Organization & Human resource	3.4708	0.6590	0.7230
Competitive strategy			
Cost leadership	3.3472	0.7419	0.7868
Differentiation	3.5143	0.8041	0.8577
Focus	3.4611	0.8213	0.6062
Growth strategy	2.9375	1.0105	0.7077
Performance			
Growth in contract awards	3.0339	0.8703	NA
Profit	2.9322	0.8065	NA

After the analysis of general information and internal consistency, the competitive strategy model will be validated. The correlation analysis is used for validating the relationships between: external environment and performance, external environment and competitive strategy, internal resources and capabilities and performance, internal resources and capabilities and competitive strategy, competitive strategy and performance.

The most common measure of correlation is the Pearson Product Moment Correlation, which shows the degree of linear relationship between two variables. The Pearson correlation coefficient is used when both variables are approximately normally distributed. Another correlation is Spearman's correlation coefficient, which is sometimes referred to as Spearman's rho. The Spearman's correlation coefficient is used when the data have been ranked (Morgan et al., 2001). In this study, the collected data can be considered as approximately normally distributed according to the sample scale, and the Pearson correlation coefficient is therefore selected to take the correlation analysis.

The coefficient of correlation is concerned about the relationship between two sets of variables. The value of the coefficient is assumed from -1.00 to +1.00. A correlation coefficient of -1.00 or +1.00 indicates perfect correlation, while zero indicates no relationship between the two sets of variables. The Pearson correlation coefficient can be calculated by using following formula (Lind et al., 2005):

$$r = \frac{\sum (X - \overline{X})(Y - \overline{Y})}{(n-1) s_X s_Y} \tag{7-1}$$

where r: Pearson correlation coefficient

X: values of variable X

$\overline{X}$: mean of variable X

Y: values of variable Y

$\overline{Y}$: mean of variable Y

n: number of values in the sample

s_X : standard deviation of variable X

s_Y : standard deviation of variable Y

7.4.1 Relationship between External Environment and Performance

According to the competitive strategy model, the external environment has great impact on company's performance. In the survey, the statements of five forces are used for describing the industrial environment and relationships with various project participants are use for describing the task environment. It can be seen that the five forces will have negative impact on contractors' performance and good relationships with project participants will benefit contractors' performance. Therefore, the researcher proposes that "the five forces are negatively related to contractors' performance"; and "relationships with various project participants are positively related to contractors' performance". With the assistance of SPSS, the correlation coefficients between the external environment and contractors' performance are calculated, and the results are shown in Table 7.7.

Table 7.7 Correlation coefficients between external environment and performance

External environment \ Performance	Growth of contract awards	Profit
Industrial environment		
There are many new entrants.	-0.213	-0.163
Suppliers have high bargaining power.	-0.148	-0.118
Clients have high bargaining power.	-0.115	-0.036
There are substitute services.	-0.082	-0.077
The rivalry between competitors is high.	0.012	-0.091
Task environment		
Relationship with clients	0.082	0.186
Relationship with Government departments	0.270*	0.238
Relationship with professional consultants	0.171	0.350**
Relationship with creditors	0.007	0.231
Relationship with subcontractors	-0.227	0.092
Relationship with suppliers	0.132	0.497**

Note: ** Correlation is significant at the 0.01 level (2-tailed)
*Correlation is significant at the 0.05 level (2-tailed)

Significance level represents the probability of rejecting the null hypothesis when it is true (Lind et al., 2005). For example, “correlation is significant at the 0.05 level” indicates that the probability of rejecting the hypothesis (the correlation is significant) is 5 percent. And the 0.05 level, 0.01 level and 0.001 level are commonly used in the statistical hypothesis testing.

In the industrial environment, the results show that the industrial environment is negatively related to performance. It is obvious that the descriptions of the industrial environment can increase the intensity of competition in the industry that can lead to poor performance of contractors. The only exception is that the correlation between rivalry between competitors and growth of contract awards is positive. It indicates that high rivalry between competitors compels contractors to give more effort to obtain contracts, which may lead to a slight growth of contract awards despite sacrificing profit.

In the task environment, the results show that all relationships with the exception of the relationship with subcontractors are positively correlated with the growth of contract awards, and the relationship with government departments is significant at the 0.05 level. Due to the decline of the construction industry in last decade, contractors in Hong Kong can not get enough contracts despite having good relationships with subcontractors. It may be the reason for the negative impact of relationship with subcontractors on growth of contract awards. Furthermore, the statistical analysis also suggests that relationships with all the key parties are positively correlated with contractors' profit, and the relationships with design and consulting firms and suppliers are significant at the 0.01 level. The results indicate that good relationship with government departments contributes greatly to the growth of contract awards, and good relationships with professional consultants and suppliers enable contractors to make higher profit.

7.4.2 Relationship between External Environment and Competitive Strategy

In the external environment, the five forces will have different impact on the selection of different competitive strategies, and the relationships with various participants will benefit the selection of different competitive strategies. Therefore, it is considered that "the five forces are related to the selection of competitive strategy, either negatively or positively; and the relationships with various project participants are positively related to the selection of competitive strategy". By using the SPSS, the correlation coefficients between the external environment and competitive strategy are calculated, as shown in Table 7.8.

Table 7.8 Correlation coefficients between the external environment and competitive strategy

Competitive strategies / External environment	Cost leadership	Differentiation	Focus	Growth strategy
Industrial environment				
There are many new entrants.	-0.103	0.137	0.047	0.064
Suppliers have high bargaining power.	-0.091	-0.102	0.014	-0.058
Clients have high bargaining power.	-0.046	-0.029	0.180	-0.023
There are substitute services.	-0.017	0.083	0.114	0.173
The rivalry between competitors is high.	0.108	0.114	-0.004	-0.011
Task environment				
Relationship with clients	0.234	0.294*	0.193	0.087
Relationship with Government departments	0.247	0.265*	-0.015	0.373**
Relationship with professional consultants	0.232	0.256*	0.090	0.199
Relationship with creditors	0.128	-0.077	0.023	0.019
Relationship with subcontractors	0.025	-0.166	-0.156	-0.137
Relationship with suppliers	0.267*	-0.086	-0.020	-0.088

Note: ** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

For the industrial environment, the results indicate that five forces are related to the selection of competitive strategies either negatively or positively. Contractors place different emphasis on competitive strategies by considering these five forces. When the rivalry between competitors is high, contractors tend to take cost leadership strategy. It echoes the fact that "… *cut-throat competition has sometimes led to unrealistically low bids which fail to make adequate provisions for meeting all the statutory and tender requirements*." (CIRC, 2001). When there are many new entrants, the differentiation strategy will be a better choice. New entrants will lead to intensive competition in the market. Differentiation can protect existing contractors from new entrants' threat. High bargaining power of clients makes the focus strategy a better choice. Focusing on niche market and providing specialized products or services enable contractors to gain competitive advantage in competition (Langford and Male, 2001). Finally, the substitute services could be the sources of new growth. The substitutes in construction can be new building versus refurbishment, repair and maintenance versus renovation; traditional construction services versus one-stop service, such as the BOT (build-operate-transfer) project.

Referring to the task environment, the results show that not all relationships with project participants are positively related to the four competitive strategies. It indicates that contractors have different emphasis on various relationships when considering different strategies. With a cost leadership strategy, for example, the relationship with suppliers is important. Good relationship with suppliers can help contractors establish an effective supply chain and keep construction cost to a low level. For a differentiation strategy, relationships with clients, government departments, and professional consultants are significantly important. These parties are interested with contractors' differentiated products or services. Good relationships with these three parties will enable contractors to clearly understand their needs. When considering focus strategy, contractors consider their relationship with clients as an important factor. Focusing on clients' needs and niche markets will help contractors gain competitive advantage. Government is one major client in the local construction market and Government initiatives can provide new opportunities for contractors. Good relationship with Government departments can help contractors develop growth strategies to meet public client's potential needs. On the other hand, good relationship with professional consultants can help contractors to identify potential opportunities in the market.

7.4.3 Relationship between Internal Resources and Capabilities and Performance

The variables for internal resources and capabilities are chosen from the KCIs and they are considered as the sources of contractors' competitive advantage. It is therefore considered that "the internal resources and capabilities are positively related to contractors' performance". The correlation coefficients between internal resources and capabilities and performance are shown in Table 7.9.

Table 7.9 Correlation coefficients between internal resources and capabilities and performance

Internal resources & capabilities \ Performance	Growth of contract awards	Profit
Corporate image		
Organization's credibility	0.034	0.065
Qualification of the company	0.127	0.350**
Project performance record	0.072	0.162
Technology and innovation		
Technology know-how	0.261*	0.361**
Technology advancement	0.234	0.272*
Investment on R&D	0.154	0.332*
Conversant with local practice	0.095	0.204
Financial capability		
Financial status	0.115	0.441**
Credibility grade	0.156	0.408**
Payment to subcontractors or suppliers	0.091	0.279*
Loan repayment	-0.026	0.153
Marketing capability		
Market coverage	0.386**	0.338**
Procurement ability	0.325*	0.356**
Ability to forecast market changes	0.187	0.368**
Relationship with clients and consultants	0.292*	0.409**
Project management skills		
Site progress management	0.141	0.304*
Quality control	0.016	0.439**
Coordination with subcontractors	0.179	0.301*
Contract and risk management	0.055	0.214
Environmental and safety management	0.130	0.214
Knowledge about local construction law	-0.052	0.217
Organization & Human resource		
Organizational structure &culture	0.182	0.228
Quality of personnel	0.053	0.191
Effectiveness of training program	0.333*	0.250
Effectiveness of internal cooperation	0.138	0.230

Note: ** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

The results in Table 7.9 show that all internal resources and capabilities with the exception of 'loan payment' and 'knowledge about local construction law' are positively correlated with 'growth of contract awards'. Market coverage is significantly related to the growth of contract awards (significant at the 0.01 level). Increasing the market coverage is the most effective approach when a contractor tends to increase its turnover. Technology know-how, procurement ability, relationship with clients and consultants, and effectiveness of training program also contribute significantly to the growth of contract awards (significant at the 0.05 level). The results indicate that contractors should put more emphasis on their technology and innovation, marketing ability and organization and human resources if they want to achieve growth in contract awards. A good marketing capability can enable contractors to explore new opportunities in the market. Advanced technology and good human resources enable contractors to provide clients with good service which will build up a contractor's reputation in the industry. Good reputation will also help contractors attract more clients to cooperate with them.

Furthermore, the analysis results also demonstrate that all internal resources and capabilities are positively related to contractors' profit. This can be interpreted as contractors with good corporate image offer a higher tender price in bidding, and high profit is achieved as a result. Investment on technology and innovation can help contractors improve their productivity and bargaining power which lead to the high level profit. Strong financial ability can help contractors get adequate financial support from financial bodies, utilize their money more efficiently, apply proper management of extra money, and hence achieve high returns. Good marketing capability enables contractors to explore new markets where they can achieve high profit. These new construction markets can be reflected by projects in new geographic locations, or projects that adopt different procurement methods. Advanced project management skills also contribute to competitive advantage. Without proper project management skills, contractors cannot achieve high profit even though they may have many contract awards. Proper project management skills can help contractors complete construction work more effectively and efficiently, and consequently achieve higher returns. Good organizational culture and human resources are assets for contractors. Building up a healthy organization culture and a good human resources management system can improve the internal cooperation and efficiency of work, so higher profit can be achieved through completing construction projects more efficiently.

7.4.4 Relationship between Internal Resources and Capabilities and Competitive Strategy

The internal resources and capabilities are fundamental for implementing different competitive strategies. Internal resources and capabilities are considered positively related to the selection of competitive strategy. Table 7.10 presents the results of the correlation coefficients between internal resources and capabilities and competitive strategies.

Table 7.10 Correlation coefficients between internal resources and capabilities and competitive strategy

Internal resources & capabilities \ Competitive strategies	Cost leadership	Differentiation	Focus	Growth strategy
Corporate image				
Organization's credibility	0.183	0.212	0.142	0.128
Qualification of the company	0.462**	0.386**	0.246	0.340**
Project performance record	0.353**	0.16	-0.058	0.072
Technology and innovation				
Technology know-how	0.382**	0.303*	0.213	0.083
Technology advancement	0.432**	0.336**	0.229	0.184
Investment on R&D	0.378**	0.243	0.192	0.165
Conversant with local practice	0.291*	0.306*	0.370**	0.301*
Financial capability				
Financial status	0.114	0.018	0.112	0.004
Credibility grade	0.154	0.030	0.033	0.071
Payment to subcontractors or suppliers	-0.003	-0.016	-0.037	-0.165
Loan repayment	-0.055	-0.051	-0.038	-0.113
Marketing capability				
Market coverage	0.309*	0.350**	0.267*	0.445**
Procurement ability	0.379**	0.411**	0.347**	0.458**
Ability to forecast market changes	0.437**	0.369**	0.222	0.458**
Relationship with clients and consultants	0.440**	0.318*	0.187	0.230
Project management skills				
Site progress management	0.370**	0.353**	0.223	0.283*
Quality control	0.382**	0.234	0.131	0.197
Coordination with subcontractors	0.318*	0.296*	0.078	0.094
Contract and risk management	0.384**	0.343**	0.162	0.127
Environmental and safety management	0.446**	0.379**	0.236	0.242
Knowledge about local construction law	0.308*	0.439**	0.214	0.03
Organization & Human resource				
Organizational structure &culture	0.407**	0.291*	0.056	0.252
Quality of personnel	0.441**	0.339**	-0.035	0.259*
Effectiveness of training program	0.617**	0.145	-0.046	0.346**
Effectiveness of internal cooperation	0.539**	0.149	0.149	0.18

Note: ** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

The results in Table 7.10 show that the majority of internal resources and capabilities are positively related to the four competitive strategies. It is interesting to note that financial capability is not positively related to the four competitive strategies. The reason is considered as that contractors do not take the effort to improve their financial capabilities due to the low capital requirement of entering the construction industry. However, finance is a major barrier for domestic contractors to get large design and build contracts since such contracts request more finance and technology. It is always difficult for them to raise enough finance to improve and develop their technology (Chiang et al., 2001). Therefore, local contractors need to enhance their financial capability in order to enter into new markets and new business.

The internal resources and capabilities have different impacts on the selection of four competitive strategies. For cost leadership strategy, most internal resources and capabilities are significantly related to this strategy, especially the ‘effectiveness of training program’ and ‘effectiveness of internal cooperation’. Cost leadership strategy is commonly used in construction industry since contracts are normally awarded to the low bidders. Nevertheless, clients (especially public clients) are increasingly using multiple criteria in contractor selection. Contractors need to meet clients’ requirements other than price. Therefore, strong internal resources and capabilities can help contractors adopt the cost leadership strategy successfully.

Referring to differentiation strategy, more than half items of internal resources and capabilities are significantly related to this strategy. In practice, many internal resources and capabilities can be used to develop a differentiation strategy, especially differentiation in technology, marketing and project management. Contractors should analyze and identify their core competence which can be used to develop a differentiation strategy in competition. Differentiation strategy is particularly a better choice when there are many new entrants, and this supports the results in Table 7.8.

Focus strategy is significantly influenced by technology and marketing. For example, some contractors engage in niche markets, such as hydrocarbon processing and power generation, and they possess specialized technical or managerial capabilities which enable them to position themselves competitively on the world stage. Therefore, specialized technology and carefully selected niche markets are particularly effective to the choice of focus strategy.

Furthermore, marketing capability and organization and human resources are significantly related to growth strategy. Good marketing capability can help contractors to explore new markets in other countries or regions which will lead to the formulation of a growth strategy. Appropriate organization structure and quality human resources provide support to the implementation of growth strategy. Therefore, contractors should emphasize on enhancing marketing and human resources if growth strategy is to be adopted.

7.4.5 Relationship between Competitive Strategies and Performance

Generally, competitive strategies should contribute to good performance. In other words, "competitive strategies should be positively related to contractors' performance". Using the survey data, the correlation coefficients between the competitive strategies and performance are obtained, as shown in Table 7.11.

Table 7.11 Correlation coefficients between competitive strategy and performance

Competitive strategy \ Performance	Growth of contract awards	Profit
Cost leadership		
Standardization of products or services	0.273*	0.331*
Superior training of personnel	0.254	0.205
Effective control of labor and materials	0.062	0.309*
Careful selection of subcontractors/suppliers	0.014	0.265*
Technological advancement	0.395**	0.377**
Incentive programs for productivity improvement or resource saving	0.301*	0.198
Differentiation		
Building company's reputation	0.389**	0.134
Offering higher quality of product	0.131	0.254
Faster project completion	0.104	0.224
Innovative financing methods	0.147	0.148
Innovative project management methods	0.275*	0.269*
Sustainable practice and social responsibility	0.125	0.177
Offering additional services to clients	0.102	0.066
Focus		
Offering a certain type of project	0.110	0.173
Operating in a particular region	0.033	0.268*
Serving a certain type of client	0.020	0.049
Growth strategy		
Entry into new locations or regions	0.252	0.102
Entry into new types of construction projects	0.210	0.074
Engaging in new businesses	0.213	0.230
Expanding by acquisition or merger	0.477**	0.349**

Note: ** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

The results in Table 7.11 show that all the four classes of competitive strategies contribute to contractors' performance. All the behaviors in practicing these strategies are positively related to both growth of contract awards and profit. Most effective behaviors include: standardization of products or services, technological advancement, innovative project management methods and expanding by acquisition or merger. These strategic behaviors would be given more attention with support of more resources, which should enable contractors to make efficient growth of contract awards and achieve higher profit in competition.

Some strategic behaviors can contribute more to higher profit than that to growth of contract awards. These strategic behaviors include, for example, effective control of labor and materials, careful selection of subcontractors/suppliers, and operating in a particular region. Then, these strategic behaviors would be good strategies for contractors if they have no expanding plan and want to make higher profit in their existing market. On the other hand, incentive programs for productivity improvement or resource saving and building company's reputation can contribute more to the growth of contract awards than to higher profit. These strategic behaviors would be good choices for contractors if they want to expand their business with fair returns.

It is interesting to note that the strategic behavior 'serving a certain type of client' can not bring contractors good growth of contract awards and high profit. When using this strategic behavior, clients' needs in the future are an important factor determining contractors' performance. In some niche markets, if there is an increasing need from certain clients, contractors can gain good business performance by this competitive strategy. However, clients' needs fluctuate with time, thus contractors can not always achieve good performance by serving a certain type of client. That is why large contractors often diversify their business and serve multiple clients in order to maintain their high growth and profit.

7.5 Cluster Analysis

The analysis of relationships in the previous section supports the principles of the competitive strategy model expressed in Figure 2.5. In practice, however, contractors take different competitive strategies due to their different backgrounds. Therefore, those contractors who have similar backgrounds and adopt similar competitive strategy can be identified as a group. The benefits of group classification are to help contractors understand their strategic orientations in a market, review their current strategies and find possible ways to improve the adaptability of their strategies. Therefore, the cluster analysis is used to classify contractors into different groups according to their strategic orientations. Cluster analysis is one of the most commonly used techniques for classification in social science and has been used in many studies for classifying companies based on their strategies (Harrigan, 1985; Kim and Lim, 1988; Congden, 2005).

The basic principle of cluster analysis method is to classify a set of values or variables into proper number of groups or clusters. The details of the principle and various kinds of clustering algorithms can be referred to previous studies (Aldenderfer and Blashfield, 1984; Everitt, et al., 2001; Hair, et al., 2006; Gan, et al., 2007). The algorithms can be divided into two major categories: hierarchical and nonhierarchical. The selection of an appropriate clustering algorithm is critical to the efficiency of cluster analysis (Ketchen and Shook, 1996). In nonhierarchical algorithms, the *k*-means algorithm is mostly used by researchers. The *k*-means algorithm was initially introduced by MacQueen (1967), and further developed by Hartigan (1975) and Hartigan and Wong (1979). The *k*-means clustering algorithm is based on assigning each point to the nearest cluster center and aims at minimizing the following squared error function:

$$V = \sum_{i=1}^{k} \sum_{x_j \in S_i} (x_j - \mu_i)^2 \tag{7-2}$$

where *k*: number of clusters

S_i : clusters, *i=1,2,…,k*

n: number of data points

x_j : value of data point x_j

μ_i : the mean point of all the points $x_j \in S_i$

The algorithm steps of *k*-means cluster analysis are as follows (MacQueen, 1967):

- Choose the number of clusters, *k*.
- Randomly generate k clusters and determine the cluster centers, or directly generate *k* random points as cluster centers.
- Assign each point to the nearest cluster center.

- Re-compute the new cluster centers.
- Repeat the two previous steps until some convergence criteria are met.

7.5.1 Clustering Contractors into Different Groups

In this research, the *k*-means algorithm is selected to conduct the cluster analysis for its efficiency in clustering large data sets and simple calculation process. The twenty strategic behaviors, identified in previous discussion, are used for cluster analysis. For contractors with different backgrounds, their strategic behaviors are different. Therefore, the contractors could be classified into different groups with different strategic orientations based on cluster analysis. The clustering process is conducted as follows.

Identifying Outliers

Before starting the clustering, the original data of twenty strategic behaviors should be examined to identify the potential outliers which are distant from the rest of data. The squared Mahalanobis distance, denoted as D^2, is used for identifying outliers (Hair et al., 2006), which can be calculated by following formula:

$$D^2(x) = (x-\mu)^T S^{-1}(x-\mu) \tag{7-3}$$

where x: a group of values $(x_1, x_2, ..., x_p,)^T$;

μ: the mean of values $(\mu_1, \mu_2, ..., \mu_p,)^T$;

S : the covariance matrix;

T: transform matrix; *-1*: inverse matrix.

By using above formula to analyzing the data collected in the survey, the squared Mahalanobis distances of sixty responses' judgment can be calculated and ranked, as shown in Table 7.12. It can be seen that one response (no. 4) has substantially higher D^2 value than the remaining responses. There is no specific cutoff value for designating a response as an outlier (Hair et al., 2006). In this case, response no. 4 has a relatively high D^2 value comparing to rest of responses and is identified as an outlier. Therefore, fifty-nine responses are used for the cluster analysis.

Table 7.12 Identifying potential outliers with squared Mahalanobis distance D^2

Response No.	**Mahalanobis D^2**	**Response No.**	**Mahalanobis D^2**	**Response No.**	**Mahalanobis D^2**
4	47.6	32	21.9	49	16.1
36	33.5	54	21.9	30	15.3
26	33.3	27	20.7	56	15.2
22	33.1	9	20.5	44	14.9
23	32.6	25	20.5	1	14.5
18	31.6	38	20.3	47	14.2
39	31.1	55	20.0	33	14.1
5	30.5	31	19.9	40	14.0
37	28.9	59	19.8	52	13.5
53	28.1	60	19.2	48	12.4
13	27.7	50	18.9	57	11.5
19	27.5	3	18.4	45	11.4
43	25.9	58	18.0	21	10.7
24	25.2	17	18.0	29	10.6
8	24.5	46	17.2	42	10.6
16	23.4	6	16.9	2	10.3
34	23.3	35	16.9	28	10.3
7	23.0	51	16.9	15	9.3
10	22.9	11	16.7	41	9.3
20	22.3	12	16.7	14	7.5

Standardizing Data

The standardization of data is used to avoid potential bias in computing the Euclidean distance (Harrigan, 1985; Kim and Lim, 1988). Standardized data also provide an easy way to know whether the value is above, equal or below the mean value. The normally adopted approach for standardization is to transform the values to *z*-scores (standard normal distribution) with zero mean and unit variance (Anderberg, 1973; Cool and Schendel, 1987). Therefore, the original data of responses' judgment on the twenty strategic behaviors are standardized as *z*-scores (mean = 0, standard deviation = 1) for clustering.

Selecting the Number of Clusters

Selection of the number of clusters is important since an optimal number of clusters can provide right explanation of data. The rule of cluster analysis is to determine whether there is a substantial increase in the tightness of clusters (or a decrease in the squared error) as the algorithm changes from one cluster to the next. This method was criticized for not representing the fact, especially in social science (Hambrick, 1984). Lehmann (1979) proposed that survey data generally yield no more than n/30 to n/50 reliable clusters (e.g., a sample of 300 would yield 6 to 10 clusters). Other methods for determining the number of clusters, such as percentage changes in heterogeneity, were also used in studies (Hair et al., 2006). There are no standard criteria for selecting an appropriate number for clustering. Hambrick (1984) said that "*the lack of any natural breakpoints does not nullify the insight to be gained from clustering strategic phenomena. Rather, it places pressure on the researcher to select cluster solutions on the basis of well-chosen subjective criteria, trading off parsimony and detail…*" Therefore, selecting an appropriate number of clusters enables researchers to have new insights on their studies.

In this research, four clusters are selected for taking the cluster analysis. The selection is based on three criteria. First, the number of clusters is limited by the sample size (fifty-nine responses). The clusters can not be explained properly by the sample when more clusters are considered. Second, the strategic behaviors are grouped into four major classes in the survey. Four clusters could be more representative in this case. Third, Miles and Snow (1978) proposed four strategic orientations in their research. The selection of four clusters can be used to validate whether these four different strategic orientations exist in the local construction industry.

Clustering

With the standardized data and identified number of clusters, the clustering can be conducted by using SPSS computer package. After input the standardized data, the *k*-means clustering algorithm is selected in the package and the results show that there are 9 responding contractors in cluster one, 8 in cluster two, 17 in cluster three and 25 in cluster four, as shown in Table 7.13. Based on the clustering results, the mean and standard deviation of strategic behaviors in different clusters can be calculated. Meanwhile, the means comparison with the entire sample (zero) is conducted (by using SPSS package) for identifying the outstanding behaviors among different clusters. And the analysis of variance between different clusters is also conducted (by using SPSS package) to test the significant difference among different clusters.

Table 7.13 Mean, standard deviation, and analysis of variance of the four clusters

Strategic behaviors	Cluster analysis [a]								Analysis of Variance
	Cluster 1 (*n=9*)		Cluster 2 (*n=8*)		Cluster 3 (*n=17*)		Cluster 4 (*n=25*)		
	Mean	***S.D.***	***Mean***	***S.D.***	***Mean***	***S.D.***	***Mean***	***S.D.***	***F-value*** [b]
Cost leadership									
Standardization of products or services	0.58	0.92	-0.94*	1.39	-0.29	0.80	0.29	0.76	5.589
Superior training of personnel	0.99**	0.68	-1.55**	0.48	-0.37	0.68	0.39	0.69	26.197*
Effective control of labor and materials	0.99**	0.89	-0.65	1.12	-0.65*	0.74	0.29	0.72	10.894*
Careful selection of subcontractors/suppliers	0.61	1.06	0.20	0.62	-0.93**	0.99	0.35	0.62	10.729*
Technological advancement	1.25**	0.88	-0.85*	0.98	-0.20	0.79	-0.04	0.78	10.033*
Incentive programs for productivity improvement or resource saving	0.91*	0.64	-1.13**	0.75	-0.39	0.87	0.30	0.82	11.539*
Differentiation									
Building company's reputation	1.08**	0.81	0.20	1.04	-0.38	0.71	-0.19	0.97	6.002*
Offering higher quality of product	1.23**	0.89	-0.35	0.87	-0.51	0.87	0.02	0.80	8.854*
Faster project completion	0.98**	1.09	-0.68	1.09	-0.44	0.78	0.16	0.77	7.171*
Innovative financing methods	1.34**	0.94	-1.35**	0.77	-0.14	0.58	0.05	0.65	21.331*
Innovative project management methods	1.31**	0.89	-1.32**	0.94	-0.16	0.65	0.06	0.61	19.440*
Sustainable practice and social responsibility	1.46**	0.75	-0.96*	0.66	-0.44	0.69	0.08	0.73	19.606*
Offering additional services to clients	1.00**	1.26	-0.21	0.78	-0.51	0.85	0.05	0.81	5.732
Focus									
Offering a certain type of project	0.35	0.98	0.86*	0.52	-0.28	1.04	-0.21	0.95	3.559
Operating in a particular region	0.21	0.58	0.27	1.33	-0.35	0.92	0.07	1.05	1.062
Serving a certain type of client	1.00**	1.03	-0.21	0.78	-0.34	1.03	-0.06	0.84	4.483
Growth strategy									
Entry into new locations or regions	0.71*	0.63	-0.50	0.93	0.26	0.99	-0.27	0.99	3.597
Entry into new types of construction projects	0.70*	0.69	-1.29**	0.51	0.57*	0.70	-0.22	0.91	13.403*
Engaging in new businesses	0.71*	0.79	-1.30**	0.94	0.23	0.85	0.01	0.83	8.924*
Expanding by acquisition or merger	0.75*	1.10	-0.66	0.90	0.31	0.91	-0.27	0.85	4.813
Cluster name	*Analyzers*		*Reactors*		*Prospectors*		*Defenders*		

[a] Difference from mean of entire sample is significant at 0.01 level (**) or 0.05 level (*)
[b] F-value is significant at 0.001 level (*)

Contractors in four clusters are named as analyzers, reactors, prospectors and defenders according to their different strategic orientations, and will be further discussed in next section. The results demonstrate that four strategic orientations adopted by contractors in the Hong Kong construction industry. Their selections for different strategies reflect their different backgrounds, different understanding of strategy, and different visions of business development. These lead to different company characteristics, different attitudes and relationships to the external environment, different internal resources and capabilities, and different performance among the four clusters.

7.5.2 Analyzing the Four Clusters

In order to interpret the four strategic orientations effectively, more information is needed except the results in Table 7.13. The performance analysis among four clusters can provide useful information for interpreting the four strategic orientations. Therefore, the performance is firstly discussed in this section.

Different Performance among the Four Clusters

There are different strategic orientations for contractors in four clusters. Accordingly, it is considered that they will have different performance in competition. Therefore, the differences of contractors' performance will be examined. For testing the performance differences among the four clusters, Duncan's multiple range test is used since it can test whether there is significant difference between any two clusters. Duncan's test is based on comparing the range of a subset of the sample means with a calculated least significant range. If the range of the subset exceeds the least significant range, the population means can be considered significantly different (Bewick et al., 2004). The least significant range denoted as R_p is given by:

$$R_p = r_p \sqrt{\frac{s^2}{n}} \tag{7-4}$$

where r_p : the least significant range

s^2 : error mean square

n: sample size for each treatment

With the clustering results, the original data of performance can be classified into four groups with a label for each group. These labeled data can be input to the SPSS package to compare their means. The result of Duncan's multiple range test of 'growth of contract award' is shown in Table 7.14. It can be seen that only contractors in cluster one and cluster two have significant differences in growth of contract award. Similarly, Duncan's multiple range test of the profit is also conducted. The results of performance difference among the four clusters are shown in Table 7.15.

Table 7.14 Duncan's test of differences among clusters (growth of contract awards)

CLUSTER	**N**	**Subset for alpha = .05**	
		1	**2**
2	8	2.7500	
4	25	2.9600	2.9600
3	17	3.0000	3.0000
1	8		3.6250
Sig.		.508	.079

Table 7.15 Differences of performance among the four clusters

Performance	**Means of Four Clusters**				**Significantly Different Pairs of Cluster Means** [a]
	1	2	3	4	
Growth of contract awards	3.63	2.75	3.00	2.96	1–2
Profit	3.50	2.75	2.94	2.84	1–2

[a] The difference is significant at 0.05 level.

The results in Table 7.15 show that there are significant differences on ‘growth of contract award and ‘profit’ between cluster one and cluster two, while the mean values of performance show that contractors in cluster one have better performance than contractors in other three clusters. Contractors in cluster three outperform those in clusters two and four, while contractors in cluster four outperform those in cluster two. This result is echoed by other studies (Snow and Hrebiniak, 1980; Bourgeois, 1980; McKee et al., 1989) wherein it has been found that analyzers have the highest performance, defenders and prospectors have a lower performance or substantially lower and approximately at equal level performance (Snow and Hrebiniak, 1980), and reactors have the lowest level of performance as shown in Figure 7.2. It indicates that the relationship illustrated in Figure 7.2 can be applied in the local construction industry. Contractors in different clusters need to review their strategy type and adaptive capability accordingly if they want to improve their competitiveness. By combining the results in Table 7.13, the interpretation of matching the four clusters to analyzers, reactors, prospectors and defenders will be discussed in following paragraphs.

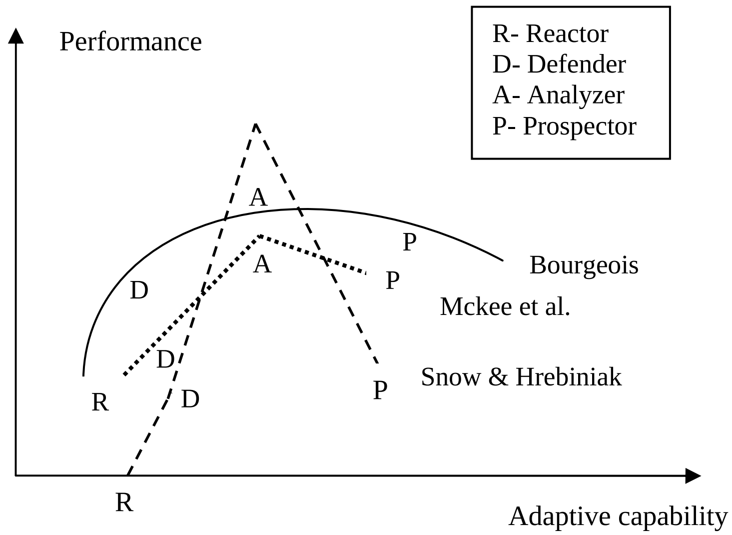

Figure 7.2 Relationship between adaptive capability, strategy type, and performance
Source: McKee et al., (1989)

According to Miles and Snow (1978), the four strategy types have different adaptive capabilities: reactor < defender < analyzer < prospector. The reactor (R) lacks adaptive capability since it fails to develop the mechanisms to sense and respond to changes in the market. This condition results from (a) lack of a clear strategy by top managers, (b) lack of appropriate linkages between strategy and the organization’s structure, and (c) a tendency for managers to maintain current status despite environmental changes (Miles and Snow, 1978). Contractors in cluster two have the characteristics of a reactor in the market since they only offer a certain type of project in a particular region, lack the capability to respond to environment changes, and have the lowest performance.

The defender (D) deliberately reduces adaptive capability by selecting a stable and narrowly defined market, which enables the organization to emphasize on improving operation efficiency. One advantage of the defender’s efficiency-based strategy is to reduce operation cost. However, the defender organization has to take the risk of changes in the market. Since the defender deliberately reduces adaptive capability, it is unlikely to notice market change or adapt to change if it is noticed (Miles and Snow, 1978). Contractors in cluster four have the characteristics of a defender since they focus on the cost leadership strategy to improve efficiency, take passive action to market changes without giving distinct emphasis on other strategies, and have higher performance than contractors in cluster two.

The analyzer (A) maintains a stable domain where it can operate with relative efficiency and attempt to identify emerging opportunities through market scanning and research. It often achieves above average new product success rates because it is 'second in' to new product markets, with the advantage of observing and learning from the new product problems of other firms (Miles and Cameron, 1982). Contractors in cluster one have the characteristics of 'analyzer'. They put more emphasis on various competitive strategies than those in other clusters as shown in Table 7.13, and they can achieve superior performance in competition. They have the ability to notice changes in the market and take relevant action.

The prospector (P) emphasizes on identifying and capitalizing on emerging market opportunities, and puts much effort on studying and communicating with the market. Due to its external orientation, the prospector tends to maintain extensive capabilities to respond to market changes and bear the inherent cost (Miles and Snow, 1978). Contractors in cluster 3 have the characteristics of a prospector since they put more emphasis on growth strategy. Their strategic orientation is to find new opportunities in the existing market or explore new markets. They are very sensitive to environment changes and have good marketing capability, and their performance is approximately at equal level with contractors in cluster four.

Different Company Characteristics of the Four Clusters

The responding contractors in the survey are classified into four clusters according to their strategic orientations. It is considered that contractors in different clusters have different characteristics. In the questionnaire, the company profile is investigated in the first part, including work experience, size, contractor type, main business. According to the collected data, the characteristics of the four clusters are compared in Table 7.16.

Table 7.16 Comparison of contractors in four clusters

	Cluster 1		**Cluster 2**		**Cluster 3**		**Cluster 4**	
Work	55.6%	>20	62.5%	>20	76.5%	>20	80.0%	>20
experience	44.4%	11- 20	37.5%	11-20	23.5%	11-20	16.0%	11-20
(Years)							4.0%	6-10
Size	55.6%	>200	0.0%	>200	35.3%	>200	36.0%	>200
(number of full	22.2%	101-200	25.0%	101-200	5.9%	101-200	12.0%	101-200
time employees)	22.2%	<101	75.0%	<101	58.8%	<101	52.0%	<101
Contractor type	77.8%	Group C	25.0%	Group C	52.9%	Group C	48.0%	Group C
	22.2%	Group B	12.5%	Group B	11.8%	Group B	24.0%	Group B
			12.5%	RGBC	17.6%	RGBC	12.0%	RGBC
			50.0%	Specialist	17.6%	Specialist	16.0%	Specialist
Main business	55.6%	B	50.0%	B+M	41.2%	B+M	44.0%	B+M
	33.3%	C+B	50.0%	S	17.7%	C+M	24.0%	C
	11.1%	C+B+M			23.5%	B+C	16.0%	B+C+M
					17.6%	S	16.0%	S

Notes: RGBC – Registered General Building Contractor
B – Building
C – Civil
M – Maintenance
S – Specialist work, material supply

Contractors in cluster one have good work experience in Hong Kong, large company size, all on the list of approved contractors for public works, main business on building and civil. This group of contractors represents small part of large contractors in Hong Kong. Their main business is on building and civil construction work, especially on public works. They have built up good reputation in the local industry which enables them to have competitive advantage in competition. Their focus on clients' needs and pursuers of superior performance bring them interests on implementing various kinds of strategies in practice. They are the leaders in the local construction industry.

Contractors in cluster two have good work experience in Hong Kong, small company size, specialist contractors, main business on building and specialist contract. This group of contractors represents the specialist contractors and some small and medium general contractors in Hong Kong. Their main business is on specialist work or building construction work. Their specialist character and single business (building) make it a better choice for them to take the focus strategy. For specialist contractors, they can concentrate on the niche markets with high technical requirements. For general contractors, focusing on building projects may not be a good choice.

Contractors in cluster three have good work experience in Hong Kong, about 60 percent with small company size, most on the list of approved contractors for public works, most on building and civil construction work. They represent few large general contractors, most small and medium contractors, and some specialist contractors. They have different reasons for taking growth strategy. For those few large general contractors, they need to find new markets to keep sustainable development of their business. For small general contractors, they need to find ways to grow up and improve their competitiveness in industry. For some specialist contractors, they also need to find ways to grow up, for example, upgrading to general contractors.

Contractors in cluster four have similar characteristics with contractors in cluster three. They also represent few large general contractors, most small and medium general contractors, and some specialist contractors. Contractors in this cluster have established their position in the local industry and usually take the cost leadership strategy in competition. For few large general contractors, they take this strategy to keep their position in the industry and also keep eyes on potential opportunities. For most medium and small general contractors, it is not easy to find proper ways to grow up and their first objective is to keep their business going on and improve their work efficiency. For some specialist contractors, they are in a relatively stable niche market and cost leadership would be a competitive advantage for them.

Different Attitudes and Relationships to the External Environment of the Four Clusters

In this section, Duncan's multiple range tests is used for testing whether there are differences of contractors' attitudes and relationships to the external environment among the four clusters. The test is conducted by using SPSS package and the results are shown in Table 7.17.

Table 7.17 Differences of the external environment's impact on the four clusters

External Environment	Means of Four Clusters				Significantly Different Pairs of Cluster Means [a]
	1	2	3	4	
Industrial environment					
There are many new entrants.	3.00	2.38	3.12	2.84	—
Suppliers have high bargaining power.	2.78	3.13	3.06	2.96	—
Clients have high bargaining power.	4.11	4.38	4.29	4.12	—
There are substitute services.	2.67	2.50	2.88	2.80	—
The rivalry among competitors is high.	4.33	4.50	4.06	4.40	—
Task environment					
Relationship with clients	4.33	3.88	3.59	3.72	1–2, 1–3, 1–4
Relationship with Government departments	4.11	3.13	3.65	3.48	1–2, 1–4, 3–2
Relationship with professional consultants	4.11	3.38	3.76	3.60	1–2
Relationship with creditors	4.11	3.88	3.76	3.84	—
Relationship with subcontractors	3.89	3.75	3.82	3.88	—
Relationship with suppliers	4.00	3.63	3.65	3.84	—

[a] The difference is significant at 0.05 level.

The results in Table 7.17 indicate that there are no significant differences of contractors' attitudes to the industrial environment. They all give high values to the statements 'Clients have high bargaining power' and 'The rivalry among competitors is high'. It indicates intense competition environment in the local construction industry. However, there are significant differences among the four clusters when considering their relationships with clients, government departments, and professional consultants. As 'analyzers', contractors in cluster one have the best relationships with various project parties than other three clusters. Good relationships with these project participants enable contractors in cluster one to have more opportunities to win contracts and achieve superior performance. As 'reactors, contractors in cluster two focus on the relationship with clients for implementing the focus strategy in competition. Their performance will be influenced largely by the needs of their typical clients. As ‘prospectors’, contractors in cluster three focus on the relationships with Government departments and professional consultants for exploring new opportunities in the market. As ‘defenders’, contractors in cluster four focus on the relationships with subcontractors and suppliers for potential cost reduction.

Different Internal Resources and Capabilities among the Four Clusters

Contractors in four clusters have different strategic orientations, performance and relationships with project participants. Do they have different competitive advantages on internal resources and capabilities? In order to answer this question, Duncan’s multiple range tests is used for testing the difference among the four clusters. By using SPSS package, the test is conducted and the results are shown in Table 7.18.

The results in Table 7.18 indicate that there are significant differences of competitive advantages on internal resources and capabilities among the four clusters. Contractors in cluster one (the analyzers) have competitive advantages on most internal resources and capabilities. It indicates that contractors in cluster one use their internal resources and capabilities more effectively and efficiently than contractors in other three clusters. For contractors in cluster two (the reactors), their internal resources and capabilities are not competitive among the four clusters, except the financial capability. Passive response to the market can not stimulate them to build up competitive advantage on internal resources and capabilities. Contractors in cluster three (the prospectors) need to improve their marketing capability to be real prospectors and enhance their knowledge on local construction law. Contractors in cluster four (the defenders) need to enhance those internal resources and capabilities that could be sources for implementing cost leadership strategy.

Table 7.18 Differences in internal resources and capabilities among the four clusters

Internal resources and capabilities	**Means of Four Clusters**				**Significantly Different Pairs of Cluster Means** [a]
	1	2	3	4	
Corporate image					
Organization's credibility	4.56	3.88	3.94	3.84	1–2, 1–3, 1–4
Qualification of the company	4.56	3.63	3.94	3.80	1–2, 1–3, 1–4
Project performance record	4.22	3.38	3.82	3.96	1–2, 4–2
Technology and innovation					
Technology know-how	4.00	3.38	3.59	3.68	—
Technology advancement	3.78	2.88	3.29	3.28	1–2
Investment on R&D	3.44	2.13	2.65	2.56	1–2, 1–3, 1–4
Conversant with local practice	4.44	3.63	3.76	3.60	1–2, 1–3, 1–4
Financial capability					
Financial status	4.33	4.13	4.00	3.88	—
Credibility grade	4.44	4.00	3.94	3.76	1–4
Payment to subcontractors or suppliers	4.44	4.25	3.88	3.96	1–3
Loan repayment	4.50	4.25	3.82	3.83	1–3, 1–4
Marketing capability					
Market coverage	3.89	3.25	3.29	3.24	—
Procurement ability	4.33	3.50	3.41	3.40	1–2, 1–3, 1–4
Ability to forecast market changes	4.22	3.50	3.50	3.60	1–2, 1–3, 1–4
Relationship with clients & consultants	4.44	3.63	3.59	3.80	1–2, 1–3, 1–4
Project management skills					
Site progress management	4.44	3.38	3.71	3.72	1–2, 1–3, 1–4
Quality control	4.33	3.50	3.59	3.72	1–2, 1–3, 1–4
Coordination with subcontractors	4.22	3.63	3.65	3.92	1–2, 1–3
Contract and risk management	4.22	3.13	3.53	3.64	1–2, 1–3, 1–4
Environmental and safety management	4.44	3.25	3.59	3.76	1–2, 1–3, 1–4
Knowledge about local construction law	4.44	3.88	3.41	3.88	1–2, 1–3, 1–4, 2–3, 4–3
Organization & Human resource					
Organizational structure &culture	4.00	3.13	3.35	3.48	1–2, 1–3, 1–4
Quality of personnel	4.33	3.25	3.41	3.72	1–2, 1–3, 1–4
Effectiveness of training program	3.56	2.50	3.24	3.32	1–2, 3–2, 4–2
Effectiveness of internal cooperation	3.78	3.00	3.29	3.68	1–2, 1–3, 4–2

[a] The difference is significant at 0.05 level.

7.6 Summary

In this chapter, contractors' competitive strategies are analyzed with reference to the Hong Kong construction industry. The relationships proposed in the competitive strategy model are validated through correlation analysis of the data collected from a questionnaire survey. By using cluster analysis, the responding contractors are classified into four clusters according to their different strategic orientations: analyzers, reactors, prospectors and defenders. The results of correlation analysis and cluster analysis provide useful references for assisting contractors to review their current strategies, performance, relationships to the external environment, competitive advantages on internal resources and capabilities; and find effective ways to improve the adaptability of their strategies for achieving superior performance in competition.

CHAPTER 8 CONCLUSIONS

CHAPTER 8 CONCLUSIONS

This chapter presents the major findings, contributions, and conclusions of this study. The potential future research areas are also discussed in this chapter.

8.1 Conclusions

8.1.1 Contractors' Business Environment in the Hong Kong Construction Industry

The construction industry is considered one of the pillar industries in Hong Kong. However, with the impact of the Asian Financial Crisis, the Hong Kong economy entered into a slow development period, and investments on housing, infrastructures, and facilities reduced a great deal. As a result, during the period of 1997 to 2005, the output of the construction industry was reduced by 43 percent, the number of building and civil engineering establishments reduced by 10 percent, and the number of persons directly engaged in the construction industry reduced by 28 percent. This has led to appealing for actions to boom the industry. Specific plans have been addressed in the government's policy in which 10 major infrastructure projects have been proposed for economic growth. Furthermore, with more active cooperation between Hong Kong and the neighboring cities in Mainland China, it is expected for an increasing demand for new infrastructures to facilitate the cooperation. In line with these developments, the construction industry has been recovering from the downturn in last couple of years. However, contractors need to consider the influence of new financial crisis on the industry.

The discussions in the previous chapters suggest that the clients have high bargaining power, and the rivalry between competitors is high. The findings from the analysis on the data generated in the survey demonstrate that the clients in Hong Kong construction industry have high bargaining power and the rivalry between competitors is high. The depressed state of the market makes clients more careful when considering on investing on new construction projects, and they may impose more restrict criteria and requirements when selecting contractors for constructing projects. The construction market in Hong Kong is typically buyer's market, in which the clients have more bargaining power when they purchase products or services in the market. This leads to intense competition between contractors in order to find enough work to keep the cash flowing and maintain business operations. In fact, the intense competition has been compelling some construction companies to quit the industry. Therefore, finding competitive strategies is the major management function to construction companies in the local market.

The value of construction work at construction sites is reduced greatly, and the value of construction work at locations other than construction sites exceeds those at the sites. The construction market analysis shows that the decrease of construction work at sites contributes to the major part of the reduction of construction output in the previous decade. The outputs of the building sector and structures and facilities sector have both reduced greatly in the last decade. The gross value of construction work performed by main contractors in the building sector was reduced by 64 percent from 1998 to 2006. Since the decrease of property value makes investors lose their confidence on investing on buildings, building works have decreased substantially over previous years. Nevertheless, it seems that the output of structures and facilities sector has not been affected by the market as much as that to private building sector since the major investments on structures and facilities are from the government. The output of the structures and facilities sector has been stable during the period of 2000 to 2004 at around HK$20,000 million per year. Another finding on the market is the increase of the construction work at locations. The value of construction work performed by main contractors at locations exceeded those at the sites in 2006. It indicates that clients spent more money on improving the quality of existing buildings through decoration, repair, maintenance, and other minor works. Repair and maintenance are taken as the substitute for constructing new projects to provide the same functions. In developed regions, repair and maintenance is a major market segment, and this is one of the reasons that contractors in developed regions prefer to explore new markets there.

The high level of freedom of the Hong Kong construction market has been attracting many contractors with various backgrounds and organization structures. The economic freedom of Hong Kong has been ranked at the top level on the "Index of Economic Freedom" since 1995. Many international companies have established their regional headquarters in Hong Kong. There are less legal or institutional restrictions on the entry of foreign contractors into the local industry. As a result, contractors working in Hong Kong have various backgrounds. Besides the indigenous local contractors, there are foreign contractors, localized foreign contractors, and contractors from China. Most indigenous local contractors start their business in the building sector where there are low entry barriers before diversifying to relevant businesses such as construction materials and real estate development. Some local contractors belong to large real estate group companies such as New World (developer) – Hip Hing Construction (contractor). Foreign contractors usually enter the Hong Kong construction industry with their advanced technology and management skills with targeting for large civil engineering infrastructure projects, which the indigenous local contractors cannot provide. Some foreign contractors are gradually localized. These localized foreign contractors take advantage of their local expertise and capitalize on the resources and technological support from their home bases. These competitive advantages allow them dominate the works in the civil engineering sector. On the other hand, contractors from Mainland China have entered the local market since the late 1970s, and most of them are large state-owned group companies in Mainland China. Their major competitive advantage is low cost since they bring some staff from Mainland China to Hong Kong. Overall, contractors in the Hong Kong construction industry have different backgrounds and competitive advantages in competition.

The discussion demonstrates that good relationships with clients, government departments, and professional consultants can be competitive advantages for contractors. Contractors have to engage in various kinds of relationships with the project participants. Contractors' relationships with clients, government departments, and professional consultants are particularly important, and it has been found that these relationships are significantly different among various groups of contractors. These good relationships will help contractors to achieve superior performance in competition. With the development of the industry, construction clients, especially public clients, will impose more requirements on contractors aside from providing low tender price. High quality, fast completion, risk sharing, and environmental and social responsibility are among the typical requirements from clients. In applying new procurement methods such as private-public partnership, contractors act as both the service provider and the shareholder involved in the whole process of the project and also share relevant risks. Having a good relationship with clients can help contractors clearly understand their potential needs and explore new markets. Government departments are both the constitutor of regulations and the major construction clients. Therefore, having a good relationship with public clients not only enables contractors to get more work but also helps them to be familiar with the local construction regulations. On the other hand, having a good relationship with professional consultants can provide contractors with more opportunities to acquire work with the consultants' recommendation. In the construction stage, this good relationship with the consultants can improve the efficiency of cooperation between the different parties, reduce disputes and uncertainties between project parties, and help contractors complete the projects and meet the clients' multiple requirements. Overall, contractors need to establish good relationships with various parties involved in projects not only for obtaining more contracts but also for improving the productivity and efficiency of the construction industry.

8.1.2 Contractors' Competitiveness

Developing and maintaining competitiveness are important parts of strategic management for contractors. Adequately understanding competitiveness enables contractors to maintain a sustainable development in the dynamic environment. Competitiveness is a dynamic ability to any business organization, which enables sustainable development in business. Competitiveness is a dynamic driving force, by which firms can make quick response to the new changes in the environment. For example, contractors should think about exploring new markets to maintain their competitiveness when the industry enters a declining period. Adequately understanding their competitiveness can help contractors take effective action to maintain or improve their competitiveness, consequently obtain sustainable superior performance in a dynamic environment.

Competitiveness indicators are developed for helping contractors to understand their competitiveness within the contents of Hong Kong construction industry. Construction market in developed countries or regions such as Hong Kong favors those contractors who have real competitiveness. This presents the importance for contractors to gain a proper understanding on the practice of how their competitiveness is assessed in a specific construction market. This study introduces a competitiveness indicators system for assessing contactors' competitiveness from six aspects: corporate image, technology and innovation, marketing capability, financing capability, project management skills, and organization and human resources. The key competitiveness indicators (KCIs) are identified, which will be used to improve the efficiency of understanding contractors' competitiveness in the Hong Kong construction industry.

A fuzzy competitiveness assessment method is developed to help assess contractors' competitiveness in the Hong Kong construction industry. An appropriate method for assessing contractors' competitiveness can lead to proper interpretation of their competitiveness. As the vagueness and uncertainty existed in the assessing process, a fuzzy competitiveness rating (FCR) method is introduced to measure contractors' competitiveness in an effective way. A hypothetical example demonstrates that the fuzzy competitiveness rating method is applicable in measuring contractors' competitiveness. Contractors can use the FCR method to take internal competitiveness assessment. The results of assessment can help contractors position themselves in the industry, help them analyze their strengths and weaknesses, and become useful references for making strategic decisions in practice for further improving competitiveness. Clients can also use this method to assess contractors' competitiveness in prequalifying or short-listing process.

8.1.3 Contractors' Competitive Strategy

The industrial organization and resource-based view of competitive advantage, Porter's generic competitive strategy, and Miles and Snow's strategic approach are fundamental theories for developing contractors' competitive strategies. The industrial organization and resource-based view of competitive advantage explain the firms' superior performance from both external and internal aspects. Both theories are applied in this study to explain companies' competitive advantage in the construction industry effectively, but there are limitations in their applications. The two theories can be considered complementary rather than contradictory with each other. The external and internal environments in the local industry are both analyzed to explain the competitive advantage to different groups of contractors. The research results from this study show strong association between the competition environment, strategy and contractors' performance. The results also show that Porter's three generic competitive strategies (cost leadership, focus, and differentiation) are adopted in the local construction industry with different emphasis between different groups. By using Miles and Snow's strategic approach, the result of cluster analysis can be explained effectively. These theories are important in developing contractors' competitive strategies. The industrial organization and resource-based theories explain the sources of competitive advantage and competitiveness, while Porter's generic competitive strategies and Miles and Snow's strategic approach help contractors formulate their competitive strategies in competition.

External and internal environment analysis enables contractors to identify the opportunities and threats in a market and identify their strengths and weaknesses, and then formulate competitive strategies to match their distinct capabilities to a market. External and internal environments have a great impact on the formulation of competitive strategies for construction businesses. This has been justified from the result of the survey. External environment analysis can help contractors identify opportunities and threats in a market. Internal environment analysis can be used to identify contractors' internal strengths and weaknesses. These analyses therefore help to formulate relevant competitive strategies which match contractors' distinct capabilities in a selected market. The match between competitive strategy and external and internal environment determines contractors' performance. A good match enables a contractor to grasp opportunities in the market and effectively use its internal resources in competition, consequently resulting in superior performance. The study demonstrates the importance for contractors to take careful and full-scale external and internal environment analyses before formulating their competitive strategy and do their best to fit the strategy to the external and internal environment.

Contractors take different competitive strategies (Porter's generic competitive strategies) in competition, and they can be classified as reactor, defender, analyzer, or prospector according to their strategic orientations (Miles and Snow's strategic approach). Porter's generic competitive strategies are widely adopted in many industries. The results in this study show that these strategies are also effectively applied in the construction industry, and there are positive correlations between competitive strategies and performance. The positive correlations illustrate that these competitive strategies enable contractors to use their competitive resources in competition effectively, consequently achieving superior performance. Using Miles and Snow's theory, contractors in Hong Kong construction industry are classified into four groups according to their strategic orientations, characterized with reactors, defenders, analyzers, or prospectors in the market. It is important and valuable to gain this understanding as different types of contractors should take different strategies. The analyzers give emphasis on all competitive strategies and achieve higher performance than others. These kinds of contractors are mostly the leaders in the industry. The prospectors focus on growth strategy, and they need to improve their market forecast ability to be real prospectors. The defenders adopt the cost leadership strategy to keep their positions in the market. The reactors only provide services on particular projects or clients in certain regions. The cluster analysis result echoes the findings in other researches on the relationship between adaptive capability, strategy type, and performance.

8.2 Contributions of the Research

8.2.1 A Competitiveness Indicator System and an Assessment Method for Assessing Contractors' Competitiveness

There are many existing researches on assessing contractors' competitiveness in a bidding process, either to help clients select proper contractors or to help contractors maximize their competitiveness in bidding. Comparing to the previous studies, this study provides a more comprehensive competitiveness indicator system for measuring contractors' competitiveness, and this system is more related to the Hong Kong construction industry. The identified KCIs make the competitiveness assessment focus on key areas and improve the efficiency of the assessment. With the identified KCIs, a fuzzy competitiveness rating method is proposed for helping to assess contractors' competitiveness in the local construction industry. The results of assessment provide useful references for contractors to understand their competitiveness in a particular market.

8.2.2 A Competitive Strategy Model for Helping Contractors Formulate Competitive Strategies

The dynamic construction business environment requires companies to make quick responses to the changes in the market. The construction industry in Hong Kong has experienced a downturn in the past decade, and many contractors had to close their business because they could not get enough work to keep the business going. Therefore, it becomes necessary for contractors to formulate their competitive strategies, enabling them to take adequate action in responding to the changes in the market, and retain sustainable development of their businesses. Contractors in Hong Kong have realized the importance of competitive strategies and the need for a guide to help them. For this purpose, this study introduces a competitive strategy model, which provides guidelines for contractors to formulate competitive strategies. This model explains the formulation of competitive strategies in three steps: (1) analysis of external and internal environment, (2) identification of competitive positions and advantages, and (3) formulation of competitive strategies.

8.2.3 Valuable Reference for Relevant Research in Other Countries or Regions

The research results enable contractors, in the local industry or from other regions, to understand their competitiveness, thus preparing themselves effectively when considering on competing particularly for construction works in Hong Kong, and improve the effectiveness of formulating competitive strategies. The results are useful guidelines for contractors to improve the efficiency of strategic management in business. While the data used in the analysis are collected from the Hong Kong construction industry, the findings provide useful references for conducting comparative studies between Hong Kong and other countries or regions.

8.3 Limitations and Future Research

There are limitations in this study. Firstly, the study is limited to the identification of the KCIs without the time for studying their application. A real case study using KCIs in practice could provide further insights to the indicators. Second, the research data were collected in the Hong Kong construction industry; thus, the findings are more applicable in the Hong Kong construction industry. Third, the conceptual model of competitive strategy was validated only by a questionnaire survey. Further case studies would strengthen the quality of validation and provide more references for contractors on formulating competitive strategies. These limitations should be addressed in future research.

The following areas can be considered in future research.

- The first direction is to apply the competitiveness indicator system and the KCIs in practice including position analysis, strength and weakness analysis, and competitor and strategic group analysis. These applications should be validated through case studies on selecting certain groups of contractors for analysis.
- The further works can also be conducted to compare contractors' competitiveness and competitive strategies between Hong Kong and other countries or regions. The findings will be useful for contractors preparing to enter into different regional markets.
- It is suggested to further analyze the growth strategy for different types of contractors. For example, joint ventures and partnerships are preferred by contractors in the local construction industry, while internationalization is preferred by large international contractors, taking the world as one market and effectively allocating their resources worldwide.

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APPENDIX A

SAMPLE OF COVER LETTER FOR

QUESTIONNAIRE SURVEY

November, 2007

«FirstName»«LastName»
«Company»
«Address»

Dear «LastName»,

An invitation for participating in a questionnaire survey

The *Competitiveness Research Group (CRG)* in the Department of Building and Real Estate of Hong Kong Polytechnic University is doing the research on contractors' competitive strategy. In order to complete the ongoing stage of our research, I write to seek for your further help by participating in a questionnaire survey. Please find the attached questionnaire, and kindly provide your opinion and judgments on these questions.

I believe that the findings from this survey will also help the professionals in our industry to gain more understanding on the competition practice in the local construction market. With such understanding, businesses should more confidence in their decision-making on competitive strategy, thus the overall business performance can be improved at the whole industry level.

All the data collected from this questionnaire survey will be kept strictly confidential and used solely for academic research purpose. It would be greatly appreciated if you could complete the questionnaire, and return to us through mail, fax or email on or before **22 December, 2007**.

We thank you again for your kind participation in this survey. And we shall continue to report to you the research progress by the research group. If you have any queries about this questionnaire, please contact me at: tel/ fax/ email.

Look forward to hearing from you.

Yours sincerely,

Convener of Competitiveness Research Group (CRG)
Department of Building and Real Estate
The Hong Kong Polytechnic University

APPENDIX B

SAMPLE OF QUESTIONNAIRE FOR VALIDATING THE COMPETITIVE STRATEGY MODEL

A SYRVEY ON CONSTRUCTION BUSINESS COMPETITIVE STRATEGY

INSTRUCTION

This survey is used to find out the influence of environment, organizational resources and capabilities on the selection of competitive strategies and to understand the relationship between competitive strategies and business performance.

PART 1: Company Profile

1. The work experience of your company in Hong Kong (number of years):
   ☐ <3 ☐ 3-5 ☐ 6-10 ☐ 11-20 ☐ >20

2. The size of your company (number of full time employees):
   ☐ <30 ☐ 30-50 ☐ 51-100 ☐ 101-200 ☐ >200

3. The classification of your company on the List of Approved Contractors for Public Works:
   ☐ Group C ☐ Group B ☐ Group A

4. The main business/works of your company:
   ☐ Civil ☐ Building ☐ Maintenance

PART 2: External Environment for Construction Market

5. Please indicate the extent to which you agree with the following statements:

Description	**Not at all**	**→**	**Somewhat**	**→**	**Great extent**
There are many new entrants.	1	2	3	4	5
Suppliers have high bargaining power.	1	2	3	4	5
Clients have high bargaining power.	1	2	3	4	5
There are substitute services.	1	2	3	4	5
The rivalry among competitors is high.	1	2	3	4	5

6. Please indicate the relationship of your company with the following parties:

Task environment factors	**Extremely poor**	**→**	**Average**	**→**	**Excellent**
Relationship with clients	1	2	3	4	5
Relationship with Government departments	1	2	3	4	5
Relationship with design and consulting firms	1	2	3	4	5
Relationship with creditors	1	2	3	4	5
Relationship with subcontractors	1	2	3	4	5
Relationship with suppliers	1	2	3	4	5

PART 3: Organizational Resources and Capabilities

7. Please indicate the degree of advantages that your company has over your competitors in the following listed areas:

Resources and capabilities	**Not at all**	**→**	**Somewhat**	**→**	**Extremely**
Corporate image					
Organization's credibility	1	2	3	4	5
Qualification of the company	1	2	3	4	5
Project performance record	1	2	3	4	5
Technology and innovation					
Technology know-how	1	2	3	4	5
Technology advancement	1	2	3	4	5
Investment on R&D	1	2	3	4	5
Conversant with local practice	1	2	3	4	5
Marketing capability					
Market coverage	1	2	3	4	5
Procurement ability	1	2	3	4	5
Ability to forecast market changes	1	2	3	4	5
Relationship with clients and consultants	1	2	3	4	5
Financial capability					
Financial status	1	2	3	4	5
Credibility grade	1	2	3	4	5
Payment to subcontractors or suppliers	1	2	3	4	5
Loan repayment	1	2	3	4	5
Project management skill					
Site progress management	1	2	3	4	5
Quality control	1	2	3	4	5
Coordination with subcontractors	1	2	3	4	5
Contract and risk management	1	2	3	4	5
Environmental and safety management	1	2	3	4	5
Knowledge about local construction law	1	2	3	4	5
Organization & Human resource					
Organizational structure &culture	1	2	3	4	5
Quality of personnel	1	2	3	4	5
Effectiveness of training program	1	2	3	4	5
Effectiveness of internal cooperation	1	2	3	4	5

PART 4: Competitive Strategies

8. Please indicate the degree to which the following competition methods have been emphasized by your company in the current practice:

Competitive strategy	Not at all	→	Somewhat	→	Extremely
Cost leadership					
Standardization of products or services	1	2	3	4	5
Superior training of personnel	1	2	3	4	5
Effective control of labor and material	1	2	3	4	5
Careful selection of subcontractors/suppliers	1	2	3	4	5
Technological advance	1	2	3	4	5
Incentive programs for productivity improvement or resource saving	1	2	3	4	5
Differentiation					
Building company's reputation	1	2	3	4	5
Offering higher quality of product	1	2	3	4	5
Faster project completion	1	2	3	4	5
Innovative financing methods	1	2	3	4	5
Innovative project management methods	1	2	3	4	5
Sustainable practice and social responsibility	1	2	3	4	5
Offering additional services to clients	1	2	3	4	5
Focus					
Offering a certain type of projects	1	2	3	4	5
Operating in a particular region	1	2	3	4	5
Serving a certain type of clients	1	2	3	4	5
Growth strategy					
Entry into new locations or regions	1	2	3	4	5
Entry into new types of construction projects (highways, tunnels etc.)	1	2	3	4	5
Engaging in new business (real estate, design, operation, maintenance etc.)	1	2	3	4	5
Expanding by acquisition or merger	1	2	3	4	5

PART 5: Business Performance

9. Please indicate the level of satisfaction on the growth of contract awards and profit your company has been receiving over the last three years:

Business performance	Not at all	→	Somewhat	→	Extremely
Growth of contract awards	1	2	3	4	5
Profit	1	2	3	4	5

We wish to continue our communication with you and reporting our research activities. For our further effective communication, we will be grateful if you could provide your e-mail address or attach your business card when you return your completed questionnaires.

Name: ________________________________

Tel: ________________________________

Fax: ________________________________

Email: ________________________________

Corresponding address:
____

Please send the completed questionnaire to the following address:

Mr. Yong-tao Tan, PhD Research student
Research Officer of Competitiveness Research Group (CRG)
Department of Building & Real Estate
The Hong Kong Polytechnic University
Tel: Fax:
E-mail: