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A Study of Business Risks of Public Housing Construction in Hong Kong and Risk Management Methods adopted by Contractors

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

Signature: EE)

Date: 12 October 2004.

ABSTRACT

The research conducted in this thesis studies the business risks considered as critical by construction contractors in the public housing construction industry in Hong Kong and the risk management methods adopted by these contractors. There is an inherent weakness in the public housing construction procurement in which price has been the overriding factor in the award of contracts and this has led to poor quality.

A quantitative research method was adopted. The data for analysis included share price of listed construction contractors and other listed companies in Hong Kong. In addition, annual turnover of listed construction contractors from its company reports and available public housing projects to be tendered versus the number of prospective contractors were analysed. A main survey and a supplementary survey were also conducted after a qualitative initial study was launched to find out themes for the questions in the main survey.

It is suggested that business risks of construction industry in Hong Kong are high when compared with non-construction business. As a consequence, risk premium from stocks of listed construction contractors should be higher than stocks of non-construction business. It is further suggested that risk premium of stocks of listed public housing construction contractors should be lower than other listed non-residential public buildings construction contractors due to adoption of subcontracting as risk management in the public housing construction industry. All these were being verified using share price, number of available public housing construction projects and company reports.

The main survey was conducted to find out the perceptions of the public housing construction contractors on the business risks of its business due to: (a) its client, the Hong Kong Housing Authority, (b) statutory requirements, (c) penalty from poor performance and its ramifications, (d) suppliers and (e) staffing. The main survey also sought public housing construction contractors' perception on the relative effectiveness of risk management proposals and quality improvement proposals.

The supplementary survey looked at reasons for subcontracting in the Hong Kong construction industry.

Exploratory factor analysis was carried out initially, which reduced the 47-item main survey questionnaire to 40 items with 8 factors and the 22-item supplementary survey to 20 items with 3 factors.

In the main survey, for each of the factor identified, t-test of the mean on each of the item and of the summated items under each factor indicated the perceived business risks of public housing construction were:

(a) critical due to "client" (the Hong Kong Housing Authority) – 7 critical items out of 9 items;
(b) not critical due to "statutory requirements" – none of the 5 items is critical;
(c) critical due to "poor performance ramifications" – all 2 items are critical;
(d) critical due to "suppliers" – all 4 items are critical;
(e) not critical due to "staff" – none of the 4 items is critical.

For effectiveness of risk management measures to mitigate business risks due to suppliers and staffing, t-test of the mean was carried out. Risk management methods to mitigate business risks from:

(a) "suppliers" were not perceived as effective – 1 effective item out of 3 items;
(b) "staffing" were perceived as effective – 5 effective items out of 7 items.

For effectiveness of quality improvement proposals, t-test of the mean indicated there were 3 effective items out of 6 items. Overall the quality improvement proposals were perceived as effective.

For the supplementary survey to find out reasons for subcontracting in the Hong Kong construction industry, from the subcontractors' point of view, the business practice of main contractors was perceived as critical to the operation of subcontractors (all 7 items). On the other hand, relevant reason for further (secondary) subcontracting from subcontractors was due to lack of expertise (1 item out of 5 items). For quality improvement proposals, 6 items (workers registration, strengthen supervision by contractors on subcontractors, strengthen supervision by client, registry of subcontractor, award contract based on quality and treat subcontractor as business partners) were perceived as effective.

Regression was carried out for the main survey and it was found that various statutory requirements were not significant predictors for the extent of pecuniary fines due to violations of statutory requirements. However site safety obligations were found to be a significant predictor to predict the period of suspension from tendering which would be considered as critically affecting the business of the contractor.

For the supplementary survey, the regression was centred on relevant reasons for subcontracting (as independent variables) and extent of subcontracting (as dependent variable). The tests indicated that subcontracting to reduce risk of over expansion and price could be significant factors to predict the extent of subcontracting.

To supplement what has been proposed as a possible solution (partnering) in improving the adversarial relationship amongst contracting parties in the construction industry, a case study was carried out to see how a local non-government organisation managed an underground transit system construction project by using "partnering". The case study indicated partnering could be useful to improve the inter-organisation co-operation in the construction industry.

From the main survey, supplementary survey and the subsequent analysis as well as the case study, the most significant implication of this research is the need to have equitable terms in the contract between clients and its construction contractors. In the competitive public housing construction industry in Hong Kong, award of contract by price alone to the lowest bidder would not induce quality performance from construction contractors. To cater for fluctuating workload and risk of over-expansion, subcontracting is a form of risk management practiced by construction contractors. Subcontracting cannot be stamped out and to induce quality performance from construction contractors and subcontractors, what is essential between clients and construction contractors (equitable terms) is equally applicable between construction contractors and its subcontractors.

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CHAPTER ONE

1. THE RESEARCH PROBLEMS

1.1 Introduction

The purpose of this study is to examine the business risks experienced by construction contractors in the public housing construction industry in Hong Kong and risk management methods used by these contractors. The contribution of this study lies in exposing the weakness in public sector construction procurement in which price has always been the overriding factor for awarding contracts, and that has found to be more costly in the long run due to the poor quality of the completed public housing buildings.

1.2 Public housing construction in Hong Kong

Construction industry encompasses a wide range of sectors (residential and non-residential buildings, civil engineering works for infrastructure such as reclamation, roads, bridges, railways, water supply etc), and the current study will be limited to one sector of the construction industry in Hong Kong – the public housing construction industry. Several terms are defined below for this industry, its background and the problems facing the public housing construction contractors.

1.2.1 Operational definitions

The construction industry or heavy construction applies to civil engineering and building works procured by private companies, government and institutions. It excludes individual dwellings and houses built for individual which are classified as home construction.

Public housing in Hong Kong refers to public rental housing for low-income residents with eligibility established by means test of family income and fixed assets (Housing Bureau, 1999). Area is typically 8.5 sq.m per person (Housing Bureau, 1997). There are, in addition, flats built for sale at a discount from prevalent market price, known as home ownership scheme (HOS).

Public housing construction contractors are contractors responsible for the superstructure construction of the public housing blocks and they have a direct contract with the Hong Kong Housing Authority. It is usually called as the main contractor. The operational definition of public housing construction contractors also includes foundation (substructure) contractors, as well as specialist electrical and mechanical contractors that are under nominated subcontract arrangements and these subcontracts are formal written contractual agreement with the Hong Kong Housing Authority via the main contractor.

Other public sector (or non-public housing) construction works refer to non-residential public buildings and infrastructure civil engineering works for highways, railways, land development, reclamation and drainage. Civil works require higher expertise, when compared with non-residential public buildings and residential public buildings (Chiang *et al.*, 2001).

Main contractor refers to the firm that has a direct written contractual relationship with its client. In the construction industry and this thesis, main contractor refers to the construction contractor responsible for the superstructure construction of the construction project.

Multi-layer or secondary subcontracting is defined as subcontracting of part or whole of the construction work from one contractor to a domestic subcontractor, who further subcontracts part or whole of the work to another domestic subcontractor, and so on. These domestic subcontractors do not have any formal written contractual relationship with the client.

In a business transaction, the party which delegates work to another party is the principal and the party which takes up the work is the agent (Sharma, 1997).

Agency costs are: (a) costs that the agent incurs to bond its willingness to perform its duties under the contract, (b) costs that the principal incurs to monitor and enforce performance, (c) residual opportunities for non-performance not controlled by the contract (Kane and Wilson, 1998).

Business risk is the uncertainty of income that is caused by the firm's industry, and such uncertainty is due to the firm's variability of sales due to its products, customers, and the way it produces its products (Reilly, 1994, p.342).

Firm-specific risks are characteristic factors unique to the company (Cho, 1997) that have been found as empirically capable of explaining a significant portion of a firm's stock returns.

Opportunistic behaviour (or opportunism) is linked to the degree of uncertainty surrounding a transaction (Pitelis and Pseiridis, 1999). It is defined as "self-interest seeking with guile" (Williamson, 1985, p.30) which includes attempts to distort or hide information and "calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse" (Williamson, 1985, p.47). With opportunism the contract "as a promise is naive and the cost of writing and safeguarding a contract may be high" (Williamson, 1993, p.93).

Risk premium is the difference between the return on the market of an asset and the interest from a risk free investment (Brealey and Myers, 1991, p.161).

1.2.2 Public housing programme in Hong Kong and its problems

Hong Kong's public housing programme started with an emergency measure to rehouse some 53 000 people made homeless overnight in a squatter fire on Christmas Day 1953 and has developed into a comprehensive programme, which encompasses a wide range of rental and home ownership scheme flats with self-contained facilities (Housing Bureau, 1999). The programme is in line with a long-term strategy to produce more and better housing, to meet outstanding demand and to encourage home ownership in the community (Housing Bureau, 1997). The Hong Kong Housing Authority has primary responsibility for this programme through its executive arm, the Housing Department.

Quality has always been a problem in the Hong Kong public housing construction industry (Hong Kong Housing Authority, 2000; Audit Commission Hong Kong, 2001). The Hong Kong Government made its decision in the mid eighties to redevelop 26 public housing blocks, which were only about 15 years old (built in the early 70s) because of quality problems. Problem was believed due to corruption resulting in the use of substandard material, but only three contractors were taken to court and the majority of civil servants and contractors involved got away (The Independent Commission Against Corruption Hong Kong, 1989). In addition, nearly 400 public housing blocks of around 20 years old were demolished in the last 13 years, under the disguise of redevelopment to improve the higher expectations from public housing tenants (Plumjuic, 1999). Those not due for redevelopment were required to be strengthened due to substandard concrete and steel reinforcement.

In the last decade, the Hong Kong Housing Authority took the lead in promoting quality assurance in construction from 1991 (Hong Kong Housing Authority, 1999b). All contractors tendering for projects of the Hong Kong Housing Authority are now required to be ISO9000 certified. In addition concrete suppliers and nominated subcontractors have to achieve certification as well. The Hong Kong Housing Authority also maintains a performance assessment scoring system (PASS) to assess the performance of different contractors. This assessment system has since been introduced for building services nominated subcontracts and maintenance works. The intention is to give higher tender opportunity for contractors with good past records and award contracts not necessarily to the lowest bidder (Hong Kong Housing Authority, 1999b).

Inspite of the enormous effort, there is always general opinion that the quality (poor workmanship, corruption and poor safety record which do NOT conform to all the requirements of the Hong Kong Housing Authority and fail to meet the agreed goals of the Hong Kong Housing Authority) of the public housing is not good and the Hong Kong Housing Authority acknowledged this (Hong Kong Housing Authority, 2000).

1.2.3 Quality in the construction industry

In the construction industry, various definitions have been put forward to define quality. One definition of quality is fitness for use (Construction Industry Research and Information Association, 1985). Atkins (1994) considered quality as the conformance to requirements of clients. Fan (1995) opined that it is the effective achievement of agreed goals between the client and the main contractor. Battikha and Russell (1998) and Moatazed-Keivani *et al.* (1999) took quality as a critical factor in determining project acceptance and success.

Seymour and Low (1990) hold the view that there is no absolute definition of quality. From this context, Low (1993) therefore felt that quality is a multi-faceted concept and should be approached and managed as such. He noted various schools of thought within the industry, each seeking to define the meaning of quality. These are fitness for purpose, conformance to specifications, technical rationality and socio-technical rationality.

Low and Tan (1996) listed the quality expectations in the construction industry as buildings with good and practical design and layout, which are functional and yet aesthetic. They also used several parameters to define quality in the industry:

- number of defects and number of complaints from end users;
- extent of pollution to environment by the construction process;
- workmanship;
- reports of malpractice in the trade (substandard material, corruption);
- occupational safety problem due to construction activities and site accidents.

Chung (1999, p.3) holistically defined construction quality to mean the satisfaction of requirements of all parties to the construction project – meeting contractual requirements of the client, legislative and regulatory requirements of the authorities, social requirements of the public and even cost requirements of the contractor.

International Standards Organisation uses a less explicit and generic approach for quality and in the ISO9000:2000 context, the standardised definition of quality refers to all those features of a product (or service) which are required by the customer (ISO9000, 2000). Taking a building as a frame of reference, should the whole structure or any component part of it not meet the client's needs that were stated contractually or otherwise, the building designer or contractor would have failed in supplying the quality required for that building.

Low and Tan (1996) considered that quality issues in construction can be classified at two levels – namely, the broader industry level and the narrower project level. Most quality promotion and safety improvement programmes targeted at construction can be seen to shift between this industry-project spectrum with the appropriate actions taken by related government departments or professional/trade associations and construction contractors respectively Low and Tan (1996). These problems in the construction industry were primarily looked on as specific problems related to the site, building structures, production, financing, workers and end-users, among others. However, if such problems can be identified and resolved so readily as such, quality issues would have long been resolved in the construction industry (Low and Tan, 1996). The fact that these problems still persist in the construction industry seems to suggest that there is a much more fundamental problem than contemplated or acknowledged thus far. Is this structural problem related to risks experienced by construction contractors? Of these what are the greatest risks – fluctuating workload for construction, inequitable contractual terms with clients or any other?

In February 1998, the Hong Kong Special Administrative Region Government promulgated a White Paper on Long Term Housing Strategy in Hong Kong: 'Homes for Hong Kong People into the 21st

Century' which provided a blueprint for future housing policy. In particular, the Government is fully committed to achieving three key specific initiatives: producing an average of 50 000 flats a year in the public sector, and forming land and building the necessary infrastructure to meet the long-term demand for about 35 000 flats a year in the private sector; achieving a home ownership rate of 70 per cent by 2007; and reducing the average waiting time for public rental housing to three years by 2005 (Housing Bureau, 1998).

To increase supply, the Hong Kong Housing Authority, as the employer, revised the terms of the construction contracts and average construction time for a block of flats had to be reduced by nearly one-third (The Hong Kong Construction Association, 2000). Such has been criticised as "unrealistic client expectations in relation to time, cost and quality outcomes" (Moy and Tse, 1999) and these "harsh contract and sub-contract conditions that impose one-sided obligations and punitive damages" could drive bidders to cut costs by lowering quality. It should also be noted with reference to studies in Canada, imprecisely defined project would similarly give temptations to contractors to do poor quality work, since it would be difficult to gauge quality objectively (McAfee and McMillan, 1988).

According to Pitelis and Pseiridis (1999), under the prediction of the Principal-Agent Model, when business risks (such as contract terms favourable to the Hong Kong Housing Authority) are high and business is unstable, contractors could lead an opportunistic behaviour, resulting in poor quality, if supervision is lax and penalty for non-performers is low.

Facing with the risks (such as fluctuating workload) in the public housing construction industry, contractors have to be flexible and subcontracting is one of the widespread practice (National Economic

Development Office, 1978) to provide flexibility to cater for unstable business. This is the same in Hong Kong (Chugani, 1999; Ho, 2000; Hong Kong Standard Editorial, 2000).

For investors, stocks of listed public housing construction contractors should have a higher risk premium if the risk in this sector of the construction industry is higher than other industry (Shah *et al.*, 1997). If risk premium is not high enough to cover risks, demand of these stocks must be small, and will be reflected in the low capital growth in its market value.

With the ambitious target of 85 000 flats and sudden surge of demand, public housing construction is having a major impact on one of the key sectors of the Hong Kong economy. The quality of these housing estates, as well as the public outrage that would be generated whenever there are adverse media reports in the public housing construction industry, are of concern to people. It is therefore the researcher's intention, against this historical scenario, to contribute to an area that has not been researched vigorously.

1.2.4 Significance of study

This research is significant due to several reasons. The estimated mid-1999 population of Hong Kong was 6 843 000, according to figures released on August 20, 1999 (Census and Statistics Department, 1999). Longer-term forecast of population growth is on average 1.6% per annum (Information Services Department, 1999). As the majority of these new arrivals (mainly due to immigrants from Mainland China) are from the low-income group, demand for public housing will be great. The Hong Kong Housing Authority pledges to shorten the waiting list for public rental housing from five years by 2001 to three years by 2005 (Hong Kong Housing Authority, 1999b). An average of

40,000 public housing flats would need to be built per annum until 2005. This will cost HK$20 billion per annum and would remain a significant boost to the industry, especially during the current economic downturn.

The norm in the Hong Kong public sector construction procurement has been to award contracts to the lowest bidders (Moy and Tse, 1999). The apparent (but often misleading) economy and convenience of awarding contracts to the lowest bidder is particularly comforting in the public sector, where high accountability regimes may require onerous justification if awarded to any other bidder (Kumaraswamy and Palaneeswaran, 2000). This has long been viewed as problematic (Gransberg and Ellicott, 1997). In this aspect, there is great interest among practitioners and scholars to see how government agencies award construction contracts to contractors which are not the lowest bidders (Kashiwagi and Ziad, 1997). Another previous study looked at contractors' selection based on an analytical hierarchy process (Saaty, 1980), and would help construction clients to identify contractors with the best potential to deliver satisfactory outcomes in the final contractor selection process which is not based simply on the lowest bid. This process comprises three parts: hierarchical structure, prioritisation procedure and calculation of results, and the lowest bidder does not necessarily get the contract (Fong and Choi, 2000).

All these studies intend to uncover the need to be accountable to the public for proper use of public funding to get real value for money and long-term benefits (high quality building free from defects and resulting in minimal resources to maintain) to the society. Thus the findings of the research will have practical use for the Hong Kong Housing Authority and the public housing construction industry to develop win-win solution such that good contractors have reasonable return on investment, and the Hong Kong Housing Authority and the general public have products of the quality desired.

Quality in construction industry has all along been subjects of research in other countries as Singapore, Australia, United States and United Kingdom (White, 1999). Some of the findings of this research, although identified in the Hong Kong environment, could still be of reference for other countries.

1.3 Chapters organisation

There are eight chapters in this thesis, and the chapters are organised as follows:

Chapter One introduces the background of the research, the research problem, the main research questions, the principal hypotheses and the research framework. The significance of the study will also be presented.

Chapter Two introduces the background of the inquiry, from the wider literature down to the more narrow as applicable to the current study. It includes the business risks of the construction industry and the profitability of the industry in the United Kingdom. Construction industries in Singapore and Taiwan are cited. It then narrows down to the characteristics of the local construction industry. There is also discussion on the setup and operations of the Housing Department. Following that is the review of the principal-agent relationship and its application to the relationship between contractors and subcontractors. Reasons, advantages and disadvantages of subcontracting will be discussed. Partnering and supply chain management as a mean to improve inter-organisation co-operation in the construction industry is suggested. The other aspects of the study – risks of construction industry as shown by the share price are then presented.

Chapter Three states the methodology like qualitative and quantitative and the choice of positivist approach for this study. The research process and the different stages are presented.

Chapter Four explains the calculation of the profitability of the local construction industry through share prices. Other indicators of profitability such as P/E, price and competition of the public housing construction industry are shown. There is then explanation on how competition, ease of entry and economic rent would affect the profitability of the construction industry.

Chapter Five presents the qualitative study to identify key issues to formulate the initial questions in the pilot survey. There is a brief description of how themes in qualitative data are extracted. Use of computer programme NUD*IST is explained to assist with the analysis. The index tree so formed helps to relate the initial relationships of some of the constructs in the pilot survey. The link between Chapter Five and Six will be stated.

Chapter Six discusses in detail the framework for investigations based on previously proposed generalisations and the hypotheses to be tested. There are six groups of questions with 46 items for the main survey dealing with public housing construction contractors and three groups of questions with 22 items for the supplementary survey dealing with subcontractors. The reliability tests of the survey are discussed. The face validity and the scales for survey measurement are explained.

Chapter Seven presents the results of an exploratory factor analysis on the two surveys and discusses the findings. t-tests will be carried out on the items within each factor identified from the main and supplementary surveys. Comparison of the responses from the two surveys on the quality improvement proposals will be carried out. Use of partnering in the Hong Kong Housing Authority is discussed. There is also a case study to see how partnering is used in a local construction project.

Chapter Eight presents conclusions of the study. The limitations of the study are stated. Some recommendations are made and areas for further study are suggested.

1.4 Main research questions

Whilst the terms business risks and risk management methods will be discussed in subsequent chapters, the definitions as applicable to the construction industry in the current study are:

Business risks in the construction industry are the uncertainty of income from contracts secured and is caused by factors predictable such as site conditions, constructability issues or unforeseeable such as adverse weather (Smith and Bohn, 1999).

Risk management methods in the construction industry are means to protect the asset, reputation, and profits of the contractors by reducing the possible losses or damages before it occur, and to ensure financing through insurance and other means (Miller and Lessard, 2001).

It has been mentioned that subcontracting has been widely adopted in the construction industry in Hong Kong (Chugani, 1999; Ho, 2000; Hong Kong Standard Editorial, 2000), and that is a form of risk management for contractors to be flexible to cater for fluctuating workload (The Hong Kong Construction Association, 2000). If firms are able to reduce their business risks by subcontracting, rational investors should have a higher confidence to provide funding for these contractors and this could be reflected on the risk premiums of stocks of these contractors.

Means are proposed that could be used to mitigate the various business risks in the public housing construction industry and methods are also suggested to improve the quality of the public housing construction.

With the above, the main research questions that have been formulated are:

(i) Is the risk premium of listed construction contractors' stocks in Hong Kong higher than stocks of non-construction business?

(ii) Are the mean risk premium, mean price/earning ratio and mean share price of stocks of listed construction contractors majoring in public housing construction lower than stocks of listed construction contractors majoring in non-public housing construction?

(iii) What are the business risks (due to contract terms with the Hong Kong Housing Authority, statutory requirements, suppliers & others factors) facing public housing construction contractors, and which of these are perceived as critical to the operation of the public housing construction contractors?

(iv) What are the risk management methods that could be used by the public housing construction contractors, and which of these would be perceived as effective?

(v) What are the quality improvement proposals (by using contract workers, restricting subcontracting and other means) that could be used by the public housing construction contractors, and which of these would be perceived as effective?

To further probe into the reasons for multiplayer subcontracting and the business relationships between main contractors / subcontractors / further layer of subcontractors, the sixth research question has been formulated.

(vi) (a) What are the business practices of main contractors which will affect the bidding strategy of its subcontractors?

(b) What are the reasons for subcontractor to further sublet work to another subcontractor?

(c) What are the quality improvement proposals in the construction industry which would be perceived as effective from point of view of subcontractors?

1.5 Principal hypotheses

The principal hypotheses translated from the research questions are as:

(i) *H1 - It is hypothesised that investors require higher risk premium from stocks of construction contractors than from stocks of non-construction business.*

(ii) *H2A to H2C - It is hypothesised that the mean risk premium, mean price/earning ratio and mean share price from stocks of listed construction contractors majoring in public housing construction should be lower than stocks of listed construction contractors majoring in non-public housing construction.*

(iii) *H3A to H3D - It is hypothesised that the business risks facing public housing construction contractors due to:*

(a) terms of contract (client factors);

(b) statutory requirements;

(c) fines; and

(d) procurement and staffing

are perceived by public housing construction contractors to be significantly critical to its operation.

(iv) *H4 - It is hypothesised that the risk management methods which could be used to mitigate the business risks of the public housing construction industry would be perceived by public housing construction contractors to be significantly effective.*

(v) *H5 - It is hypothesised that the quality improvement proposals which could be used to improve the quality of public housing construction would be perceived by public housing construction contractors to be significantly effective.*

The above hypotheses will be elaborated in later chapters. The testing of the first two hypotheses H1 and H2 will be through share prices and other financial performance data of construction contractors. For the third hypothesis H3 survey will be used to find out perceptions of construction contractors on how they view the business risks associated with public housing construction, i.e. whether the business risks are critical to its operation. The fourth (H4) and fifth (H5) hypotheses are not meant for verification, as it is not possible to find out the casual relationship between (a) the business risks / effectiveness of risk management methods, and (b) quality / effectiveness of quality improvement proposals. Instead data will be collected through survey and contractors are asked whether the risk management methods would be perceived as effective. Contractors will also be asked whether quality improvement proposals would be perceived as effective. In all cases, statistical tests of significance will be conducted on the response received.

For the research question on subcontracting, hypothesis H6 is formulated as below and is verified by a supplementary survey.

(vi) (a) *H6A – It is hypothesised that the business practices of main contractors will affect the bidding strategy of its subcontractors significantly.*

(b) *H6B - It is hypothesised that the subcontractor's business practice will affect its decision significantly to further subcontract to other subcontractors.*

(c) *H6C - It is hypothesised that the quality improvement proposals which could be used to improve the quality in the construction industry would be perceived by subcontractors to be significantly effective.*

1.6 Research framework: Principal - Agent relationship in public housing construction - Hong Kong

This study can be classified as "testing out research" (Finnemore *et al.*, 2000; Phillips and Pugh, 2000) to find the limits of previously proposed generalisations (business risks in construction industry, risk management methods and quality improvement proposals) to study interrelationships between variables in the new setting - Hong Kong public housing construction industry. The various parties identified in this study are:

Stakeholders - Public housing tenants, general public in Hong Kong and the Hong Kong Special Administrative Region Government.

Principal - The Hong Kong Housing Authority

Agents - Building contractors, electrical and mechanical works contractors with direct contractual relationship with the Hong Kong Housing Authority

Sub-agents - Layers of local subcontractors, suppliers, contingent workers

The relationship among the different stakeholders in the Hong Kong public housing construction industry and the research questions, hypotheses (see section 1.5) so formulated can be summarised in the framework in Fig. 1.1

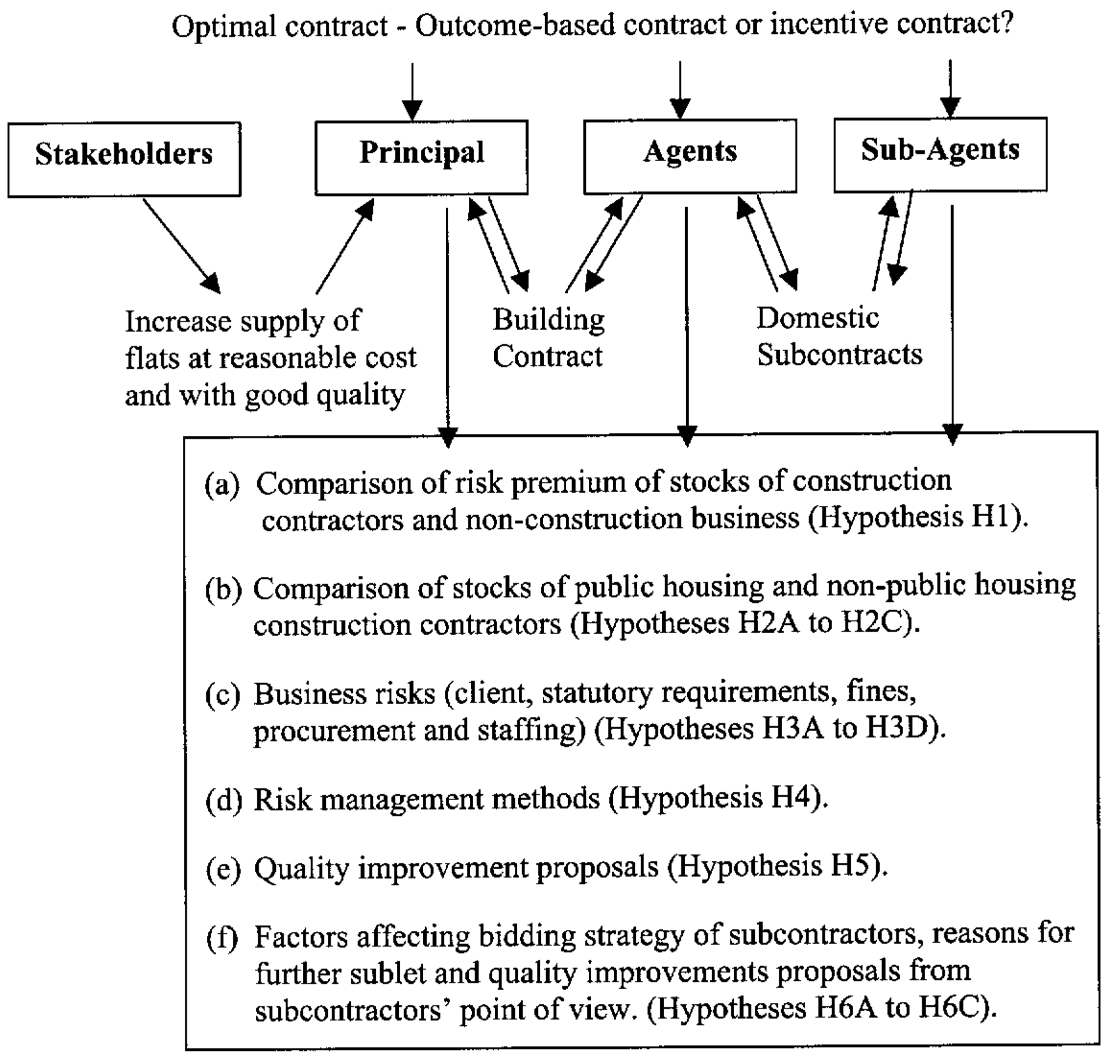

Figure 1.1- Research framework and associated hypotheses

1.7 Summary of Chapter One

Chapter One discussed the background of the research, the research problem, the main research questions, the principal hypotheses and the research framework. The scope of the study was stated and the problems of the public housing construction industry were identified. The significance of the study was also presented.

CHAPTER TWO

2. LITERATURE REVIEW

Chapter Two introduces the background of the inquiry, from the wider literature down to the more narrow as applicable to the current study. It includes the business risks of the construction industry and the profitability of the industry. It then narrows down to the characteristics of the local construction industry. There is discussion on the setup and operations of the Housing Department. Following that is the review of the principal-agent relationship and its application to the relationship between contractors and subcontractors. Partnering and construction industry supply chain are discussed and the other aspects of the study – risks of construction industry as shown by the share price are then presented.

2.1 Business risks of construction industry

Unlike other industries (especially in manufacturing), the construction industry is characterised by activities which are discontinuous, dispersed, diverse and distinct in nature (Tay, 1994). Rowlinson and Walker (1995) also pointed out that the construction industry is characterised by its non-standardisation, and production processes are to some extent different among projects. Project management in the construction setting is therefore rendered more difficult not only at the national level (Seymour and Low, 1990) but also at the project level (Low and Goh, 1994) for a wide spectrum of reasons (Sharma, 1997). Standardisation and mechanisation of the building process have, so far, provided limited success, as each project has its own distinct characteristics (Tay, 1994).

The main players in a construction project include the developer, all the contractors, architects, engineers and designers. Similar to any business, all players have to face a certain level of business risk which can be defined as the uncertainty of income and profit specific to the firm's industry (Smith, 1992). For the contractors, such uncertainty is due to its customers, its ability to secure contracts (or sales) commensurating with its expertise and the way it produces its products (Reilly, 1994; Cho, 1997). Despite the uncertainty of sales, income and profits, it is very important to pay for all overheads and expenses to maintain the firm's survival and growth by attaining an appropriate income and profit level (Akintoye and Skitmore, 1991). Such profit level, according to Wright (1970), is a function of sales volumes or turnover and capital investment to support sales and the margin of profit earned.

The business risks (unforeseeable or predictable) faced by contractors in the construction industry are generally higher than other business (Smith, 1992). Smith and Bohn (1999) further suggested problems like delays due to weather, loss of productivity because of construction changes, and delays caused by constructability issues or differing site conditions are forms of predictable risks, bur risks related to natural disasters or gross design errors are usually unforeseeable during project planning. According to Smith and Bohn (1999), some of these could be overcome and mitigated, being firm-specific (as design, logistic, construction, natural and environmental), but some are beyond the control of the construction contractors - workload, legal / regulatory and political risks.

Brown (1984) opined that a contractor's beliefs about cost, its attitude towards risk, and understanding about its competitors influence its optimal bidding strategy. Hanson (1999) believed contractors that succeed are those that outperform its competitors, control costs, and manage the risks inherent in the industry. He also suggested key areas that affect the company's profitability are marketing and sales, capital and finances as well as employees and technology.

Whilst there are risks associated with construction projects, there is a price for risk takers, and there are always new entrants to the market who believe that they could do better than others despite of the competition (Chiang *et al.*, 2001). In fact there are many risk takers involved in a major construction project: the owner, the financial agency, the project manager, the designer, the contractors, the manufacturers and suppliers, labour, the insurance agency, the legal advisor, and the public and statutory authorities (Mulholland and Christian, 1999). However, by the time a project moves into the construction phase, Mulholland and Christian (1999) observed that most of the risk is forced onto the contractors, who have to complete the job within the time frame, tender price and all the resolved or unresolved unforeseeable and predictable risks.

The extent to which contractors can absorb losses due to unforeseeable business risks is limited, due to the nature of contracting business where both low profit margins and low equity capital to asset ratios are common (Ward, 1999). Risk management is essential to mitigate the business risks of construction contractors, and it is a management discipline whose goal is to protect the asset, reputation, and profits of the contractors by reducing the possible losses or damages before they occur, and to ensure financing through insurance and other means (Miller and Lessard, 2001).

Kangari (1988) opined that risk management is the process of risk identification, risk policy definition, risk sharing and allocation, risk analysis and evaluation, response planning and risk minimisation.

Many researchers have asserted that risk analysis and assessment is essential and that management practitioners need to develop proven techniques, such as risk simulation, rather than rely on intuitive methods (Li *et al.*, 1999).

Perry and Hayes (1985) suggested a simple and systematic approach for construction risks management, which consists of three stages. The first stage involves the identification of major sources of risks pertaining to the decision problem. In the second stage, the effects of these risks are assessed and evaluated. Thereafter, appropriate risk policies and responses are developed to reduce and control the risks involved. Thus, it can be seen from the mechanism of the above process that risk management does not actually remove all risks from a project. It merely provides an organised framework for assisting decision-makers to manage risks more effectively and efficiently.

Hampton (1993) used a multiple-step process chart to explain this management process, which involves setting objectives, identifying risks, evaluating risks, designing a comprehensive program, implementing the program, and monitoring results. Lam (1999) suggested that it is imperative to identify and understand the impact of the inherent risks in order to formulate appropriate risk management strategies to cope with them. Ward (1999) considered that a common problem in project risk management is the need to determine the relative significance of different sources of risk so as to guide subsequent risk management effort and ensure it remains cost effective. In his opinion, a common approach is to rank risks in terms of probability and impact to identify sources of risk, which will receive the most attention. For cost-effective management it is desirable to distinguish not only between the size of impacts and probability of impacts occurring, but also other factors such as the nature of feasible responses, and the time available for responses.

Therefore, it is desirable from the broad context of the total project perspective that all of the risks associated with a construction project should be identified adequately by contractor and risk management methods proposed (Kim and Bejaj, 2000; Ledman, 2000).

It is not acceptable to wait for risks to emerge before taking risk management action (Uher and Toakley, 1999). A more proactive approach is required from contractors and it is in their best interest to undertake a consideration of potential risks at the tender stage before they are committed to a project (Diekmann *et al.*, 1988).

From previous paragraphs, the major business risk in the construction industry is the high level of uncertainty in turnover due to severe competition (Smith, 1992; Smith and Bohn, 1999) and the resulting low profit margin (Ward, 1999). The risks generated by the contracting system lead to an emphasis upon flexibility rather than efficiency (Winch, 1989; Ngowi and Rwelamila, 1999). As a result, if there was lax supervision from building owners, low penalty for non-performers and asymmetry of information favouring contractors, it is natural that contractors would indulge in opportunistic behaviour, resulting in poor quality (Mingpao Editorial, 2000; Wong and Poon, 1999).

2.2 How is profitability of a business evaluated and profitability in construction industry

2.2.1 Evaluation of profitability of a business

According to Pizzey (1990), risk is determined by the nature of the business: the luxury trades are considered more risky than trades providing necessities and the local market is considered less risky than the foreign market. He further suggested that a highly fluctuating market, or a product which easily becomes obsolete will all increase the risk of an investment. In addition, the past record of a business, its earnings, and the dividends it has paid out will show the payout or plough-back policy of the directors (Brealey and Myers, 1991). Such financial policy can be compared with that of similar firms, and the result of this comparison will have an effect on risk. The trend of profits in a business will show whether there is growth or recession, and whether future earnings are likely to be sufficient to maintain the required rate of dividend (Pizzey, 1990). The ratio of net profit to capital employed can also be used in this context to show the return earned by a business on its capital to compensate for the risk taken in investing the capital in that way (Pizzey, 1990). This ratio is known as the primary ratio, since it reveals the return on capital employed and comments on the efficiency of management in employing the funds placed at their disposal by shareholders and lenders. Furthermore this ratio is often expressed as a percentage and can be used to compare performance with other companies in the same industry, or other industries, or other economies, or at other time periods.

2.2.2 Previous studies on profitability of construction industry in United Kingdom

Both profit percentage of sales (POS) and return (gross profit) on capital employed (ROCE) have been used in studies of profitability in the construction industry. Lea and Lansley (1975a; 1975b) and Lenard and Heathcote (1990), for instance, used the average return on turnover. Asenso and Fellows (1987), on the other hand, used two measures: (a) the pre-tax return on net assets employed and (b) the return on (equity) shareholders' investment.

One argument against the use of POS as a measure of profitability is that firms may achieve apparently high profitability primarily because of the high net asset involved (Akintoye and Skitmore, 1991). Apart from this, however, there is little to choose between the two approaches, as implied by Wright's (1970) three factors of profit level as a function of sales volumes or turnover, capital investment to support sales and the margin of profit earned.

Wright (1970) specifically termed return on investment, or total assets less current liabilities, "profitability", as it seems most accurately to encapsulate the level of financial achievement against the long-term funds committed to the business. However, the practice of subcontracting in the construction industry may not encourage firms to increase their net assets despite increase in workload. This may exaggerate construction company profitability based on net assets when compared with, for instance, manufacturing companies. As a result, profit generally, in terms of excess income over expenditure, is still the most important criterion for assessing performance in the construction industry (Fellows and Langford, 1980).

Empirical studies had been mainly concerned with the relationship between profitability and the size of firms (Asenso and Fellows, 1987). In some cases (Hall and Weiss, 1967; Samuel and Smith, 1968), a strong relationship was found, whereas in others (Singh and Whittington, 1968; Lea and Lansley, 1975a; Asenso and Fellows, 1987) the results were inconclusive.

Two of these studies related specifically to the construction industry. Lea and Lansley (1975a; 1975b) examined a sample of 23 United Kingdom construction firms to ascertain the effects of the extreme fall in demand for building work over a 2-year period ending in 1975. As a result, they were able to conclude that the management of these firms should have considered reducing their overheads rather than profit margins as a means of survival during this time. In addressing the relationship between size and profitability, they also found:

"*There was no indication that POS profitability depended on the size of the firm nor indeed has there been in other studies, so that high profitability in terms of return on turnover and capital was just as accessible to the small as the large firms provided their management was good. An analysis carried out for the study showed no clear relationship between the total demand on the industry and either the total turnover or the average annual profitability of the industry as indicated by the average profitability figures available*".

Asenso and Fellows' (1987) work, based on an analysis of 41 United Kingdom firms that were classified into four groups on the basis of their net assets employed, tended to endorse Lea and Lansley's observations regarding the lack of a relationship between profitability and size. In addition, however, they found that the dispersion between construction contractors' profitability tended to decrease with the size of company, suggesting that the larger contractors in their sample showed a higher level of stability in profits. There was also, a pervasive negative trend in average profitability observed over the period (1975-79, 1980-84) under study.

Akintoye and Skitmore (1991) opined that there was drawback of these two studies. Lea and Lansley neglected to provide any indication of the numbers of groups considered in relation to the independence of size of firms and profitability. Whilst Lea and Lansley did find an average POS level of 2.5% for the firms over the period of studies, their sample size was very small. Asenso and Fellows, on the other hand, provided no figures to support their conclusions. Also, their sample size seemed rather small for any generalisations to be made.

Despite the drawbacks, these results provided some insights into the study of contractors' pricing strategies in tender submission. The evidence above also suggested that contractors might be primarily concerned with making appropriate ("normal") profits relative to their investment level and the need to satisfy associated shareholders with reasonable dividends (Akintoye and Skitmore, 1991).

Lea and Lansley (1975b) identified several situations where contractors found it difficult to meet this normal profit and low profits might also be caused by low mark-up in contract bidding in order to enhance the order book. Fellows and Langford (1980) found that some firms deliberately made low profits only in the short term by buying work to survive in recession periods or in order to obtain further work from the same client. The problem of course was that, although this strategy might lead to long-term profits, the dangers of underestimating production costs are ever present, thereby increasing the risk of failure.

In another research by Akintoye and Skitmore (1991), they undertook an analysis of company accounts of United Kingdom construction contractors from 1980 to 1987, which segmented construction firms into contractors and housebuilders and examined the effect of size on returns. Three important conclusions were derived from their analysis. Firstly the pre-tax profit of contracting was found to be generally low and fairly constant at around 3% when measured as a ratio of turnover. This they attributed to "excessive" competition, though excessive was not defined. Secondly housebuilders returns were greater than contracting because of the greater risks and need for working capital. Thirdly larger firms had persistently higher rates of return, which they attributed to greater managerial efficiency. These findings of Akintoye and Skitmore were however questioned by Ball *et al.* (2000).

For the first point in Akintoye and Skitmore's study, Ball *et al.* (2000) disputed the idea that building contracting produced long-term low and constant rates of return. They opined that contractors' profits would be expected to vary considerably over time rather than constant and profits were dependent on market and input costs. Fluctuations in the relative prices of construction stocks indicated such volatility. Over the long run, however, once differences in risk and market fluctuations were taken into account, the rate of return in construction industry should approximate those in other industries. Otherwise, in the absence of rigidities and other market imperfections, investors would not invest in construction industry, and this would raise prices until returns in construction industry approximated those in other industries.

For the second point regarding higher return for housebuilders, it might be because of rigidities, such as family ownership structures. However with the large number of publicly quoted United Kingdom building firms, this effect was unlikely to be strong and smaller firms must have some advantages that keep them in existence (Ball *et al.*, 2000).

Ball *et al.* (2000) considered that the third point does not tally with a long-term view of firm and investor behaviour. By considering the relationship between firm size and profitability, if larger firms exhibited greater managerial efficiency, smaller firms could not exist in a competitive construction market. The result would be the larger firms could make substantial profits by taking over smaller ones or their areas of business, if larger firms had such a persistent competitive advantage so that over time only large firms would remain (Ball *et al.*, 2000).

Another study by Hillebrandt *et al.* (1995) adopted a somewhat different approach. They added up the financial data for 70 of the top 80 United Kingdom construction firms, and then examined, using graphs, fluctuations in turnover and profits, etc. Turnovers (in current prices) were shown to have been rising in contracting throughout the 1990s recession. Profits were however negative for three years, 1991–1993, caused by losses in housing, property development and other non-contracting activity. Larger firm, they suggested, but did not demonstrate, had increased their overall market share by entering markets for smaller contracts at the expense of smaller firm. Like Akintoye and Skitmore (1991), they suggested that competition was too intense in the construction industry, with long term impacts on efficiency and innovation, although they specifically identified intense competition with the 1990s recession rather than at all times. Ball *et al.* (2000) opined the robustness of Hillebrandt *et al.* (1995) study was unluckily weakened by a failure to distinguish between housebuilders and non-housebuilders and by the skewness of the sample: a few very large firms dominated the data, so that their aggregate fortunes determined the results rather than showing what happened to a representative firm. Overall Hillebrandt *et al.* (1995) considered changes in firm outcomes was due to "management strategy" rather than economic forces (Lansley, 1987; Hillebrandt and Cannon, 1990). The adoption of management strategy was a view shared by most of the construction firms and was accepted in literature (Langford and Male, 1991; Betts and Ofori, 1992; Abdul-Aziz, 1994). Bennett (1992) however had voiced caution, suggesting that "survival of the fittest" might be a more appropriate explanatory factor.

2.2.3 Construction industry in Singapore

The construction industry in Singapore has been involved in the creation of a physical infrastructure which has facilitated the country's economic development and enhanced Singapore's international competitiveness as a desired location for globalising companies (Debrah and Ofori, 1997). Construction contributed around 4-6 per cent of gross domestic product of Singapore in the last decade, depending on the overall economic situation (Department of Statistics, 2004).

Similar to other countries, the construction industry in Singapore is dominated by a competitive business environment driven by a lowest cost mentality that has significantly eroded the profit margins in the industry (Dulaimi and Shan, 2002). Workload fluctuation also affects the markup of contractors (Low and Tan, 1996). Entry to the Singapore market by foreign contractors since 1980s were also substantive (Ofori and Lean, 2001) and added to the competitiveness of the industry. Some characteristics of the industry in Singapore are stated below.

2.2.3.1 Competitive bidding

In his study, Dulaimi and Shan (2002) observed that the majority of contractors in Singapore tended to obtain new work through competitive bidding: 84.4% of the respondents in the study indicated that more than 50% of their jobs were obtained through competitive bidding, with 63.2% of the large contractors acknowledging that 75–100% of their jobs were obtained through competitive bidding. Only 6.2% of the respondents obtained more than 50% of their jobs through negotiation. These results indicate that generally speaking construction projects are awarded on the basis of the lowest tender that meets the stated specification and contractors in Singapore are more likely to obtain work through competitive bidding than negotiation. This very competitive environment would put great pressure on the likely size of their mark-up.

The above findings also reinforces the belief the most serious challenges facing construction contractors in Singapore are related to competitive tendering fuelled by clients focusing on obtaining the lowest cost as reported in a previous study by Dulaimi *et al.* (2001).

2.2.3.2 Bidding environment

Dulaimi and Shan (2002) also examined the bidding environment within which Singapore contractors would have to decide their bidding markup size. These aspects are related to the procurement of labour, equipment and finance for its construction projects.

First, the research examined the extent of use of subcontractors on site. Of the responding firms to his study, 68.8% subcontracted 50% or more of their works. Only 9.4% of the responding firms subcontracted less than 25% of their works, and 21.9% subcontracted 25–50% of their works. This shows that general building contractors in Singapore rely to a great extent on subcontractors to carry out the majority of the work. This would allow such general building contractors to increase the level of certainty of achieving the set mark-up. Outsourcing in this case would enable contractors to minimise their overheads by reducing the reliance on their own resources, because certain construction activities could be subcontracted for fixed lump sums.

Further, the contractors' reliance on leasing rather than making a capital investment to purchase the necessary construction equipment was examined. Of the responding firms in the study, 68.8% indicated that they leased less than 50% of the construction equipment and 28.1% indicated that they leased 50–75% of the equipment they used. The results seem to suggest that the trend is for Singapore contractors to own items of key equipment and plant, although this may expose such firms to higher maintenance and investment costs and all the advantages and disadvantages of own versus leased equipment.

The extent to which contractors and subcontractors are required to provide a performance bond is seen to indicate the level of confidence and trust that exists in the industry (Shash and

Abdul-Hadi, 1993). The results of the study show that in 78.1% of the sample the contractors reported that they were required to provide performance bonds in 75–100% of the works obtained. This implies that contractors would be subjected to further pressures and uncertainty, when preparing their bids, as they have to include the cost of providing such bonds knowing that there is a level of doubt about their ability to deliver the required level of performance.

2.2.3.3 Workload fluctuation

Construction demand and output in Singapore have increased gradually from 1991 to 1997 but this trend was disrupted in 1998 with a 35.9% drop in demand for construction due mainly to the sharp fall in private sector demand during the Asian financial turmoil in 1997 and 1998 (Building and Construction Authority, 2001). During this period the industry experienced significant pressures to reduce tender prices as construction firms struggled to improve their competitiveness. The scenario in the Singapore construction industry in 1997 and 1998 due to the Asian financial turmoil supports the findings from other studies that the major business risk in the construction industry is the high level of uncertainty in turnover due to severe competition (Smith, 1992; Smith and Bohn, 1999) and the resulting low profit margin (Ward, 1999).

2.2.3.4 Foreign contractors

Foreign contractors have been prominent in Singapore since the early 1980s but their competitive edge is eroding (The Straits

Times, 1994, p.47) although they still dominate the large-complex project market (The Straits Times, 1998, p.46). Ong (1997, p.2) noted that local firms "grew rapidly in the last 30 years and now compete with their once formidable rivals". This implies more severe competition for work from contractors.

2.2.4 Construction industry in Taiwan

The construction industry in Taiwan has been dominated by a competitive business environment which has significantly eroded the profit margins in the industry (Lin, 2002).

According to Austrade (2004), competitive pricing is the most important factors that influence purchasing decisions in the construction industry in Taiwan and the industry is highly price sensitive and the major construction contractors are fiercely competing for work. Quality, on the other hand, has been emphasised by clients ever since ISO9000 was applied to the construction industry in 1996 and contractors have to provide quality but low cost construction services (Lin and Yang, 2002).

Continuing high levels of economic growth in the eighties and nineties has also made Taiwan an attractive market for foreign construction companies and since the construction sector was opened to foreign firms in 1986, around 30 contractors have established themselves in Taiwan (Fenn and Yan, 2002). This has resulted in stronger and stronger competition. As reported by the British Trade and Cultural Office (2001), Japanese companies, with their cultural and historical links and "long-term" approach to the market have led the way and the Japanese are likely to remain a formidable competitor, especially as many seem able to negotiate very favourable loan rates. US companies are also well placed, mainly in consultancy and construction management, and European companies are being drawn to Taiwan. Countries (France and the Netherlands etc.) have shown considerable flexibility in their political relationship with Taiwan, which may well benefit, their companies when it comes to bidding for contracts (British Trade and Cultural Office, 2001). Severe competition is resulted.

2.2.5 Construction industry profit margin

As mentioned in section 2.2.2, the major construction contractors in the United Kingdom experienced pre-tax profit margin of about 3% in the period 1980 to 1987 (Akintoye and Skitmore, 1991). Nevertheless in the same study, housebuilders showed profit margins to be around four times that of construction contractors.

In another article, Doyle (1997) indicated that profitability for the United Kingdom construction sector as a whole, measured as return on capital, in the second quarter 1997 improved from 3.41 to 4.38% year-on-year. Despite the improvement, Doyle (1997) observed that construction industry remained firmly at the bottom of the industrial league table, which was topped by the pharmaceuticals sector at 43.18% and below textiles and clothing at 7.42%, when compared with the national average of 12.51%. Construction pre-tax margins in the same period were 1.58%, compared to an all-industry national average of 7.85% and the average return on shareholders funds was 6.05%.

In another report in the 24 June 1998 issue of newspaper Contract Journal, Chief Executive of United Kingdom HBG Construction (one of the heavy construction contractors) said that their profit margin is not acceptable (Leitch, 1998). He called on other major construction contractors to stop taking a short-term approach to the way they bid for work. He further suggested that:

"The industry should be achieving margins of 2.5-3 %, which is not an outrageous return for the risks incurred. One or two companies are doing it and at HBG we are targeting to reach that figure".

The trend in respect of return of house builders in the United States, when compared with heavy construction industry, is the same as noted in the United Kingdom (Dow Jones, 2000a). In the year 1999, the ratios were:

Table 2.1 Industry (heavy construction) to Industry (house builder) comparison United States for 1999 (Dow Jones, 2000a).

Ratios	Heavy Construction	House Builders
Profit Margin	1.2%	3.9%
Return on Equity	4.8%	14.6%
Return on Asset	0.9%	5.3%

In the United States, when the performance of the heavy construction industry in year 1999 was compared with the other 97 industries as classified by Dow Jones, profit margin of the heavy construction industry was -0.3% and return on asset was -0.8%) (Dow Jones, 2000b). Indeed only 6 other industries (biotechnology, coal, consumer/household services, household product (durable), pollution control, and mobile telephones), out of the 97 industries, showed similar negative returns.

In Japan, the pre-tax margin as a percentage of sales for the major heavy construction contractors - Obayashi, Kajima, Shimizu and Taisei was in the order of 1 to 2 % in year 1999 (Asia Pulse Analysis, 2000).

It thus appears that there is a general consensus that construction industry is indeed not a lucrative business. Mark-up is a few %, and if risks are not managed properly, such meagre profits could be eroded.

2.2.6 Implications

The indications from literature in United Kingdom, Singapore and Taiwan are that fluctuating workload, severe competition, low profit level and outsourcing dominate construction contracting. Low markup for some tenders could be intentional in the short term, with the expectation of profit maximisation in the long term, or possibly due to unfamiliarity with the risks involved in contract bidding, or simply due to the effect of persistent keen competition (by both local and foreign contractors) in the industry due to fluctuating workload. Whatever the cause, the result is that a firm might not necessarily make a profit on every tender won. However, a firm is nevertheless expected to make adequate profits on its total annual business activities if it were to continue to remain in business.

In order to clarify the above issues as applicable to the construction industry in Hong Kong, some empirical calculations of the profitability of construction contractors and the extent of competition are needed. The analysis described in Chapter 4 of this thesis is aimed at providing empirical evidence to support this, together with some explanations into the possible causal mechanisms involved.

2.3 Construction industry in Hong Kong

In the past the construction industry in Hong Kong has always contributed significantly to the Gross Domestic Product (GDP) of the colony of Hong

Kong and after 1 July 1997, the Hong Kong Special Administrative Region Government (Information Services Department, 1999). The industry covers civil engineering and building works. A major client in the construction industry of Hong Kong is the public sector that includes the government and other subvented organisations.

In the period 1996-97, HK$9.8 billion was spent on public housing construction and HK$5 billion on public housing maintenance (Information Services Department, 1996). In 1997-98, 5.8% of the GDP or HK$73 billion (Information Services Department, 1999) was contributed due to the construction industry, and public sector construction works accounted for nearly HK$59 billion. Of this amount of public sector construction works, 25.2% or HK$ 14.9 billion was used as capital expenditure for public housing (Hong Kong Housing Authority, 1999b).

The Hong Kong Housing Authority is responsible for the public housing program and the substantial expenditure involved.

In the last decade, there were also the huge port and airport development strategy projects and the 10 airport (for the replacement airport in Chek Lap Kok) core programme projects costed close to HK$158.2 billion (Information Services Department, 1996).

2.3.1 Characteristics of the Hong Kong construction industry

Under Annex 3 of the Sino-British joint Declaration for Hong Kong in 1984 (Justice Department Hong Kong, 1984), land sale prior to 1997 was limited to 50 hectares per annum. The limited land supply caused a surge in property prices and resulted in a strong emphasis on construction and real estate development (Rowlinson and Walker, 1995). Lam (1990), Walker and Flanagan (1991), Rowlinson and

Walker (1995) and Ganesan *et al.* (1966) identified various unique characteristics of the construction industry in Hong Kong.

2.3.1.1 High-rise constructions

Owing to the scarcity of land, many buildings in Hong Kong are high-rise, constructed of reinforced concrete or steel frames. Buildings are designed to the maximum possible extent to make utmost gain from the expensive site area, with the result that most construction sites are congested (Chan, 1991). Efficiency of internal traffic is of paramount importance. Therefore high speed lifts and escalators are common features of any compatible office and residential tower blocks, which house other sophisticated building service equipment. The latter point is worth mentioning because in today's pricing, building services can account for up to 40 % of the building cost (Green and Wall, 2002).

2.3.1.2 Procurement method

The procurement method used in Hong Kong construction industry is still very traditional (Tam, 1992). The use of selective tendering dominates the market. There have been only a few records of management contracting or design and build contracts and they were normally confined to the very large projects (Rowlinson *et al.*, 1993).

The situation in the last few years changed, and there is now more dependence on the expertise of the contractors. The client adopted a non-traditional approach - guaranteed maximum price (Mass Transit Railway Corporation Ltd., 2002; Building.com.hk, 2002) and the construction contractor was brought in at the very outset of the project to provide buildability input in construction design, construction method and advising on construction costs (Ho, 2002). Nevertheless this is in general limited to the private developer.

2.3.1.3 Foreign competition and approved List of Contractors

The Works Bureau of the Hong Kong Special Administrative Region Government has lists of approved contractors for public sector construction works (Works Bureau, 2000), other than public housing, whereas the Hong Kong Housing Authority established its list of approved building, electrical and mechanical contractors to tender for public housing construction contracts. Firms who have been admitted to the lists should superficially be capable of working to the satisfaction of its public sector clients.

As a founding member of the World Trade Organisation, Hong Kong has abided by the plurilateral Agreement of Government Procurement (Yue, 2000). Under the Agreement, members have to open the market to foreign contractors for construction services valued at 5 million Special Drawing Rights or more (1 Special Drawing Rights = US$ 1.37 in 1997). Indeed, Hong Kong has been far more "generous", because the minimum contract amount (HK$50 million) eligible for foreign contractors is much lower than this value. The openness of the construction industry has moved one step ahead since 19 June 1997 with the elimination of the demarcation between "local" and "overseas" contractors by the government (Works Bureau, 2000).

Irrespective of origins, all contractors are now included in one consolidated List of Approved Contractors for Public Works, provided that they have fulfilled three simple requirements on local business registration, technical competence of personnel and financial capability (Works Branch, 1997). Once admitted to the list, all contractors bidding for public works would be evaluated with the same set of rules, regulations and criteria. All these measures are in stark contrast with the relatively closed market and protected industrial conditions in other parts of Asia, which require foreign contractors to engage a local partner before foreign firms are allowed to bid for construction projects (Raftery *et al.*, 1998).

The open Hong Kong construction industry has in the past led to fierce competition between local and overseas contractors, particularly in the years 1984-1986, which gave rise to a certain amount of friction as the overseas counterparts gradually gained a greater share of the market, and in particular the more technical oriented infrastructure projects (Rowlinson and Walker, 1995). What is left behind seems to be building projects requiring low level of skills. Public housing construction falls within this.

For an open public sector construction market as Hong Kong, studies by McAfee and Macmillan (1988) suggested "If bidding competition is very strong and the firms are risk neutral, the optimal contract is a fixed-price contract. Weak competition in bidding will tend to make the optimal contract an incentive contract".

When competition is severe, margin tends to fall and no contractor could afford putting any contingency to cater for unforeseeable risks, if the firm were to win any job (Smith and Bohn, 1999). For the public officers who vet tenders, all these contractors are prequalified. Even if there were bids so low that might warrant further attention, the tendency is to award the contract to the lowest tenderer, because this would save them the trouble to give lengthy justifications to reject the lowest offer (Burnes and Coram, 1999).

2.3.1.4 Labour intensive construction methods

Another important feature of the construction industry (Hong Kong and abroad) is the low technology and labour-intensive activities in project implementation (Ball, 1988; Hagedoorn, 1993; Rowlinson and Walker, 1995). Whilst implementation of activities require cost control, operative capabilities, and the knowledge of labour markets (opportunity wages, suitable incentive systems, and precise screening mechanisms), the teams in a construction project are usually based on blue-collar workers, mainly craftsmen and unskilled labourers, whose purpose is to accurately carry out any project (Hillebrandt and Cannon, 1990).

According to Rowlinson and Walker (1995), despite the increasingly complex building requirements of the local construction industry, the majority of the construction workforce is still using traditional labour skills; and the large numbers of small and medium contractors specialised in buildings are used to traditional styles of management with centralised decision making. Procurement of construction plant and equipment is often hindered by the lack of capital and further by the lack of space for storage after use.

Some large contractors are taking initiatives in mechanised methods of construction, such as slip form. This is further enhanced by government leadership in enabling the use of mechanised construction methods in public housing, such as the new Harmony Block Series through improved standardisation of design (e.g. the use of large panel steel formwork to replace timber formwork, application of aluminium formwork system, precast concrete facade elements, application of the jump lift system and panel wall with concealed conduits) (Lee, 2002). There is also use of precast bathroom unit for public housing (Ko and So, 2002). Nevertheless this is restricted to the larger contractors only.

2.3.1.5 Labour shortage and general quality of labour

During the last decade Hong Kong has experienced several demographic and other changes (Standard Chartered Bank, 1993). The growth rate of Hong Kong's labour force has fallen steeply, from an annual average rate of 1.8% during the period 1982-1987 to 0.5% during 1988-1992. The labour supply primarily reflects the rate of population growth, the labour force participation rate and migration balance (Ganesan *et al.*, 1966). Based on current population projections and labour participation trends, it is projected that the labour force is estimated to increase by 1% per annum during the next five years, and this is inadequate in comparison to the projected future labour requirements, particularly as the working population will continue to age (Standard Chartered Bank, 1993).

The relatively low educational qualifications of workers in the construction industry are nothing new. Findings in many places suggest that the construction industry has always been a means of livelihood for the illiterate (Souza de, 2000). Hong Kong is no exception.

Souza de (2000) further suggested that construction industry has the ability to "absorb the excluded". It provides employment for those with little education or skill, many of them from the poorer sections of society. Recent surveys of construction workers in a number of Indian cities have revealed that they were predominantly young, from the lower class and the Muslim community, and poorly educated (Vaid, 1999). A significant proportion was illiterate and in some places were found to have had no schooling (Vaid, 1999). In many of the larger cities the construction workforce is now locally born, but the majority are still from the most disadvantaged sections of society.

In Brazil also, workers in the construction industry have a lower educational level than workers generally. "The Brazilian construction industry did not even require an average level of education from its labour force" (Zylberstajn, 1992).

The situation is very similar in China where 50 per cent of the 600,000 workers (from other Chinese provinces) on construction sites in Beijing have received no more than primary education and over 10 per cent are illiterate (Lu and Fox, 2001).

In developed countries also, the construction industry provides much needed employment opportunities for those in the community with few academic qualifications. It employs a disproportionate number of the least educated, offers vacancies to the long-term unemployed and those out of the labour force, as well as opportunities for second jobs (Dougherty, 1996). Poor education background has always been a barrier to improve the quality of the workers on construction site, as it is difficult to upgrade their skills through training.

2.3.1.6 Managerial ideology of the Hong Kong Chinese

Chinese culture has a major influence on the management style adopted by the Hong Kong construction project managers (Evans *et al.*, 1982. The Hong Kong Chinese have been described as basically loyal, hard working, pragmatic and preferring a directive leadership style (Evans *et al.*, 1982; Redding and Tam, 1985; Wong, 1986). However, by the influence of Western culture and a high level of industrialisation which tends to generate more "organic" organisations, a participative leadership style is emerging (Chan, 1995).

Bond and Hwang (1993) noted that as a society develops, its management style would inevitably converge towards the democratic style adopted in the developed Western countries. The traditional cultural characteristics, as influenced by the Western culture together with the level of industrialisation, have moulded a managerial ideology specific to the Hong Kong Chinese as noted in research done by Rowlinson *et al.* (1993), whose findings indicated that project leaders in the Hong Kong construction industry tend to use a supportive style in the feasibility study and pre-contract stage of works. As far as site staff is concerned, the participative and directive styles are common leadership styles in the Hong Kong construction projects, while the supportive and the achievement-oriented styles are secondary styles.

Management style has a profound impact on the success of construction projects (Mills and Beliveau, 1999) simply because each construction project is unique and unlike manufacturing there is limited scope for standardisation (Tay, 1994; Rowlinson and Walker, 1995). A construction project manager should therefore ideally have situational leadership style to suit the varying demand in the different phases of the project from design to construction (Forsberg *et al.*, 1996). Situational leadership requires the leaders to adjust emphasis on task behaviours and relationship behaviours according to the readiness of followers to perform their tasks (Fielder, 1967). Each phase of the construction project emphasis a different combination of task and relationship behaviours by the project manager who should be capable to delegate, participate, sell the ideas and instruct.

2.3.1.7 Lack of research and development in construction

The construction industry is widely perceived as being slow to innovate and has trailed many manufacturing industries in implementing management and technology innovations (Veshosky, 1998). This is the same in Hong Kong and there is little or no co-ordination between various institutions or between departments, and much of the direction comes from individual firms, without Government support (Ho, 2002). Inquiries with the Hong Kong Census and Statistics Department revealed that there are no measures of research and development activity. A few research programs are currently running in the academic institutions (Rowlinson and Walker, 1995). Data on individual projects and amounts of expenditure exceed HK$10 million per annum, which amounts to approximately 0.02% of the annual gross output. Compared to the typical R&D expenditure of 1% of the annual turnover in most Japanese large contractors (The Overseas Construction of Japan Inc., 1989), this is insignificant.

2.3.1.8 Subcontracting

It is thought that there are several reasons for a construction contractor to use subcontractors. The main contractor's in-house abilities might be limited in a particular area, and a subcontractor possesses specialised technical, engineering, or construction skills (Wong and Fung, 1999). Rubery (1988) pointed out organisations increase emphasis in flexibility in structuring employment.

The situation prevalent in Hong Kong aggravates the problem due to multi-layer subcontracting since the main contractor subcontracts the work to a subcontractor, who further subcontracts to a third party, which is usually unknown to the main contractor (Hong Kong Standard Editorial, 2000). There could be situation when the third layer subcontracts the work to the fourth party, resulting in loss of control and quality (Chugani, 1999). Players in the industry act not much different to a business broker, who take commission from their subcontractors and leave everything to their subcontractors.

Previous research in subcontracting and secondary subcontracting by Sozen (1999) showed it is obvious of the existence of another layer of subcontractor to the production chain in the construction industry, and it would be logical to expect that as the number of vertical layers (secondary, tertiary subcontractors) increase, the profit margin per layer would have to decrease on a project, implying inevitable sacrifices of quality.

Due to the adoption of minimal intervention, there are no stringent rules stated explicitly in the construction contract of the Hong Kong Housing Authority or other public sector works to control the use of subcontractors (Chugani, 1999). The industry all along argues that directly employed workers or contract workers are not practical because this increases overheads to the contractors, and ultimately construction works would cost more (The Hong Kong Construction Association, 2000). Subcontracting has always been the norm.

2.3.1.9 Building Ordinance in Hong Kong

Building works for the private sector in Hong Kong are subject to control by the Buildings Department of the Hong Kong Special Administrative Region Government under the Buildings Ordinance. Architects, engineers and contractors are required to be registered under the Ordinance. Non-compliance, if revealed, would be criminal offence. If convicted, imprisonment and de-registration are the result. Public sector buildings are, however, exempted from the Buildings Ordinance on the premises that professionals supervise public sector works and there is no point to have double supervision. As "government buildings", public housing construction has also been exempted from the scrutiny under the Buildings Ordinance. The Hong

Kong Housing Authority, however, denies that public housing is in any sense sub-standard, and claims that the Hong Kong Housing Authority's building standards and requirements are entirely comparable and consistent with those set by the Buildings Department for private developments (Hong Kong Housing Authority, 2000).

Despite the above argument, most of the problem exposed in the past has been associated with public sector construction works, and in particular the public housing buildings. It is also unfortunate that civil servants were involved in malpractice such as corruption in the past. Whenever there is problem, the Government would hastily do something under severe external pressure by setting up Review Committee (Vittachi, 2000), but situation has improved slightly only.

2.4 Organisation setup of the Housing Department

After the disclosing of the piling scandals in some of the housing projects, the public was questioning what happened with the Hong Kong Housing Authority (Mingpao Editorial, 2000). Limited study, however, has been done on what actually happened in the last decade in the Hong Kong Housing Authority and its executive arm, the Housing Department.

2.4.1 Organisation restructure of the Housing Department

From research by Rowlinson (2001), the Housing Department had only recently decided to change from a functional organisation to a matrix organisation, in an effort to improve efficiency and effectiveness in a time of expanding workload and tight project deadlines. In his survey, respondents were well aware of the advantages that a matrix organisational structure could bring to the Housing Department's project management system, and were keen to see the change work. However, the transition had not been immediately successful.

Matrix organisation has been considered as being particularly suitable to construction project environments (Bresnen, 1990; Project Management Institute, 2000). Matrix is a mixed organisation and has been defined as a vertical functional hierarchy overlain by lateral authority, influence or communication (Knight, 1976). The advantages of matrix structure (such as efficiency and flexibility in use of resources, technical excellence of solutions, motivation and development of employees and the freeing of top management from routine decision making) stem from intra-organisational conflicts, which if properly directed, should lead to the above said advantages (Galbraith, 1973; Shtub *et al.*, 1994). However matrix organisations are most effective only when a particular organisational culture – the task culture evolved in the organisation (Handy, 1985), i.e. a tendency to see the task as the key issue in the organisation and to adopt flexibility and whatever means that are appropriate to accomplish the task. Then what are "culture" and "organisation culture"?

2.4.2 Culture and organisation culture

"Culture" has many meanings, which have changed over the past two generations (Barthorpe *et al.*, 1999). Culture is a complex and multi-faceted phenomenon that arises and develops through on-going social interaction among members of a community (Hofstede, 1980; Schein, 1985; Meek, 1988). Kroeber and Kluckhohn (1952), American anthropologists, presented 160 different definitions of culture. Bodley (1994) stated that culture involves what people think, what they do, and what they produce. Culture has several properties: it is social heritage or tradition; it is shared, learned human behaviour; and it is symbolic, and based on shared, assigned meanings of the members of a group. Putti and Chia (1990) considered culture as a set of values, beliefs, norms, attitudes and habits of a group of people, pointing out that a society's beliefs and values have an impact on the way business is conducted in that society. Edgar Schein said culture is a "Pattern of shared assumptions, invented, discovered and shared by a given group as it learns to cope with its problems of external adaptation and internal integration, that has worked well enough to be valid, and, therefore, is to be taught to new members of the group as the correct way to perceive, think and feel in relation to those problems" (Schein, 1985).

According to Kroeber and Kluckhohn (1952): "Culture consists of patterns, explicit and implicit, of and for behaviour acquired and transmitted by symbols, constituting the distinctive achievement of human groups, including their embodiment in artefacts; the essential core of culture consists of traditional ideas and especially their attached values; culture systems may, on the one hand, be considered as products of action, on the other, as conditioning elements of future action".

From these different definitions, culture is the ways adopted by different cultural groups to understand and interpret the world. Culture affects a person's attitude, which in turn affects his behaviour. Therefore the same things would have different meanings for people in each culture (Trompenaars and Hampden-Turner, 1997, p.20).

Aligning attitudes of a group of people is not straightforward. Much of the literature tends to presume that cultural alignment (where members of an organisation share some basic values, attitudes and beliefs) is a prerequisite for a successful matrix organisation environments (Bresnen, 1990). Consequently, unless there is some compatibility between teams and divisions within an organisation, members of an organisation need to change their ways of thinking and working

(Bresnen and Marshall, 2000). It is well established that it is difficult effecting cultural transformation within organisations (Beer *et al.*, 1990). The reason for this is that organisational culture is by no means a unitary and consensual phenomenon whose management involves a simple, 'top down' process of senior figures manipulating key variables (structures, reward systems) in order to effect change. It is not simply something that can be imposed from the top, and frequently attempts to do so simply provoke resistance or produce unintended and undesired consequences (Kotter and Schlesinger, 1979). Indeed, organisational culture is so penetrating but, at the same time, intangible that it even defies easy definition, identification and analysis. Precise definitions of organisational culture vary, although there is considerable agreement that it consists of a system of shared meanings, based around common values and beliefs held by members of an organisation (Pheysey, 1993; Brown, 1995). Moreover, one important complicating factor in the study of culture is that it operates at many different levels, from outward behavioural manifestations to much more deep-seated attitudes, values and beliefs (Schein, 1985). What is clear, however, is that changing behaviour does not necessarily depend upon changing such deeper underlying attitudes, beliefs and values (compliance is a possibility). Therefore, not only may economic incentives be insufficient to produce any desired behavioural change, but also claims that such changes have been any more profound rest upon the presumption that new attitudes, beliefs and values have been internalised by members of the organisation. In other words, a commitment to change might be a truly felt experience or it might simply be skin deep; either way, it is extremely difficult to tell, since behaviour can be misrepresented or rationalised (Hodgetts, 1991).

Hildebrandt *et al.* (1991) suggested that the implementation of an organisation's culture is influenced by: nature of environment, type of company, and special character of company and employees. To Handy (1985), the factors that influence organisational culture are:

organisation's history, ownership and size; technology of production; goals and objectives; market; competitive scene; geographical and societal environment; and people. Johnson and Scholes (1993) considered the way culture drives organisational strategies, and emphasised that culture is influenced by external factors such as values of the society and organised groups, and by internal factors which they refer to as the "cultural web". Morgan (1986) noted that culture within organisations is reflected in the way people perform tasks, set objectives and administer resources. It affects the way people consider issues, analyse and solve problems, make decisions and take actions in response to opportunities and threats. Handy (1985) identified four primary forms of organisational culture: "power", which is configured as a web with the primary power at the centre; "role", in which functions and professions provide the structural pillars to support the overarching top management; "task", in which jobs or projects are a primary focus yielding an organisational net; and "person", in which people interact and cluster relatively freely.

Quinn (1988, p.47-49) proposed the "competing values framework" for analysing organisation culture. The framework has two axes: the vertical axis ranges from "flexibility" to "control", and the horizontal axis from an internal to an external focus. In each quadrant of the framework were: "open systems model" (the Adhocracy), "rational goal model" (the Firm), "internal process model" (the Hierarchy), and the "human relations model" (the Team). For example, the external focus reflects an orientation towards competition, engagement, urgency, or short time lines, whereas internal focus indicates maintenance, co-ordination, equilibrium, or longer time lines.

2.4.3 Cultural issues of the Housing Department

In his research, Rowlinson (2001) distributed Handy's organisational culture questionnaire (Handy, 1985) to a sample of 40 professionals, of various grades, randomly chosen from the Housing Department in order to explore the cultural issue of the Housing Department. This represented about 10% of the professionals employed at the time. The results of the survey showed that the difference between the preferred culture and perceived culture of the Housing Department was significant at 0.1% level. This highlighted a mismatch between the aspirations of the professionals and the organisational culture of the Housing Department.

Six to eight weeks after completion of the initial analysis, Rowlinson (2001) interviewed ten of the respondents in order to discover the ways respondents responded and where the sources of the mismatches between the preferred and observed cultures were. Rowlinson (2001) found that the respondents correctly identified the task culture as their preferred culture but, according to the questionnaire responses and in subsequent interview, it became apparent that the predominant culture of the organisation was a role culture, i.e. procedures and formal authority were seen as the mechanisms by which work was undertaken.

This reflected the way in which the Housing Department, and indeed the Hong Kong Special Administrative Region Government, had operated traditionally under the colonial administration. Similar reports were abundant and mentioned the need to follow codified rules and procedures is always more important than efficiency and customer focus (Mingpao Editorial, 2000; Moy and Tse, 1999). Hence, a mismatch existed, as evidenced by both the questionnaire responses and subsequent interviews. This was initially assumed to have stemmed from the fact that the organisational structure had changed recently, and that this change was taking time to diffuse into the system. However, on further investigation, Rowlinson (2001) found that other cultural factors had compounded the observed changes.

During interview, one of the problems was unveiled to be at the senior management level as it appeared that the previous discipline heads still adopted a policy of centralised decision making at senior levels and were reluctant to decentralise decision making, as required in the matrix organisation (Rowlinson, 2001). This undermined the whole concept of a matrix. Such should not have occurred because a series of workshops on matrix organisation had been arranged and discussed, and all levels in the organisation had understood and accepted the principles of decentralisation. To explain this, another force was identified that might explain the situation (Rowlinson, 2001). This reluctance to decentralise was a manifestation of one of the cultural dimensions of power distance (Hofstede, 1984; Rowlinson and Root, 1996) and the tendency to accept or expect hierarchical structures with uneven power distributions. Hence, a cultural barrier to the effective implementation of matrix organisation was identified, and this is a hurdle that cannot be overcome easily in a short time.

Rowlinson (2001) questioned the same group of professionals, at the same time, on the concept of commitment using Allen and Meyer's (1990) taxonomy of affective, normative and continuance commitment. Affective commitment (an emotional attachment to the organisation) was found to be very weak – in fact, virtually non-existent – and normative commitment (based on acceptance of the organisation's set of values) was likewise weak (Rowlinson, 2001). There was, however, a high score on the continuance commitment dimension (based on the idea that the costs of leaving the organisation outweighed the opportunity costs of staying). These results should not have occurred among a group of professionals, and this suggested the existence of a rational-economic man psychological contract with the Housing Department (Handy, 1985). It could only be surmised that Hong Kong professionals were much more pragmatic in their outlook and reflected the social origins of Hong Kong in the past prior to 1997 – a borrowed place. This was much different with building professionals in United Kingdom as reported in Rowlinson and Root (1996)'s previous study: "Within the United Kingdom, the concept "professional" refers to more than the acquisition of a body of knowledge but also values in its application. The sociological approach to professionalism and professions has viewed both concepts as having evolved from the medieval university system and craft guilds of Europe. In contrast in Hong Kong, the professional structures have been imported relatively unchanged from the United Kingdom and have no corresponding cultural roots. This supports the idea that Hong Kong professionals are more mercantile in outlook".

Matrix organisation emphasises decentralisation of decision-making and relies on individuals taking responsibility for task production (Bresnen, 1990). A high degree of commitment to the organisation's values, normative commitment and the acceptance of professional responsibility are required (Project Management Institute, 2000). This normative commitment appeared to be a missing link in the Housing Department but the questionnaire responses did not explain how this situation had arisen (Rowlinson, 2001). Was it because the cost of leaving the Housing Department was greater than the cost of remaining, i.e. continuance commitment, and they felt no professional obligation to respond, or was it in fact that the apparently unsuccessful organisation change had caused the "negative" attitudes?

These questions were explored in follow up interviews by Rowlinson (2001), and the root cause of the problem was identified as the failure of the change of organisational structure to meet the professionals' expectations and aspirations. The apparently unsuccessful change appeared to have caused the low levels of commitment to develop, or be perpetuated, and the mismatch between organisational structure, procedures and organisational culture was identified as the key problems (Rowlinson, 2001). Moving from directive management to a more participative style was seen as a major issue to be addressed and national cultural characteristics of Hong Kong Chinese could have explained the behaviours of professionals of the Housing Department (Rowlinson, 2001).

2.4.4 National cultures of Hong Kong Chinese

To understand how national cultural issues might have affected management practices, cultural differences between nations should be considered. Four dimensions of national cultural differences were identified in the original Hofstede study in 1980 (Hofstede, 1985).

Power distance: At the core of this dimension lies the question of involvement in decision-making. In low power distance cultures, employees seek involvement and have a desire for a participative management style. The hierarchy means an inequality of role that is established for convenience and the ideal boss should be a resourceful democrat. At the other end of this scale, employees tend to work and behave in a particular way because they accept that they will be directed to do so by the hierarchy of the organisation and the ideal boss is a benevolent autocrat.

Uncertainty avoidance: This dimension is concerned with employees' tolerance of ambiguity or uncertainty in their working environment. In cultures that have high uncertainty avoidance, employees will look for clearly defined formal rules and conventions governing their behaviour.

Individualism/collectivism: This reflects the extent to which individuals value self-determination as opposed to their behaviour being determined by the collective will of a group.

Masculinity/femininity: In highly "masculine cultures", dominant values relate to assertiveness and material acquisition. In highly "feminine cultures", values focus on relationships among people, concern for others and quality of life.

As far as Hofstede's cultural dimensions as applied to Hong Kong professionals, Rowlinson and Root (1996) observed that Hong Kong professionals scored highly on Hofstede's power distance index, indicating the acceptance of inequalities and status differentials. Also, Rowlinson and Root (1996) reported that Hong Kong professionals scored relatively low, compared with a United Kingdom sample, on Hofstede's individualism index, indicating more collectivist attitudes and values.

These findings have implications for decision-making styles, indicating that the western problem-solving style by subordinates might have to give way to a more consensus-based approach. This was reinforced by the finding that being consulted by one's direct superior was not seen as important in a sample of Hong Kong professionals, and this was further supported by the view expressed by a number of interviewees that Hong Kong professionals are more "situation accepting", and somewhat averse to western problem-solving styles (Rowlinson and Root, 1996). Fear of expressing disagreement with leaders was also a frequent worry for the Hong Kong sample, adding further weight to the arguments above. Thus, the principle of deliberate conflict on which matrix organisation is based appears not applicable in Hong Kong.

High power distance of professionals would lead to authoritarian management and leadership styles in Chinese cultures, and Bond and Hwang (1993) noted the dangers of such a cultural characteristic in the large organisation:

"Many Chinese leaders tend to adopt an authoritarian pattern of leadership, making all the important decisions, assigning tasks to subordinates, all the while striving to be kind and considerate towards those led. This pattern of leadership may work well in temporary leader-subordinate relationships and in small-scale organisations. In large-scale organisations with the more complex levels of business, however, it is difficult for the manager to keep everything within his span of control. In the latter case, insistence on running the organisation by traditional ways may result in chaos and decrease the satisfaction level of subordinates. Demands of scale and complexity thus push the Chinese manager towards a more Western style of management - delegating and formalising".

This fits into Rowlinson's research findings and explains the reasons for the apparent failure of the matrix organisation in the Housing Department.

As further proposed by Rowlinson (2001), another complicating factor observed in Housing Authority is the existence of "subcultures" that were associated with horizontal (e.g. in a matrix organisation setting) and vertical differentiation (departmental specialisation of disciplines). It has long been acknowledged, for a complex organisation the internal complexity can have implications for the management of external relations (Cherns and Bryant, 1984). The effects of horizontal differentiation are likely to make themselves felt when attempts are made to collaborate with other groups in the organisation who are driven by their own departmental or divisional interests (Bresnen, 1990). Thus, for example, although project teams might themselves be well aligned, relations with other internal groups (e.g. discipline leaders) might be poor. In some cases, this might even lead to a marginalisation of the project team within the organisation. The effects of vertical differentiation are likely to be encountered when attempts are made to "cascade" new ways of working down the organisation.

Frequently the literature is insistent that top management's support and enthusiasm are vital in generating and sustaining changes to give a collaborative approach within organisation (Barlow and Cohen, 1996). However, it is not easy to narrow any gap between expressed intentions at top management and what actually happens on the front end, where behaviour can be influenced by a wide range of factors (including experience of actually working directly with members of other departments). Thus it might be difficult to convert formal matrix arrangements into real differences in behaviour at operational levels, creating a difference between an "espoused theory" and a "theory-in-use" (Argyris and Schon, 1978, p.174).

The obvious way to compensate is through more direct control of behaviour. However, this runs counter to many prescriptions for effective matrix organisation, which stress the importance of decentralised, flexible structures where the team is expected to operate with considerable autonomy and discretion. Hence the hidden conflicts between disciplines have resulted in problems facing members of the project team to work with members of other disciplines. Such has been the main problem facing construction-related organisation which is organised traditionally along disciplines.

2.5 Principal-Agent relationship and subcontracting

2.5.1 Subcontracting to respond to unstable demand

It has been mentioned that contracting business fluctuates, and there is never any guarantee of stable workload for contractors (Lai, 2000). They have to compete, and the competition has been severe (Smith, 1992; Smith and Bohn, 1999). A consequence of fluctuating workload is that contractors will tend to keep fixed costs down. Whether as a deliberate or as an emergent strategic process, one way to optimise performance (staffing flexibility, reduction in labour cost) is to hire through sub-contracting or employing contingent workers, rather than employing their own staff and equipment (Rubery, 1988).

The effectiveness of an organisation is contingent upon the responsiveness to diverse environment and integration of action across environment (Doz and Prahalad, 1996). This strategy is not new. The ancient Chinese military strategist Sun Tsu is the "father" of strategy. In 350 BC, he proposed that appropriate choice of strategic action should only be made after the individual "know the enemy and know himself". It is also important to understand the "terrain" (Lee, 1998).

Other studies also indicated that the unstable market conditions had been suggested as the overriding reason for subcontracting (McWilliams and Gray, 1995; Jones *et al.*, 1997). Williams (1993) observed that flexibility had come to represent a variety of functional techniques that organisations deployed to maximise the efficiency of the contribution of the human resource to the strategic purpose of the organisation. In this respect, flexibility was used to describe and explain some new forms of employment restructuring and other changes in the labour market. Wilkinson and White (1994) considered flexibility as being synonymous with the close adjustment by the firm of the labour it employed, the way labour was utilised, the wages paid to changing levels of output and the prices of the products.

Subcontracting enables contractors to be flexible in responding to potential market ups and downs (Rubery, 1988). The unstable and seasonal demand (i.e. market volatility) do not justify the emergence of large construction firms that have the capability of carrying out the entire construction process with their own workforce and equipment (Low and Tan, 1996). Unstable demand and seasonality cause construction firms to split into autonomous units and to rely on subcontractors to undertake some of the work packages. Construction firms prefer to be flexible rather than maintain a large organisation to undertake the entire construction process (Beardsworth *et al.*, 1988). Therefore the construction contractor–subcontractor relationship emerges as a rational response to the instability of demand in the industry and to problems caused by seasonality (Jones *et al.*, 1997).

A wide range of strategies to respond to seasonality has been identified. These were categorised by Atkinson (1985a; 1985b) as financial, numerical, functional, and distancing strategies in what has now come to be known as the "flexible firm model". The model envisages employers as segmenting their workers into a core of full-time employees and a periphery of a marginal or contingent / temporary workforce (Doeringer *et al.*, 1991). The core employees provide functional flexibility while the peripheral employees provide numerical flexibility. Firms adopt both functional and numerical flexibility in order to enjoy financial flexibility, which is achieved by reducing the number of core employees and by adjusting wage levels for the peripheral employees, thus limiting the firm's financial commitment. Hendry (1995) suggested that by adopting any, some or all of the flexibility strategies, an organisation can adjust its unit labour costs to increase profitability or to track revenue more closely.

According to Doeringer *et al.* (1991), functional flexibility implies that the firm has stable (core) employees, trained in a variety of skills, who move from function to function, performing the key activities of the organisation. These multi-skilled workers can undertake a range of tasks in the organisation. They enjoy security of employment, career advancement or prospects, and relatively good wages (Atkinson and Meagre, 1986). The peripheral workers are mainly part-timers, temporary (casual) and short-contract workers, subcontractors, and outsourced or self-employed people who are outside the organisation. Such peripheral workers have only secondary labour market employment terms including low pay and poor working conditions, and are easily recruitable and easily disposable (Atkinson and Meagre, 1986). These external workers who may carry out routine or specialised tasks probably usually have no direct relationship with the company, and it is such employment relationship that provides the employer with a numerically variable workforce (Pollert, 1988). Bernstein (1988) noted that at the beginning of this century, casual work appeared to be the residue of the industrial revolution that would soon completely disappear. However, not only had it remained, but also its importance had increased, and it had been introduced in industries and processes where it did not exist.

A number of writers have attempted to explain why employers are making greater use of contingent / peripheral workers to provide flexibility. Prowse (1990), for instance, observed that the philosophy for flexibility is economic in origin: to compete in world markets and react swiftly to changing consumer demand whilst reducing labour costs. Also, the United Kingdom literature suggested that economic recession and the consequent high employment in advanced economies have made it possible for employers to adopt more flexible human resources management practices. Moreover, employers in the United Kingdom were taking advantage of a depressed labour market and the weakened position of trade unions, owing to legislative restraints, to exploit the powerlessness of workers (Dales and Bamford, 1988).

Similarly, the United States literature suggested that employers are being pushed into relying more on peripheral workers by turbulence in the labour market caused by economic pressures at home and abroad, uncertainties concerning availability of key resources, rapidly changing technologies, and heightened global competition. Firms had been downsizing in order to retain their competitiveness and had to adopt more flexible human resources policies (Belous, 1989; Christensen, 1989). Doeringer *et al.* (1991) also indicated that United States employers are making greater use of peripheral employees to cut labour costs; to cover busy periods without engaging permanent employees; to respond rapidly to a decline in demand without having to retrench employees; and to attract specialists. In this respect, labour flexibility is seen as an innovative response to economic pressures and uncertainties.

Research by Lai (2000) observed similar findings. He considered that subcontracting is closely tailored to suit the specific needs of specific clients, typically those in the construction industry. He further suggested that subcontracting is well suited to the construction industry because projects are unique and specific in terms of type, size, class, location, time, sum, technology, specification and the like. Lai (2000) in particular concluded that the continuity of orders, confronting a construction contractor, is uncertain, as it is commonly lumpy and discrete. It is simply impossible for a construction contractor with a permanent staff who can meet all contingent requirements (i.e. all types of building works) and who can shift all liabilities to others. The subcontracting arrangement involves a division of labour in searching for specialists as well as sharing of risks and liabilities and each level of contractor needs only to be specialist in knowing his tasks and searching for experts one layer lower downstream and one level upstream (Nobbs, 1993). Each party to the contracting process bears all the risks and liabilities appropriate to the level of work and the sum of money involved.

According to Nobbs (1993) the contribution of subcontractors to the total construction process accounted for as much as 90 per cent of the total value of a construction project. He suggested that the increased involvement of subcontractors in the shift away from the traditional craft-base has led to a greater reliance on increasingly sophisticated technological based products, which has led to construction contractors concentrating their efforts on managing site operations rather than employing direct labour to undertake construction work. Jamieson *et al.* (1996) also attributed the increased use of subcontractors to the increased complexity of both the construction of buildings and the organisational relationships.

2.5.2 Core competency and flexibility

Hamel and Prahalad (1990) have argued that many multinational corporations achieve both high performance and a diversified portfolio of business by developing core competencies. The concept of core competencies has since been widely used as an explanatory framework (Heene and Sanchez, 1997). However, according to Aharoni (1996), it lacks validity when used to explain the organisation and strategy of multinational professional service firms in areas such as accounting, consulting and construction. To be useful in such industries, Aharoni (1996) suggests that Hamel and Prahalad (1990)'s original formulation must be adapted to reflect the project-based character of multinational professional service firms.

According to Lampel (2000), the four distinct types of core competencies which are crucial for multinational construction contractors are entrepreneurial, technical, relational and evaluative competencies. Entrepreneurial competencies involve marketing and project opportunity know-how; technical competencies contain basic know-how and ability to design and execute a particular project; relational competencies contain skills and know-how for developing and negotiating projects; and evaluative competencies contain routines designed to evaluate costs and measure risks (Heene and Sanchez, 1997).

Multinational construction contractors can either adhere to their competencies and go after project opportunities in which their competencies give them an advantage, or they can be opportunity driven, going after projects that offer the highest return (Lampel, 2000). The first is termed as focused strategy and the second switching strategy. Between these two extremes, there is a third strategy which is called as combining strategy which attempts to balance competencies against opportunities (Lampel, 2000).

To succeed in large projects, multinational construction contractors must confront and deal with the challenge of diversity. Projects are different from each other and it may not be entirely unique, but are sufficiently unique to defy specialisation (Lampel, 2000). Furthermore, the degree of customisation is such that firms are unable to develop operations that are specifically dedicated to development and construction of this type of projects. Without such specialisation it becomes difficult for firms to erect entry barriers which deter other competitors for bidding for the same business. With too many firms chasing relatively few similar projects (e.g. power stations) the rationale for specialisation disappears completely (Heene and Sanchez, 1997). Another approach is clearly called for. The obvious answer is a capability to bid and execute a variety of different projects, in other words, flexibility. Flexibility in this context therefore means an ability to configure and reconfigure a bundle of resources according to the demands of a particular project. It is not possible for construction contractors to have all the resources in house to suit any projects and they must rely on other specialist firms which have access to the necessary technology and this indicates there is a practical need for subcontracting (Heene and Sanchez, 1997).

2.5.3 Other benefits of subcontracting

In addition to flexibility and access to new technology, subcontracting can provide further strategic benefits for the construction contractor. It offers the possibility to delegate the responsibility for supervision and this is important in an industry where the dispersed location of sites and the craft nature of the production process both make supervision difficult (Saboia, 1997). Hence, employing labour indirectly, through subcontractors, enables construction contractors both to get the flexibility they need and to pass the problem of labour control to the subcontractor. It can therefore contribute substantially to a reduction in costs, even if all labour regulations are adhered to for the subcontracted labour (Saboia, 1997).

Moreover, the outsourcing of labour also offers the opportunity to secure a further reduction in costs by avoiding restrictive labour legislation and welfare regulations (Saboia, 1997). This opportunity is very appealing in construction as in other sectors and is particularly so in countries where the "on-costs" of labour are extremely high or where regulations are complex and therefore costly to implement. In these situations there is a strong incentive to recruit labour through subcontractors, who are more able or more willing to evade legislation (Saboia, 1997).

2.5.4 Problems of flexibility model for human resources management

Williams (1993) discussed the conceptual, methodological and empirical problems involved in the use of the term flexibility and covered the views of its protagonists and critics. Pollert (1988; 1991), a leading critic of the flexibility model proposed by Atkinson (1985a; 1985b), pointed out that the use of contingent/peripheral labour is not new, and that it is most extensive in sectors where it is already a well established practice. She found no empirical evidence at an aggregate level to support significant changes in employers' human resources use strategies, and considers flexibility to be a neat and bold model fraught with methodological and conceptual problems. In her view, she objected to corporate human resource policies based on "flexibility" being portrayed as an essential ingredient of economic progress. She argued further that the model may be dangerous if interpreted as an appealing management policy, as it may pose problems of control and efficiency (Pollert, 1988).

Geary (1992) considered the tendency to see flexibility as good and rigidity as bad is far too simple, as flexibility involves advantages as well as tensions and conflict. In fact, Hakim (1990) pointed out that in certain cases, companies had abandoned the use of peripheral workers after unpleasant experiences. This view appeared to be consistent with Geary's (1992) assertion that the widespread use of flexibility had not resulted in any significant benefits to many firms.

2.5.5 Other problems of subcontracting

Subcontractors are usually small firms and seldom have clearly defined company policy and procedures, and there is no guarantee of quality and professional competence (Ganesan *et al.*, 1966). Theoretically, it is the responsibility of the main contractor to supervise the performance of its subcontractors to ensure that they are in compliance with the requirements of the contract, but the hard facts of life are that seldom occurs (Matthews *et al.*, 1996).

The increase in complexity, the over-supply of specialist firms, and the declining construction output (maturity of the market) has cultivated an adversarial atmosphere which has had a negative effect on construction contractors-subcontractor relationships (Kale and Arditi, 2001). As construction contractor has realised that the greatest potential for cost savings lies with subcontractors, the prevalence of unfair contract conditions, subcontract auctioning and other onerous practices has increased (Matthews *et al.*, 1996). Many subcontractors do not have the necessary expertise to undertake work satisfactorily and, as a consequence, are unable to give their clients the service they require and many of the undesirable traits common to the construction contractors-subcontractor relationship are also common to the subcontractor-secondary subcontractor relationship (Matthews *et al.*, 2000).

2.5.6 Establishing and sustaining relationship of high quality between construction contractor and subcontractor

Previous paragraphs discussed the advantages and problems of subcontracting. To supplement the understanding of construction contractor–subcontractor relationships and exploring the impact on a construction contractor's economic performance of establishing and sustaining relationships of high quality with subcontractors, it is necessary to have a close look at the two dimensions of transactions: (1) uncertainty and (2) asset specificity (Kale and Arditi, 2001).

Construction contractor–subcontractor transactions involve a significant amount of uncertainty (Tay, 1994). Some of these stem from the nature of the construction process (Rowlinson and Walker, 1995) and others from the uncertainty of a potential partner's performance during the course of the construction process (Kale and Arditi, 2001) since the construction process involves uncertainty that stems from a number of sources. Construction operations are carried out on sites which present uncertainties regarding weather and soil conditions (Smith and Bohn, 1999). Each project requires a new design and generates new production problems regarding the co-ordination and integration of the outputs of specialised task groups which carry out interdependent tasks (Rowlinson and Walker, 1995); and the contracting system itself is a recipe for uncertainty since cost estimation is not an exact science (Winch, 1989).

In addition to such uncertainties, construction contractors and subcontractors also face difficulties in assessing other's performance in advance. Poor performance on the part of either party, construction contractor or subcontractor, can have profound effects on the other one (Kale and Arditi, 2001).

Construction contractor–subcontractor business deal involves a "high human asset specific investment" (Jones *et al.*, 1997). High human asset specificity is a direct result of the production technology used in the construction process, which commonly is classified as craft technology (Powell, 1990). In craft based production, each output is relatively unique, the search for outputs is non-routine, and the work process depends upon a considerable amount of intuition and experimentation (Perrow, 1967). In addition to this, in the construction process, interdependence among work groups is high and such production technology involves developing a significant amount of experience by working together (Groak, 1992).

2.5.7 Principal -Agent relationship and optimal contract

The principal-agent relationship applies to the building owner, construction contractor. It can also be extended to the construction contractor and its subcontractors, and the former conduct transactions with subcontractors for a number of reasons (Oliver, 1991). A fundamental idea of the agency theory is that of an agency relationship where two parties voluntarily commit to an agreement in which the agent will work in the interest of the principal. In our context, the principal can be the owner of the building and the agent is the construction contractor. In another mode, the principal is the construction contractor and his sub-contractors / contingent workers are agents. Eisenhardt (1989) stated that agency theory looks into risk, outcome uncertainty, incentives and information systems. Jensen and Meckling (1976) suggested that the agency problem arises when co-operating parties have different goals and division of labour. Specifically agency theory is directed at the relationship, in which one party (the principal) delegates work to another (the agent), who performs that work. Agency theory attempts to describe this relationship using the metaphor of a contract. Jensen and Meckling (1976) generalised the theory and wrote:

"*The problem of inducing an agent to behave as if he were maximising the principal's welfare is quite general. It exists in all organisations and in all co-operative efforts - at every level of management in firms, in universities, in mutual companies, in co-operatives, in governmental* *authorities and bureaux, in unions, and in relationships normally classified as agency relationships such as are common in the performing arts and market for real estates*".

Prior to any agreement or arrangement, agency theory assumes the principal and agent may have divergent interest, such that the agent does not naturally want to give his or her all for the interests of the principal, but would rather pursue his or her own interest and behave opportunistically (Jensen and Meckling, 1976). This divergence of interest will only lead to problems if the mechanism designed to govern the relationship do not adequately deal with it. Therefore, agency problem manifest themselves when both of the following occurs (Jensen and Meckling, 1976):

- The agent's interests are not in alignment with the principal's interests, resulting in opportunistic behaviour.

- The level of control and monitoring capability, which the principal has over the agent, is low such that the agent can get away with opportunistic behaviour. (In a construction site with such diversified activities going on, it would be impossible to control and monitor every piece of work, especially those that would be covered up readily after being built.) (Mingpao Editorial, 2000).

When agency problem exists, agency costs are incurred (Kane and Wilson, 1998). These costs are minimised when the marginal costs of the bonding, monitoring, and enforcement controls put in place equal the marginal benefits of the residual non-performance opportunities that these controls rein in.

From the perspective of the Hong Kong Housing Authority, as the principal, the building contract governs the relationship with the agent, the construction contractor. In the building contract, there are obviously terms in favour of the Hong Kong Housing Authority, and there are areas that are subject to interpretation (Ho, 2002). Some of these terms include fixed price for the whole duration of the contract except for fluctuation in cost of labour and material to some selected items. Any other cost fluctuation would have to be borne by the contractor. As far as subjective areas of workmanship, different employees of the principal would have different expectation and is always areas of contention between the Hong Kong Housing Authority and its contractors (Ho, 2002).

The construction contractor is faced with a dilemma (Roussseau and Libuser, 1997) - the need to attain consistent levels of performance, while at the same time to be flexible to react competitively to external pressure (customer demand, price competition and fluctuating workload). When competition is severe, profit margin is low. With high uncertainties and risks, it is easy to lose moneys. There is then a temptation for the agent to indulge in an opportunistic behaviour (Williamson, 1985). Unstable demand leads to unstable earnings and to minimise risk, the construction contractor will have to minimise overheads and be flexible. One way to optimise performance (staffing flexibility, reduction in labour cost) is to hire through subcontracting or employing contingent workers, rather than employing their own staff and equipment. Likewise the first layer of subcontractors passes the risk down to another layer and after two to three layers, control is lost and quality is difficult to maintain (Matthews *et al.*, 1996).

Options to reduce opportunistic behaviour would be increased investment by the Principal in information systems to monitor the agent's behaviour (Fama and Jensen, 1983), as well as engaging sufficient professionals to supervise (Sharma, 1997). There are suggestions that subcontracting should not be allowed, and directly employed workers should carry out a portion of the work (Chugani, 1999). Some critics said that the building process should be mechanised, with greater off-site fabrication to control quality of the components (Ko and So, 2002). There are further suggestions that construction workers should be trade-tested and registered. All these in essence would mean investment by the agents, increasing their fixed operating cost and transferring of risk to them. Nevertheless when other factors affecting outcome are present (Government policies, competition, economic climate) resulting in high outcome uncertainty, it would be expensive for the Principal to transfer risks to the agent even with outcome-based contracts (Eisenhardt, 1989).

To resolve the opportunistic problem, Scherer (1964), Bradley and McCuiston (1972) proposed that the amount saved in a contract and shared by the owner and contractor motivates contractor to save cost. McAfee and McMillan (1986) suggested the optimal incentive contract should be a trade-off between stimulating competition (a must for the Hong Kong Housing Authority in procurement using public moneys) in the initial bidding, and sharing risk between the contractor and owner, on the one hand, and giving incentives to the contractor to limit his production costs, on the other.

2.5.8 Effect of price on business transactions between contractors

Although severe competition has its downside, there is no way under current system of public sector construction procurement that this be abandoned. Public housing construction contracts have to be awarded through competitive tendering under the traditional notion of using price as a primary mechanism for co-ordinating business between parties (Smith, 1776). This is not considered as the best practice and Coase (1937) challenged this traditional proposition more than half a century ago by arguing that in some cases price is not an effective mechanism for co-ordinating business. More recently, Granovetter (1985, 1992) argued that considering price to be the primary mechanism for the business transactions ignores the social aspect of the industrial system. He introduced the concept of "social embeddedness" for studying the social aspects of industrial systems and gaining insights into how these social aspects can influence the co-ordination of business between two or more firms.

The concept of social embeddedness proposes that a firm is socially embedded in ongoing business with other firms and such social embeddedness has two important implications for the co-ordination of business between firms (Granovetter, 1985, 1992).

Granovetter (1985, 1992) suggested social embeddedness promotes the diffusion of information about the qualities (i.e. character, trustfulness, ethicalness, reliability, conformity to societal expectations, skills, etc.) of prospective partners. This information comes from parties with whom they were involved in the past and the diffusion of information regarding the probable behaviour of the parties acts as a safeguarding mechanism by providing guidance as to which parties should be avoided or preferred (Granovetter, 1985, 1992).

Furthermore social embeddedness enhances the co-ordination between parties because of inter-organisational learning that allows the firms to acquire experience from previous business (Granovetter, 1985, 1992). Organisational learning at inter-organisational boundaries enables parties to overcome problems of newness by developing trust, norms, values, roles, skills, teamwork and communication. It can further foster the ability to co-ordinate smoothly, establish routines, decrease the variance in parties' expectations and goals, and decrease the amount of monitoring required over each other's activities (Granovetter, 1985, 1992).

It is the subtle operation of social embeddedness that makes establishing and sustaining relationships of high quality with other firms a strategic factor, which can influence a firm's economic performance (Kale and Arditi, 2001). Commonly the quality of a firm's relationship with other firms has been conceptualised as a multi-dimensional construct including level of conflict, trust, co-ordination, communication, and longevity in relationship (Mohr and Spekman, 1994. Integrating these most commonly used dimensions of relationship quality, it can be stated that a higher quality relationship is obtained with a lower level of conflict together with the existence of mutual trust, effective co-ordination, open communication, and an emphasis on the longevity of the relationship (Kale and Arditi, 2001).

The impact of establishing and sustaining relationships of high quality on the co-ordination of business becomes more evident for deals that involve high "uncertainty" and high "asset specificity" (Kale and Arditi, 2001). This is due mainly to two major aspects of human behaviour, "opportunism" and "bounded rationality" (Jones *et al.*, 1997; DiMaggio and Louch, 1998), as predicted by the principal-agent relationship. Uncertainty refers to the degree of difficulty in evaluating and monitoring the performance of a business partner (Williamson, 1975). Asset specificity refers to the degree to which an asset is specific to a given business deal, to the extent that it cannot be re-deployed easily for use in another context without appreciable loss in its productive value (Williamson, 1975). Three major types of asset specificity can be identified for construction industry. According to Granovetter (1985, 1992), site specificity is obtained when an asset is useful only in its current location, as when it is immobile or dependent on another specific asset; physical asset specificity is obtained when an asset is less valuable when used in any other transaction than the one it was intended due to customised production and human asset specificity refers to job-specific know-how accumulated by business parties in previous deals. Human asset specificity increases as parties develop experience working together and accumulate specialised information, language and know-how that enables them to co-ordinate and communicate efficiently and effectively (Kale and Arditi, 2001). Opportunism is based on the assumption that individuals are in general self-interested; moreover, some individuals are prone to act opportunistically (e.g. lying, cheating, violating agreements, etc.), and it is not easy to separate these individuals from the rest (Williamson, 1975, 1985). Bounded rationality is based on the assumption that individuals intend to be rational but this intention is limited in their information processing capabilities (Williamson, 1975, 1985). It is well documented in the literature that all transactions among social actors are prone to the hazards of opportunism, due to the opportunistic nature of human behaviour and the fundamental challenge in organising a business transaction, therefore, is to safeguard it against the hazards of opportunism (Williamson, 1975, 1985). High asset specificity in a business deal increases the potential danger of opportunism because high asset specificity leads to the high dependence of partners on each other and limits replacement alternatives available to each party (Kale and Arditi, 2001). A business deal that is supported by high asset specificity can be safeguarded against the hazards of opportunism by writing a full legal contract (Fama and Jensen, 1983). However writing a full contract becomes difficult and costly under conditions of uncertainty since every contingency that may arise during the course of the deal cannot be foreseen and specified in a written contract in advance, because of the bounded rationality of human behaviour (Kane and Wilson, 1998). Neither a price mechanism nor contract documents can satisfactorily safeguard transactions that are supported by high asset specificity and involve high uncertainty against the hazards of opportunism (Williamson, 1975, 1985). In these situations parties who have no direct or indirect close ties with a potential partner protect the deal against the hazards of opportunism by identifying and assessing the behaviour of this potential business partner by referring to other parties' experiences with this business partner (DiMaggio and Louch, 1998). Furthermore, a party to a deal cannot rely only on the price mechanism in its deal with a potential partner under conditions of high uncertainty and high asset-specific investment (Kale and Arditi, 2001).

In construction projects there is uncertainty as far as the degree of difficulty in evaluating and monitoring the performance of the contractors (Sharma, 1997). The building process and the product are a kind of specific asset as it cannot be re-used easily for other purpose without appreciable loss in its productive value (Jones *et al.*, 1997).

Public housing construction involves erection on site of a large number of individual components and completion of individual tasks. The construction essentially involves arranging for each section of the building to be properly constructed and fitted out often using relatively low-technology and labour-intensive techniques (Stephen and Love, 1998). Although a construction contractor may receive contracts for a number of similar public housing projects, these are usually constructed in isolation. As a result, while there may be substantial learning curve in construction, the incidence of economies of scale may be less than in, for example, process or batch manufacturing. The nature of the construction operation also means that highly specific and specialised fixed assets are less prevalent than in many manufacturing operations. This does not, of course, mean that asset specificity is of no consequence; its importance may simply come more from dedicated human asset specificity.

Perhaps the most significant feature of building projects is the costs which it presents for delay to completion and its knock-on effects. Eccles (1981) highlighted the requirement for precise scheduling of work in most construction programmes, and this is certainly the case in building projects. Eccles (1981) further suggested that failure of a supplier or contractor to deliver on time and of the specified quality can have significant knock-on effects throughout the construction programme, possibly involving extremely costly delay, and the key element here is the cost of delay or hold-up, arising both from penalties incurred by failure to deliver the final contract on schedule, and from the opportunity cost of (transaction-specific) resources which must remain idle. This suggests that it is useful to distinguish empirically between time criticality purely in terms of production scheduling, and the costs incurred by such delay (strategic or non-strategic). Certain components or tasks in building construction may be critical in the schedule, but be relatively trivial in terms of cost. Others may have similar scheduling characteristics but have severe cost implications.

The discussion above gives some insight into the market scenario in the construction industry in general: unstable demand, highly uncertain operation, keen competition and asset-specific. A stable business partner to carry out part of the transaction is of benefit to the owner, construction contractors and its subcontractors. This process does not stop but goes further down the supply chain when applied to the using of secondary subcontractors.

2.5.9 Equitable share of risk

The Hong Kong Housing Authority is aware of the poor quality of the public housing projects coming from competitive tendering system, multi-layer subcontracting and the opportunistic behaviours adopted by some of the public housing construction contractors. Under the prediction of the principal agent model, it will not be possible to write a contract to guard against all eventualities without incurring astronomical transaction cost (Kane and Wilson, 1998). The Hong Kong Housing Authority is aware of this and in an effort to improve proposed to share risks equitably with its construction contractors (Hong Kong Housing Authority, 2000) and amended some of the contract terms so as to develop a win-win solution.

As noted in paragraph 2.5.7, regular business partners to a client is the preferred course of action in building projects due to its asset specificity. Superficially sustaining good relationship with construction contractors might be a better way than to enforce contracts to reduce opportunism. Therefore part of the research had been directed to solicit views of public housing construction contractors on what they consider as critical factors which affect its business with the Hong Kong Housing Authority, and what are the effective quality improvement measures.

2.6 Inter-organisation co-operation – supply chain and partnering

2.6.1 Supply chain and partnering in construction industry

Supply chain is a term used to explain the processes supporting physical, information, financial, and knowledge flows for moving products and services from suppliers to end-users (Christopher, 1992). In the context of the construction industry, the supply chain can be identified as system through which design teams and construction contractors working together to deliver an end-product to their clients (Wong and Fung, 1999).

The construction supply chain involves many different team members such as the clients, architects, planners, quantity surveyors, engineers, landscape architects, interior designer, main contractor, sub-contractors and the suppliers (Burnes and New, 1996). Each team members is a link in a chain of activities, adding value at each stage, designed to satisfy end-customer demand in a win-win situation. The process also embraces all the information technology necessary to support and monitor the activities. Since the members of the construction supply chain process are fragmented across many diverse disciplines, each using different systems and approaches to comply with clients' requirements, poor management and communication problems often occur readily (Barlow and Jashapara, 1998).

Moreover, activities in the construction industry are discontinuous, dispersed, diverse and distinct in nature (Tay, 1994) and not many construction projects are free of conflict, disputes, delays, disruption, cost and schedule overruns, claims or deficient items / work (Matthews *et al.*, 2000; Brandon *et al.*, 1998; Betts and Ofori, 1993; Melles and Wamelink, 1993). Therefore a better way to ensure success of the construction projects is proper management of the construction industry supply chain, and organisations involved in the construction projects should treat each as collaborating partners (Bresnen and Marshall, 2000). Agapiou *et al.* (1998) also concluded that subcontractors are an important link within the construction supply chain and that partnering could help to improve the supply chain and reduce costs.

The control of time, cost and waste is of paramount concern to all parties involved in construction projects (London and Kenley, 2001). Many problems related to issues of control result from inadequate communication of information within the supply chain as the amount of information flow in any construction project from start to finish should not be underestimated (Smith and Scherer, 1999). Different types of information / data are required by various people in the construction supply chain in various formats (O'Brien, 1996). Amongst identified problems are: fragmentation of professional expertise, lack of information sharing, lack of awareness of available technology for integration. It is through proper management of all these that success of construction projects can be assured (London and Kenley, 2001).

As such, construction supply chain management concerns the improvement of the system implemented to ensure improved project performance along various metrics such as speed, cost, reliability and quality. The supply chain management in construction offers a way to integrate the traditional islands between the members of the construction team and thereby reducing the time and cost (Matthews *et al.*, 2000).

Management of the construction supply chain also requires the commitment between all the organisations for the purpose of achieving specific business objectives by maximising the effectiveness of each organisation's resources and partnering comes into the theme (Dainty *et al.*, 2001). As suggested by the Construction Industry Institute's Partnering Task Force, partnering is the relationship based on commitment, trust, dedication to common goals, and an understanding of each other's individual expectations and values (Construction Industry Institute, 1991). According to Himes (1995), partnering is a process by which each of the organisations can achieve their respective goals while together achieving the owner's goals for the project. Partnering is, and should be viewed as, a continuous process in order to achieve its greatest value. Partnering should be integrated into the project from its conception to completion. It acts as a claims-avoidance technique, a management tool, or communication technique and covers all of these things and more (Himes, 1995).

The ultimate goal of partnering should be to achieve the owner's goals by producing a "win/win" situation for all parties (Himes, 1995). Once all goals of the respective parties are known to all other parties and buy-in is achieved to the concept and the goals, then real progress is made by creating partners to achieve one's own goals (Himes, 1995). Thus partnering goes hand in hand with proper management of the construction supply chain (Matthews *et al.*, 2000).

2.6.2 Partnering in manufacturing

Partnering could also be found between larger manufacturers and its original equipment manufacturers (OEMs) which act as suppliers and contractors to large manufacturers (Hahn *et al.*, 1986). Fluctuating economic conditions, changing labour markets and international competition have all combined within the last decade to alter radically former relationships between the final manufacturer and the OEMs, with a new wave of relationship (partnering) overtaking much of this industry (Herbig and O'Hara, 1994).

For the OEMs, short-term contracts meant a business system based on multiple sourcing and competitive bidding strategies. Within this uncertain environment, the OEMs developed a short-term orientation to business. Tied to fixed contracts with larger customers who were always ready to entertain better offers from other sources, the OEMs commonly faced irregular sales demands and inconsistent production plans. OEMs were required to conform strictly to the specifications of the manufacturer and generally were not disposed to initiate modifications that might improve quality or reduce production costs, since their commitment was tied only to the current contract (Ellram, 1991). This, combined with a competitive bidding system that encouraged the lowest price possible, often resulted in sacrificing product quality or other vital services (Ellram, 1991).

As world markets have become increasingly rivalrous, manufacturing firms have discovered that traditional, adversarial relationships with suppliers have not allowed them to remain competitive (Treleven, 1987). In response to this, many firms have formed close partnerships with important suppliers which have produced significant managerial, technological and financial benefits and have allowed them to compete with foreign concerns (Hahn *et al.*, 1986). Other advantages included improved communications as suppliers are provided with more accurate and stable purchase requirements data and can respond to requests with more helpful feedback about process capabilities, available alternatives, possible design modifications, and cost improvements (Carbone, 1993).

Nonetheless, there are potential disadvantages with these partnerships or single-source relationships, as in the case of a strike or production disruption at the single-sourced vendor facility. The biggest problem with partnerships occurs when both parties fail to distinguish the arrangement from simple time-quantity agreements and in this situation, the partnership is badly implemented and often results in a deteriorated relationship between parties (Presutti, 1992).

All these suggest that, if a purchasing partnership is to succeed, both parties must be truly interested in a continuous co-operative relationship. Top management must demonstrate support to this new alliance and set an example for others in the firm (Ellram, 1991). In addition to these basic attitudes, there must exist some level of cultural compatibility or common philosophy of doing business between the two entities. Further, there must be a commitment to quality and total costs, and not just price. In summary, mutual interdependence needs to be given much more than just lip-service if the partnership is to survive and grow (Ellram, 1991).

2.6.3 Differences between partnering in construction and manufacturing

The problems facing OEMs in manufacturing are similar to construction contractors – keen competition, irregular demands, conform to specifications of clients and not to initiate modifications that might improve quality. The main difference however is there are much more parties involved in construction projects (Tay, 1994) and make the situation much more complicated than manufacturing. First, there is inherent conflict between many of the parties' goals (Himes, 1995). The buyer (the owner) wants to minimise cost, and the sellers (general contractor, architect, engineer, etc.) have profit as their goal. Faster is better to the sellers, but that can often result in sloppy workmanship and fails to meet the owner's goal.

Also partnering in manufacturing may be a much longer term relationship between two organisations (Ellram, 1991), and not just in most cases, one single project as in the construction industry since project stakeholders differ from one project to another. Therefore, construction contractors find it hard to build long-term relationships with each other or with their clients and this has fostered the instable nature of supply chain in the construction industry (O'Brien, 1996).

2.7 Principles of Portfolio Theory - Capital Asset Pricing Model (CAPM)

It has been hypothesised that construction industry is more risky than non-construction business, resulting in a higher risk premium for construction companies stock. For an asset, its total financial risk is the sum of two components: diversifiable risk and nondiversifiable risk (Ben-Horim and Levy, 1980). Nondiversifiable risk reflects an asset's price movements caused by changes in the macro-economy. Diversifiable risk reflects factors unique to the particular asset and its operating environment that are independent of the macroeconomy. An investor can eliminate diversifiable risk by creating a portfolio containing assets from various sectors in the economy (Haugen, 1986; Elton and Gruber, 1987; Copeland and Weston, 1988, p.118). The investor is rewarded for only the nondiversifiable risk and the CAPM has been used to estimate such a risk. Therefore, it is used to value an asset with respect to the market.

The capital asset pricing theory is based on the application of expected utility theory to choices among alternatively risky assets (Sharpe, 1964; Lintner 1965) and rational investors' risk tolerance for such risky alternatives provide signals to the economy in the form of asset prices. This valuation of risky assets would result in an efficient allocation of resources over time.

CAPM can be expressed in terms of a simple linear model that captures the trade-off between the firm's expected returns and expected systematic (nondiversifiable) risk. Sharpe (1964) and Lintner (1965) defined CAPM as:

$$E(R_t) = R_{ft} + \beta_t (R_{mt} - R_{ft})$$ where,

$E(R_t)$ is the *ex ante* expected monthly returns of common equities,

R_{ft} is the contemporaneous one-month Treasury-bill rate (or risk free rate),

β_t is the systematic risk of firm (the covariation of the firm's returns with the returns on the market portfolio index), and

R_{ft} is the monthly return on the market portfolio.

The CAPM is a market and risk adjusted model. Thus, it takes into account both market-wide factors and the systematic risk of the security. Therefore, the main implication of the CAPM is that the market portfolio of invested wealth is mean-variance efficient in the sense of Markowitz (1952, 1959). Moreover, the efficiency of the market portfolio implies the following:

(1) Expected returns on securities are a positive linear function of their market β_i (the slope in the regression of a security's return on the market's return.)

(2) The single factor needed to capture the cross-section of expected returns is the market β_t. Therefore, company-specific factors would be diversified away.

Over the years, however, the enormous body of empirical research on common equities – examining how well the Sharpe-Lintner-Black (CAPM) theory fits the data – have unveiled a number of empirical inconsistencies of the CAPM model. A number of company-specific risks have been found as empirically capable of explaining a significant portion of a firm's stock returns above and beyond what's captured by CAPM's only source of risk - the systematic risk (Cho, 1997). Reinganum (1981), Lakonishok and Shapiro (1986), Merton (1987) and Chan *et al.* (1991) questioned the predictive ability of beta, while in other studies researchers suggested that non-market (company specific) factors do a better job of predicting stock returns than just beta alone. Levy (1978) found that a firm's unsystematic risk is a key predictor. Merton (1987) found both beta and firm-specific risk are important predictors, and others found the total variance in a firm's stock returns (Brown *et al.*, 1993).

In addition, according to Bhandari (1988), leverage and average returns showed empirically significant positive relation. Although the CAPM model expects that the leverage risk of the firm should be captured by its β_t, he found empirical evidence showing that leverage helps to explain the cross-section of average stock returns in tests that include size as well as β_t. The firm's price earning (P/E) ratio was also found empirically significant.

Ball (1978) argued that the P/E ratio is the most significant proxy that captures all other unnamed factors in expected returns. He reported that P/E is likely to be lower for stocks with higher risks and expected returns. Similarly, Basu (1983) found that the P/E ratio helps to explain the cross-section of average returns on United States stocks in tests that also include size and market β. He found that low P/E portfolios have rates of returns higher than what could be justified by the CAPM model.

With the various views on the different ratios, the comparison in Chapter 4 was limited to β and P/E ratios of construction industry stocks in Hong Kong, when compared with all the non-construction business.

2.8 Calculation of BETA

Beta is the sensitivity of a stock's returns to the returns on some market index (e.g., Standard and Pool for United States) and beta values can be roughly characterised as follows (Shah *et al.*, 1997):

Table 2.2 Interpretation of β

$\beta < 0$	Negative β is possible but not likely. It has been suggested that gold stocks should have negative βs.
$\beta = 0$	Cash without investment, assuming no inflation
$0 < \beta < 1$	Low-volatility investments (e.g., utility stocks)
$\beta = 1$	Matching the index (e.g., for the S&P 500, an index fund)
$\beta > 1$	Anything more volatile than the index (e.g., small capital funds)
β much greater than 1	Impossible because the stock would be expected to go to zero on any market decline. 2 –3 is probably as high as one will get.

CAPM betas are generally estimated from historical data using the 5-year rule and applied to a future period (Barra Inc., 1997). Whilst there is widespread evidence that the CAPM betas vary considerably over time, the variation can still be explained by the 5-year rule of thumb (Groenewold and Fraser, 2000).

Professional beta services such as S&P 500 also use monthly data over a five-year period to calculate beta. As adopted by Barra Inc. (1997), this is done by collecting end-of-the-month prices and any dividends for a stock and the market index for 61 months (0..60). n + 1 price observations are required to calculate n holding period returns.

The return for month 2 will be calculated as:

$$R_{\_2} = (P_{\_2} - P_{\_1} + D_{\_2}) / P_{\_1} \qquad \text{Equation 2.1}$$

Here R denotes return, P denotes price, and D denotes dividend. The following table of monthly data may help in visualising the process. (Monthly data is preferred in the profession because investors' horizons are said to be monthly.)

Nr.	Date	Price	Div.(#)	Return
0	12/31/96	45.20	0.00	--
1	01/31/97	47.00	0.00	0.0398
2	02/28/97	46.75	0.30	0.0011
.	...	...	...	...
59	11/30/01	46.75	0.30	0.0011
60	12/31/01	48.00	0.00	0.0267

(#) Dividend refers to the dividend paid during the period and is assumed to be paid on the date. For example, the dividend of 0.30 could have been paid between 01 February 1997 and 28 February 1997 but is assumed to be paid on 28 February 1997.

With a series of 60 returns on the stock and the index (1...61), the returns can be plotted on a graph and the best-fit line (visually or using some least squares process) can be determined (Barra Inc., 1997; Martin and Simin, 1999). According to Bruner *et al.* (1996), the estimated slope of this best fit line is undoubtedly the most widely used measure of market risk and return and this is confirmed in a survey concerning the current best practices of the cost of capital estimation. Also Bruner *et al.* (1996) concluded that the CAPM is currently the favoured model used for estimating the cost of equity and that beta estimates used in practice are drawn primarily from published sources.

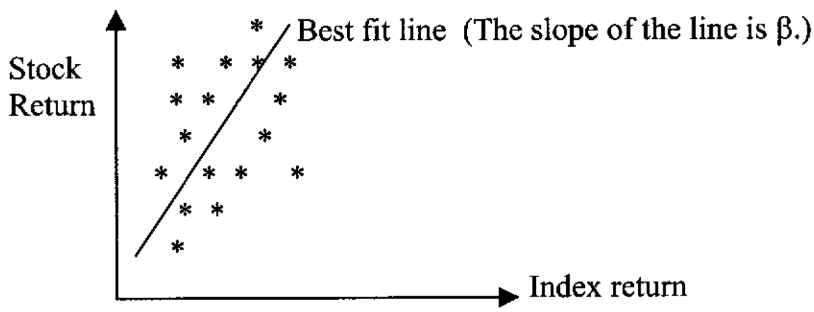

Figure 2.1 Graph of stock return Vs index return

Now what does beta mean? A beta of 1.5 does "not" mean that if the market goes up by 10 points, the stock will go up by 15 points. It even "doesn't" mean that if the market has a return (over some period, say a month) of 2%, the stock will have a return of 3%. From the graph,

$$\text{Stock return} = \alpha + \beta * \text{index return} \qquad \text{Equation 2.2}$$

Technically speaking, alpha (α) is the intercept in the estimation model. It is expected to be equal to risk-free rate times $(1 - \beta)$ (Barra Inc., 1997). Therefore, by computing the derivative, Equation 2.2 can be written as:

$$\text{Change in stock return} = \beta * \text{change in index return}$$

So, truly and technically speaking, if the market return is 2% above its mean, the stock return would be 3% above its mean, if the stock beta is 1.5.

To interpret beta, it can be said: On a day the market index goes up by 1%, a stock with beta of 1.5 will go up by 1.5% + epsilon. It won't go up by exactly 1.5%, but by something different.

The epsilon values for different stocks are guaranteed to be uncorrelated with each other. Hence in a diversified portfolio, it can be expected all the epsilons (of different stocks) to cancel out (Barra Inc., 1997).

So in a diversified portfolio, the beta of stock X is a good summary of its risk properties with respect to the "systematic risk", which is fluctuation in the market index (Cho, 1997). A stock with high beta responds strongly to variations in the market, and a stock with low beta is relatively insensitive to variations in the market (Barra Inc., 1997; Martin and Simin, 1999).

As suggested by Shah *et al.* (1997), if an investor had a portfolio of beta 1.2, and decided to add a stock with beta 1.5, then the investor would be slightly increasing the risks (and average return) of the portfolio. This conclusion is reached by merely comparing two numbers (1.2 and 1.5). That parsimony of computation is the major contribution of the notion of "beta". Conversely if the investor were uneasy about the variability of his beta = 1.2 portfolio, he could augment it with a few companies with beta less than 1.

2.9 Summary

This Chapter gave a literature review of this research. It started from the broader literature and narrowed down to the topics applicable to the current research problem.

There was initially a review of business risk of construction industry and its profitability. Literature in the United Kingdom, Singapore and Taiwan were cited. Then the characteristics of the local construction industry were presented. Such included high rise constructions, procurement method, foreign competition, labour intensive construction methods, labour shortage, management style, lack of research, proliferation of subcontracting / secondary subcontracting and Building Ordinance in Hong Kong.

The setup of the Housing Department was cited to give possible background to explain outcomes of some of the survey results. Cultural issues were raised and national cultural characteristics of Hong Kong Chinese were explained to account for the outcome of adopting matrix organisation in the Housing Department.

Reasons for subcontracting, advantages as well as problems associated with subcontracting as predicted by the principal-agent model were discussed. It was noted that subcontracting, although with its downside, provided the flexibility to contractors to deal with fluctuating workload and the wide variety of projects of the construction industry.

Supply chain management and partnering as a way to improve inter-organisational co-operation were cited for the construction industry and the manufacturing industry. The advantages of the integration of the construction supply chain and partnering were stated. Difference between partnering in construction and manufacturing were discussed.

The Chapter finally explained what were CAPM and one of the financial indicators P/E of listed companies. Only these two were included to give an indication of the profitability of the construction industry in Hong Kong.

CHAPTER THREE

3. RESEARCH METHODLOGY AND PROCESS

Chapter Three states that this study can be classified as “testing out research”. The difference between the qualitative and quantitative methods is presented. The argument for positivist approach being chosen for the main part of this study is stated. Then the different stages of the research process are explained.

3.1 Type of research

This study can be classified as "testing out research" to find the limits of previously proposed generalisations - business risks in construction industry (Phillips and Pugh, 2000). The interest in this research is the study of business risks associated with a particular sector of the construction industry in Hong Kong – the public housing construction industry and risk management methods used by public housing construction contractors. From the literature, there appears to be a lack of knowledge about the business risks experienced by this sector of the industry. There is also a lack of knowledge about the factors that will encourage improvement to the quality of the public housing construction and what the contractors’ attitudes towards the issues are.

In general, research can be undertaken for two different purposes: basic or applied research (Neuman, 1997, p.21-23). The first one is basic research to contribute to the general body of knowledge in a particular area of interest and improve the understanding and knowledge of certain issues common to organisations and to resolve the problems occurred. The second is applied research which is carried out with the aim to apply the results to solve specific problems currently experienced in organisation. In this thesis, the research can be classified as applied research with the goal to produce more knowledge about construction contractors' risks and to solve the problems evolving from business risks common in the local public housing construction industry.

In social science research, there are two main methodologies - the quantitative and qualitative, and methodology describes the design and research methods used, and the choice will depend on the nature of the data collected and the problem for the research (Ghauri *et al.*, 1995). Information and knowledge collected can be numeric or descriptive. Generally speaking, descriptive expressions in words collected are regarded as qualitative data and numeric data are considered quantitative (Creswell, 1994). Descriptive study involves interview, exploratory or historical studies, and is the method used for qualitative research (Silverman, 1997). Findings are normally not arrived by statistical methods or other procedures of quantification. For quantitative research where the data is principally numeric, the studies to be considered are usually experimental, quasi-experimental, statistical, casual or descriptive in the form of survey (Creswell, 1994). When the research solutions require viewing the problem from different angles the method is triangulation (Lee, 1991; Skodol-Wilson and Hutchison, 1991). The data will be collected using both qualitative and quantitative perspectives and then analysed applying the two different methods (Gable, 1994). The combination will give the final solution. The difference between qualitative and quantitative methods is not just a question of quantification, but also a reflection of different perspective on knowledge and research objectives (Ghauri *et al.*, 1995). Surveys using questionnaires are common methods and are considered as quantitative (Neuman, 1997, p.229). Different scholars have different views on the two methods and some of these are described as below.

3.2 Levin, Guba and Lincoln

Definitions for the qualitative methods (Levin, 1988, p.51) and quantitative methods (Levin, 1988, p.33) are:

"Qualitative Methods: The approach to research in which the qualities of objects, behaviour, or relationships are evaluated in textual (words) rather than quantitative (numbers) terms".

"Quantitative methods: The Scientific Perspective is an approach to studying the observable world that stresses systematic, objective measurement aimed at the discovery and explanation of stable order in that world. Quantitative methods are the approach to research that attempts to attach numbers in the evaluation of the qualities of objects, behaviour, or relationships".

Guba and Lincoln (1994) considered that the choice of inquiry paradigms relies on three fundamental questions to be asked and answered:

- The ontological question

  What is the form and nature of reality and, therefore, what is there that can be known? As an example, if a real world is assumed, then what can be known about it is "how things really are" and "how things really work". Then only those questions that relate to matters of real existence and real action are admissible; other questions such as those concerning matters of aesthetic or moral significance fall outside the boundary of legitimate scientific enquiry;

- The epistemological question

  What is the nature of the relationship between the knower or would-be-knower and what can be known? This is constrained by the answer given to the ontological question in that not just any relationship can now be postulated. So if a real reality is assumed, then the posture of the knower must be one of objective detachment or value freedom in order to be able to discover "how things really are" and "how things really work";

- The methodological question

  How can the inquirer go about finding out whatever he or she believes can be known? This is constrained by the answer already given to the ontological and epistemological questions. That is, not just any methodology is appropriate. For example, if a real reality is pursued by an objective inquirer, it is essential to control possible confounding factors, whether the methods are qualitative (say observational) or quantitative (say, analysis of co-variance). If a manipulative methodology (experimental) is selected, it implies the ability to be objective and a real world to be objective. The methodology question cannot be reduced to a question of methods which must be fitted to a predetermined methodology.

3.3 The research process

Both qualitative and quantitative methods are adopted in the different stages of the research. Firstly qualitative method is used in the initial study so as to find out unknown facts and the mindsets of respondents in the local construction industry. The researcher acted as part of the inquiry. There is then survey to solicit the attitude and perception of public housing construction contractors and subcontractors on business risks associated with its construction business. Data will be mostly quantitative, and data collected will be coded and refined such that it allows categorisation and quantification. The procedure of natural science will be applied directly to this social science problem, and the researcher is an observer of social reality, independent of the enquiry. The result of this social science research can be formulated parallel to that of natural science (Cohen and Manion, 1992). Hence positivist approach is adopted in the research and method is quantitative. The structure of this thesis is based on the following research processes:

3.3.1 Literature survey, preliminary fieldwork

Literature review was first carried out and some basic findings were used as the discussion guide for the preliminary fieldwork. This preliminary fieldwork with Experts in public housing construction was carried out as a qualitative link study. It included discussion with Experts in the Hong Kong public housing construction industry. Newspaper cuttings in the twelve months period from September 1999 to August 2000 involving the local construction industry were also studied, as comments by the industry would invariably indicate the mindsets of prominent figures in the industry.

This qualitative study fell under constructivist inquiry that helped to "understand and reconstruct the constructions that people (including the researcher) initially hold, aiming towards consensus, but still open to new interpretations as information and sophistication improve". (Guba and Lincoln, 1994) Computer program "NUD*IST 4" developed by Qualitative Solutions and Research Pty. Ltd. was used to analyse the collected information (Richards, 1998). Information from this initial qualitative study, after analysis, was used to set some of the questions in the pilot survey. This qualitative interview was administered in person by the researcher.

3.3.2 Secondary data collection and analysis

Risk premium estimation was done through share prices of listed construction contractors in Hong Kong. Share prices were obtained from database Datastream prepared by Thomson Financial (2000) accessed through Lingnan University Library. Information from published Annual Reports of listed construction contractors was used to supplement the share prices for analysis. Such annual reports and financial data could also be found from database Primark Exel from Thomson Financial (2000) as well as Dow Jones (2000c).

For testing of the CAPM, listed construction contractors that have a substantial non-construction business income such as trading of building material, real estate development etc. would have to be screened out, and the aim is to compare listed constructors which derive more than 50% of their business income from the Hong Kong Housing Authority. From published annual reports, only around eight listed construction contractors on the Hong Kong stock market meet this criterion. Test of the CAPM model and analyses of their return (pre-tax profit to turnover) from published company reports were limited to these firms. For listed contractors with income from public sector construction projects, the analyses were limited to firms concentrating on non-residential construction (such as civil engineering or foundation contracts) or on the part of the turnover from non-public housing construction activities.

As CAPM could not be the conclusive measure for the business risk of a firm, other financial data such as percentage return on turnover was evaluated. Number of superstructure construction tenders issued by the Hong Kong Housing Authority was also evaluated to give some insight into the extent of bidding for public housing projects.

3.3.3 Research survey design and pilot survey

A thorough literature review was conducted to identify the factors that affect the successful outcomes of construction projects, and risks / risk management adopted by construction contractors. Some of the results were already used as discussion guide in the initial qualitative study, and observations from the initial qualitative study were adopted to form part of the questions in the pilot survey.

The pilot survey was aimed at direct input from construction contractors, and was pretested on 5% of the targeted sample of the public housing construction contractors (building, electrical, air conditioning, fire services, lifts, plumbing, landscaping). The purpose was (Zikmund, 1997, p.108-109):

- To establish the most appropriate respondents;
- To check whether the questions asked were easy to understand;
- To ascertain the effectiveness / validity of the instrument.

The following guided the choice of construction contractors for pretesting the survey: (1) turnover of at least 50% from public housing; and (2) a consistent business over the last 5 years with the Hong Kong Housing Authority. After piloting, the main survey was reviewed to incorporate the outcome of the pilot survey to make the final research instrument more effective. A supplementary survey was also devised and the target respondents were subcontractors which subcontracted part of the public housing construction works from main contractors. The purpose of this is to identify reasons for the proliferation of subcontracting in the local construction industry.

3.3.4 Primary data collection by survey

The main survey would be aimed at the Hong Kong public housing construction industry. Participants would include contractors responsible for the construction works. Database of all the construction contractors of 338 companies (See Appendix F) (building, piling, demolition, landscaping, decoration, lifts and escalators, electrical, fire services and air conditioning) has been constructed from lists published by the Hong Kong Housing Authority and the survey questionnaire was sent to all the 338 Housing Authority contractors.

According to Nachmias and Nachmias (1981, p.183) and Flowerdew and Martin (1997, p.100), the usual postal survey response rate is 20%

to 40%. Akintoye (2000) states that the response rate of postal survey in the construction industry was about 20-30%. In another study by Dulaimi and Shan (2002) to find out the factors influencing bid mark-up decisions of large- and medium-size construction contractors in Singapore, they got an overall response rate for postal survey of 21.3% which they state are typical of studies involving construction companies. Therefore the target in the current study for the Hong Kong Housing Authority contractors is set to get a 25% response rate, or about 85 valid replies.

For the supplementary survey, a list of potential respondents was constructed from trade associations and approved contractors from the Hong Kong Special Administrative Region Government Works Bureau. The total number of contractors (general construction contractors, demolition, electrical, fire services, sewage treatment, air conditioning, ventilation, kitchen equipment, burglar alarm and switchboard etc) according to its trade is about 50 000 (Works Bureau, 2000). According to Zikmund (1997, p.477), for a population of 50 000 and for parameters in population assuming to be over 70% or under 30%, a sample size of about 320 will give reliability of ±5%. Random samples of 339 contractors had been selected for the supplementary survey.

The researcher would have to take a proactive approach and should phone individuals being targeted to get their co-operation, and have a major portion of the survey delivered personally to ensure that the survey would not be completed by someone else.

3.3.5 Link between initial qualitative study & survey (Chapters 5 and 6)

Information from the initial qualitative study, after analysis, will be used to develop the questions in the main survey in Chapter 6 to test hypothesis H3A regarding perception of the public housing construction contractors on the relative criticality of business risks from the client – the Hong Kong Housing Authority. Details will be in Chapter 5 Section 5.7.

3.3.6 Further literature review and research process roadmap

After primary and secondary data are obtained and analysed, results will be compared with known findings in literature. Explanations are offered to account for deviations. The various processes in this study are presented in the figure 3.1 adopted from Zikmund (1997, p.44).

3.3.7 Case study

To supplement what has been proposed as a possible solution (partnering) in improving the adversarial nature of the construction industry, the researcher spent three months (November 2001 to January 2002) under a full time industrial attachment to see how partnering is practised in a local non-government organisation in the construction of a 10 kilometre underground subway system.

3.4 Summary

This Chapter discussed the method and design of the research. It included the type of research, the different methodologies (qualitative and quantitative) and some views of scholars on the 2 methods. A positivist approach to the research was adopted for data collection and analysis. It also discussed the survey methods, respondents and research process and concluded that at different stages of the research, qualitative or quantitative methods could be used.

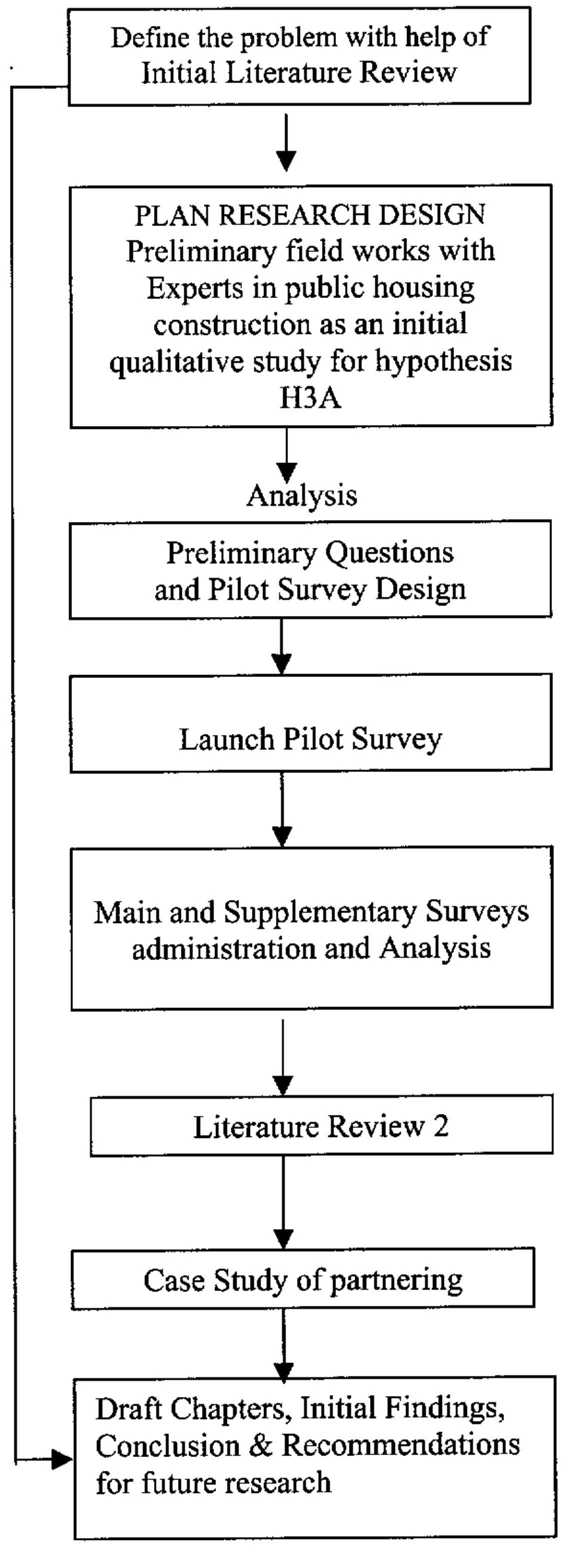

Figure 3.1 – Phases of the research process, adapted from Zikmund (1997, p.44)

CHAPTER FOUR

4. PROFITABILITY OF HONG KONG CONSTRUCTION INDUSTRY

Chapter Four explains the calculation of the profitability of the local construction industry through share prices. Other indicators of profitability and competition of the public housing construction industry are shown. There is then explanation on how competition, ease of entry and economic rent might affect the profitability of an industry.

4.1 Calculation of BETA for construction contractors in Hong Kong

Table E1a in Appendix E1 indicates the beta of the 69 categories of non-construction companies covering 581 firms listed on the Stock Exchange of Hong Kong at June 2000. For the construction industry, there were 27 companies as shown in Table E1c in Appendix E1. Total number of companies is 608. Table 4.1 gives a summary of the various categories of listed companies. In 8 categories, there were no listed companies in Hong Kong at that time and hence some of the columns in Appendix E1 are blank. From Table E1b in Appendix E1, the mean beta of the 69 categories of non-construction companies is 0.735. For the construction contractors, the mean beta is 0.740 as shown in Table E1c in Appendix E1.

The sampling method adopted can be classified as convenience sampling since data on companies are got readily from stocks of listed firms (Galloway, 1997). Convenience sampling is often used in exploratory research where the researcher is interested in getting an inexpensive approximation of the truth (StatPac Inc., 2004) whether risk premium of stocks of construction contractors is higher than stocks of non-construction business. With convenience sampling, there is no randomness and the likelihood of bias is high and results might be non-generalisable (Hancock, 2001). However this method is the only feasible one as it is not easy to get data of non-listed (private) companies and particularly with restricted time and resources, it can legitimately be used provided its limitations are clearly understood and stated (Galloway, 1997).

Table 4.1 Categories of Listed Companies in Hong Kong

Company Category	No. of Companies	Company Category	No. of Companies
AEROSPACE	1	INTERNET	4
AIRLINES & AIRPORTS	6	INVESTMENT BANKS	2
ASSET MANAGERS	5	INVESTMENT HOUSE	16
AUTOPARTS	1	LEISURE FACILITIES	7
AUTOMOBILE	1	LEISURE EQUIPMENT	6
BANKS	14	MEDIA AGENCIES	1
BUILDING MATERIALS	15	MEDICAL EQUIP + SUPPLIES	3
BROADCASTING	4	OTHER MINING	0
BREWER	3	OTHER FINANCIAL	2
CHEMICALS, COMMODITY	8	MORTGAGE FINANCE	1
CHEMS.ADVANCED MATS.	7	RETAILERS, MULTI DEPT	6
CLOTHING + FOOTWEAR	28	NON-FERROUS METALS	6
COMPUTER SERVICES	3	OIL + GAS EXPL/PROD.	2
CONSUMER FINANCE	2	OIL INTEGRATED	1
COMMERCIAL VEHICLES	0	OTHER HEALTH CARE	1
COMPUTER HARDWARE	5	OTHER INSURANCE	0
DISTRIB. IND. COMPS.	4	PAPER	3
DISTILLERS + VINTNERS	1	PACKAGING	2
DIVERSIFIED INDUSTRY	21	PHARMACEUTICALS	4
OTHER DISTRIBUTORS	10	PHOTOGRAPHY	1
VEHICLE DISTRIBUTION	2	PERSONAL PRODUCTS	0
EDUCATION + TRAINING	1	PROPERTY AGENCIES	1
ELECTRICITY	3	PUBLISHING + PRINTING	14
ELECTRICAL EQUIPMENT	12	REINSURANCE	0
ELECTRONIC EQUIPMENT	50	RESTAURANTS AND PUBS	7

ENG. CONTRACTORS	5	REAL ESTATE DEV.	108
ENGINEERING, GENERAL	9	RAIL, ROAD, FREIGHT	12
RETAILERS E-COMMERCE	1	SEMICONDUCTORS	1
FOOD PROCESSORS	12	SHIPPING AND PORTS	11
FOOD + DRUG RETAILERS	3	SOFT DRINKS	1
FARMING AND FISHING	2	RETAILERS, SOFT GOODS	0
FORESTRY	1	SOFTWARE	3
FURN. + FLOORCOVERING	6	STEEL	6
GAS DISTRIBUTION	1	TELECOM EQUIPMENT	13
HSEHOLD APPS+HSEWARES	17	TELECOM FIXLINE	2
RETAIL, HARDLINES	19	TELECOM WIRELESS	6
HOME ENTERTAINMENT	0	TEXTILES+LEATHER GDS	28
HOTELS	16	WATER	0
INSURANCE BROKERS	1		
Total number of listed non-construction companies is 581 in June 2000.			

Total number of listed **CONSTRUCTION** contractors in June 2000	27

4.1.1 Hypothesis H1

Hypothesis H1: It is hypothesised that investors require higher risk premium from stocks of construction contractors than from stocks of non-construction business. However it has been tested empirically as non-directional since there is not a bulk of research and accepted theory to support that the risk premium of stocks of construction contractors is higher than risk premium of stock of non-construction business (Decker, 1997; Newlin, 2004).

Definition: μ_1 = Mean Beta (Construction Contractors)

μ_2 = Mean Beta (Non-Construction Business)

Null Hypothesis $H1_0$ $\mu_1 = \mu_2$

Alternative Hypothesis $H1_A$ $\mu_1 \neq \mu_2$

An independent samples t-test was used to test the hypothesis. The non-construction business in Hong Kong was the 581 companies shown in Table E1b in Appendix E. The construction contractors in Hong Kong were the 27 listed companies shown in Table E1c in Appendix E.

From test results in Appendix E3, the mean beta of construction contractors is not significantly greater than the mean beta of non-construction business. As the sample size of construction contractors is 27, a non-parametric test for the mean beta of the 2 independent samples should theoretically be more appropriate to deal with small samples size below 30 (Levin, 1999). The results of the non-parametric test as shown in Appendix E3 is the same as that for the t-tests.

Table 4.2 shows that the mean beta of construction industry stocks of Australia and United States are also below its respective market return which is assumed as 1 (Shah *et al.*, 1997). In other words, volatility of construction industry stock is not higher than market. The possible reasons for this can be explained by the fact that the construction industry is an industry which is relatively easy to enter due to advance payments by client (Sozen and Kucuk, 1999; Richter and Mitchell, 1982). Contractors could also rely on interim payments to finance the projects (Chiang *et al.*, 2002).

Table 4.2 Mean Beta of Construction Industry Stock in 4 Countries

Country Code	Mean Beta	Number	Standard Division	Minimum	Maximum
Australia	0.7879	30	.2066	0.24	1.13
Hong Kong	0.7356	27	.2200	0.31	1.36
Singapore	1.0935	46	.3632	0.07	1.73
USA	0.5984	81	.2608	0.03	1.12

(Figures from Thomson Financial (2000))

4.1.2 Hypothesis H2A

Hypothesis H2A - It is hypothesised that the risk premium from stocks of listed construction contractors majoring in public housing construction should be lower than stocks of listed construction contractors majoring in non-public housing construction. However, H2A has been tested empirically as a non-directional hypothesis since there is not a bulk of research and accepted theory to support that the risk premium of stocks of listed construction contractors majoring in public housing construction should be lower than stocks of listed construction contractors majoring in non-public housing construction (Decker, 1997; Newlin, 2004).

Definition: μ_3 = Mean Beta (Public housing contractors)

μ_4 = Mean Beta (Non-public housing contractors)

Null Hypothesis	$H2A_0$	$\mu_3 = \mu_4$
Alternative Hypothesis	$H2A_A$	$\mu_3 \neq \mu_4$

The listed construction contractors are separated into 2 groups – public housing and non-public housing. Because of the small number of samples (below 30), non-parametric tests were carried out (Levin, 1999) and the results in Appendix E4a indicated that the test was not significant or beta of construction contractors majoring in public housing is not significantly different from beta of construction contractors majoring in non-public housing construction.

The implication from this test is that business risks of public housing construction contractors are not significantly different from construction contractors majoring in non-public housing construction. The possible reasons can be explained by previous study carried out by Chiang *et al.* (2001) on the market structure of the local construction industry. In Chiang's study, in terms of market concentrations, the local private building sector is the most competitive. Unlike the public building (public housing and non-residential public buildings) and civil engineering sectors, there is no dominant construction contractor in the private building sector. These contractors resort to cost competition. Their construction methods are traditional and labour intensive. Most private buildings are typically designed so as to optimise site coverage. Very often, labour-intensive construction methods are the least costly (CIDB, 1991). Subsequently profit margins are razor thin, and are only squeezed through the exploitation of lower layer subcontractors. Competitiveness based on cost reduction is not sustainable, as it creates no enduring competitive edge. Indigenous small local contractors dominate in this market (Chiang *et al.*, 2001).

Market concentration in the public building market is less than in the private sector, primarily because of technology demand. As the major client in this market, the Hong Kong Housing Authority has long required the use of prefabrication, standardisation and modularisation in public housing construction. Originally intended to improve concrete quality, such measures have incidentally worked to raise the technology of their contractors (Ganesan *et al.*, 1966). Barriers to entry were raised and contractors have since then competed on technology as well as on cost. In the civil engineering sector, especially for complex tunnelling and bridge projects, the technology gap would be too wide for local indigenous contractors to close and competition is less severe when compared with private or public buildings (Chiang *et al.*, 2001).

4.1.3 Calculation of other profitability indicators - hypotheses H2B & H2C

Other indicator on the stock performance (price/earning P/E ratios) was also calculated as shown in Appendix E2. It can be seen that mean P/E of construction industry stocks fluctuates over the 5-year period (1996 to 2000) with highest values as 68 in 1999 and 9.4 in 1996.

Hypotheses H2B and H2C are put forward to verify whether there is any significant difference in the mean P/E and mean share price of the stocks of construction contractors majoring in public housing construction and construction contractors majoring in non-public housing construction. For the same reason in Section 4.1.2, H2B and H2C have been tested empirically as non-directional hypotheses. Moreover, due to the small number of samples, non-parametric test for 2 independent samples to test the mean is used (Levin, 1999).

For hypothesis H2B

Definition: μ_5 = Mean P/E (Public housing contractors)

μ_6 = Mean P/E (Non-public housing contractors)

Null Hypothesis	$H2B_0$	$\mu_5 = \mu_6$
Alternative Hypothesis	$H2B_A$	$\mu_5 \neq \mu_6$

For hypothesis H2C

Definition: μ_7 = Mean Share price (Public housing contractors)

μ_8 = Mean Share price (Non-public housing contractors)

Null Hypothesis	$H2C_0$	$\mu_7 = \mu_8$
Alternative Hypothesis	$H2C_A$	$\mu_7 \neq \mu_8$

From Appendices E4b, E4c, the test results are not significant with p values larger than 0.05 except in year 1999 mean P/E comparison when a p value of 0.036 was found. This exception occurred in only 1 year out of 5 years and could be due to outliers and is discarded (Garson, 2004). The general trend is still not significant and the null hypotheses H2Bo and H2Co were accepted.

The implication from this is the mean P/E of the stocks of construction contractors majoring in public housing construction is not significantly different to the mean P/E of the stocks of construction contractors majoring in non-public housing construction. Also mean share price of the contractors majoring in public housing construction is not significantly different to the mean share price of the contractors majoring in non-public housing construction.

Some possible reasons have been given in section 4.1.2 to explain the insignificant difference in beta between public housing contractors and non-public housing contractors. The same reason can also be used to explain the insignificant difference in P/E and share price between public housing contractors and non-public housing contractors.

The number of listed construction contractors is 27 at June 2000 and most of them actually diversified into other business such as property development, civil engineering contracting and building materials sale. As the beta, P/E and the share price of public housing and non-public housing contractors are not significantly different, it is essential to look at other indicators by separating the turnover in public housing construction from other turnover of the contractors. The extent of competition in the public housing construction market can also be reflected from the number of tenders available for bidding and the number of tenderers.

4.2 Summary of results of the tests for hypotheses H1, H2A, H2B and H2C

Table 4.3 provides a summary of the tests for hypotheses H1, H2A, H2B and H2C. It can be seen that the p values are larger than 0.05 and the null hypothesis is accepted (except P/E calculation for Hypothesis H2B for year 1999 which occurred in only 1 year out of 5 years and could be due to data outliers and is discarded (Garson, 2004)). In other words, the beta of the construction industry stocks in Hong Kong in period 1996-2000 was not significantly different from non-construction business. Also the mean beta, P/E and share price of stocks of contractors majoring in public housing construction were not significantly different from the mean beta, P/E and share price of the stocks of contractors majoring in non-public housing construction.

Table 4.3 Summary of tests results for hypotheses H1, H2A, H2B and H2C

Hypothesis	Period	p – 2 tail significance (0.05)		Results
H1	1996	0.894	ns	Null Hypothesis accepted
	Same p-value of 0.894 for 1997 to 2000 Null Hypothesis accepted			
H2A	1996	0.820	ns	Null Hypothesis accepted
	Same p-value of 0.820 for 1997 to 2000 Null Hypothesis accepted			
H2B	1996	0.364	ns	Null Hypothesis accepted
	1997	0.075	ns	Null Hypothesis accepted
	1998	0.476	ns	Null Hypothesis accepted
	1999	0.036	s	Null Hypothesis rejected
	2000	0.181	ns	Null Hypothesis accepted
H2C	1996	0.096	ns	Null Hypothesis accepted
	1997	0.212	ns	Null Hypothesis accepted
	1998	0.223	ns	Null Hypothesis accepted
	1999	0.847	ns	Null Hypothesis accepted
	2000	0.871	ns	Null Hypothesis accepted

Note: The p values in Appendices E4a-E4c are listed as (2*(1-tailed Sig)) and reflects the two-tailed probability that the two samples offer (Garson, 2004).

4.3 Profit percentage of sales (POS) of public housing contractors

The results from the beta, P/E and share price comparisons indicated that the profitability of the public housing construction contractors in Hong Kong is not significantly different from non-public housing contractors. To provide further information regarding profitability in this industry, the profit of the contractor as a percentage of turnover was calculated from information in company reports of the few listed public housing construction contractors. Here due to incomplete data, it is only possible to look into results from eight of the public housing construction contractors. Here the requirements are that the contractor should derive more than 50% of its business turnover from public housing construction. Return from civil engineering or trading is excluded. The profits were pre-tax value.

From Table 4.4, it could be seen that the average POS (except for one or two extraordinary performers in a particular year) is in the order of 2 to 3 %. This observation is in line with that noted by previous research in other countries (Leitch, 1998; Akintoye and Skitmore, 1991; Dow Jones, 2000a).

Table 4.4 Percentage profits on turnover of public housing contractors

Name of Contractor	Percentage profit (before tax) on turnover (buildings only)				
	1999/98	1998/97	1997/96	1996/95	1995/94
Chevalier Construction	-0.8%	2.1%	1.2%	2.6%	N/A
Chun Wo Holding.	1.4%	3.0%	3.1%	3.9%	4.0%
Hsin Chong Construction	1.2%	2.8%	2.2%	0.6%	4.5%
Paul Y-ITC Construction	-11.4%	2.6%	6.4%	7.1%	8.7%
Shui On Construction	6.3%	3.5%	15.7%	8.8%	+
Wai Kee Holdings	2.8%	2.1%	*	*	*
Yau Lee	-2.6%	1.4%	2.3%	1.8%	1.8%
King Pacific (Yiu Wing)	-1.7%	0.6%	0.7%	0.3%	1.9%

(Figures from Primark Extel 2000)

* Wai Kee started building for HA under its subsidiary in 1997.

+ Data not available in 1994/95.

Whilst building construction POS is low, civil engineering works, which require higher technology should have a relatively higher POS, due to less keen competition (Chiang *et al.*, 2001). From available data, the POS of four of the public housing construction contractors in respect of civil engineering works undertaken by its subsidiaries were evaluated in Table 4.5. It appears that POS for civil engineering works might in general be better than public housing construction. Therefore contractors tend to diversify into areas where technology plays a more important role, resulting in less competition. As barrier to entry is higher, a better POS will occur (Chiang *et al.*, 2001).

Table 4.5 Percentage profits on turnover of civil works

Name of Contractor	Percentage profit (before tax) on turnover (civil engineering works only)				
	1999/98	1998/97	1997/96	1996/95	1995/94
Chevalier Construction	-21.7%	-22.6%	-0.9%	0.7%	
Hsin Chong Foundation	0.9%	3.7%	15.5%	13.8%	5.4%
UDL Holdings (marine works)		-11.8%	4.9%	3.1%	6.3%
Wai Kee Holdings (civil eng.)			7.1%	3.9%	3.4%

(Figures from Primark Extel 2000)

In the literature review a number of previous researches suggested that keen competition (Akintoye and Skitmore, 1991; Hillebrandt *et al.,* 1995) had resulted in fluctuating workload of construction contractors, and subcontracting has provided the flexibility to tackle this. A review of the number of public housing contractors and the number of contracts awarded in the past few years might give some indication of the extent of competition. From Appendix F, at year 2000, there were 25 public housing contractor classified under NW1 (for contracts limited to HK$450 million) and 27 contractors classified under NW2 (for contracts with unlimited value.). Number of contractors under percussive piling was 10 and for large diameter bored piles 7. For every project, there is a foundation contract to be tendered by 10 or 7 firms only, depending on the construction methods used. However there would be 25 contractors bidding for the superstructure contract (for project under HK$450 million) or 27 contractors bidding for the superstructure contract (for projects above HK$450 million). It would appear that the competition of the public housing superstructure construction is very keen, when compared with the foundation work for the same project.

When compared with another group of Hong Kong Housing Authority contractors, the number of registered lift and escalator contractors is only 12. These contractors enjoy a least concentrated market. Modern day high-speed lifts in high-rise public housing blocks require sophisticated technology. The lift contractors will also automatically be engaged to maintain the lifts after the installation without the need for further tender. Price for lift maintenance is through negotiation between the Hong Kong Housing Authority and the Lift Contractors' Association through an agreed formula using labour wages of lift mechanics and material index derived from materials used in lift maintenance.

Table 4.6 Tender schedule for public housing projects in year 2000

	Project Ref.	Eligibility	No. of flats	No. of Blocks	Tender Date
1	KL52NR	NW1	758	1	Mar 2000
2	TW20RH	NW1	800	2	Mar 2000
3	HK11NH	NW2	1630	5	Jan 2000
4	TKO9NR	NW2	1273	2	Feb 2000
5	TKO9NR	NW2	1518	2	Jan 2000
6	KL29RH	NW2	720	2	Jan 2000
7	IS03NH	NW2	2000	5	Jan 2000
8	TW16RR	NW2	349	1	Jan 2000
9	KL23RR	NW2	1826	3	Feb 2000
10	IS03NH	NW2	1600	4	Mar 2000
11	IS03NR	NW2	2742	4	Mar 2000
12	TW26NH	NW2	2516	4	Mar 2000
13	TK07NR	NW2	208	1	Mar 2000
14	FL13NR	NW2	3127	5	Apr 2000
15	KL28NR	NW2	180	1	May 2000
		Total	21247		

(Source the Hong Kong Housing Authority)

A review of the tender schedule in Table 4.6 of public housing superstructure construction will shed some further information on the extent of competition in the superstructure construction contract. There were 15 tenders in the first half of year 2000, 2 for contractors under NW1 and 13 for NW2. If the contracts are spread evenly, there is only 0.08 contract for NW1 contractors and 0.48 contract for NW2 contractors. With a project cycle of 30 months, and assuming similar number of projects are tendered out, a contractor might get about 1 contract each year. As contracts will never be awarded evenly but only to the lowest bidder and in order to survive, cut-throat bid was submitted.

Recently the amount of work tendered out dropped further due to the decline in the private property market. Public housing and the home-ownership scheme flats are blamed for creating a skewed market when private residential property prices have dropped in the last two years to an affordable level.

Table 4.7 Tender schedule for public housing projects Sept. 2001 - Aug. 2002

	Project Ref.	Eligibility	No. of flats	No. of Blocks	Tender Date
1	HK25RR	NW2	2875	5	Sep-2001
2	YL10NH	NW2	640	2	Sep-2001
3	IS03NR	NW2	2782	4	Oct-2001
4	TW18RR	NW2	1918	3	Oct-2001
5	YL26NR	NW1	2688	4	Oct-2001
6	FL13NR	NW2	3167	5	Nov-2001
7	ST32NR	NW1	799	1	Dec-2001
8	TW20RR	NW2	4515	7	Dec-2001
9	KL77NH	NW2	2400	6	Jan-2002
10	KL30RT	NW2	2730	5	Jan-2002
11	FL13NR	NW2	3167	5	Mar-2002
12	YL26NR	NW1	2688	4	Apr.-2002
13	FL13NR	NW1	1598	2	Apr-2002
14	FL13NR&NT	NW2	2 238	3	Apr-2002
15	HK25RR&H	NW2	2 398	5	Apr-2002
16	TW19NR	NW2	340	1	Apr-2002
17	IS03NR	NW2	2 782	4	Apr-2002
18	ST33NH	NW2	2 500	7	Jun-2002
19	KL48RR	NW2	2 033	2	Jul-2002
20	KL77	NW2	800	2	Aug-2002
		Total	33107		

(Source the Hong Kong Housing Authority)

From recent notice published by the Hong Kong Housing Authority, the number of public housing projects put out for tender for period Sept. 2001 to August 2002 are in Table 4.7. There are 20 tenders for one year compared with 15 tenders in an 6-month period in early 2000.

The simple analysis above supported the belief public housing superstructure construction is a very competitive business and return of construction contractors is relatively low. Section 4.4 below gives possible explanation on how competition has affected profitability of the construction industry.

4.4 Profitability of an industry as related to competition

Bain (1968) and Scherer (1972) established that the degree of competition in an industry is judged in relation to notions of perfect competition and monopoly. Cook (2001) argued that the performance of an industry, largely measured in terms of profitability, varies with different degrees of market structure, conduct and performance and that there are clear causal links between them. He further proposed developments of the market structure, conduct and performance widen the list of features accounting for market structure and performance, including consideration of efficiency factors and technological progress.

Economic theories further suggest that the easiness of entry and exit to a market is a central determinant of the market structure and performance (Chiang *et al.*, 2001). Stigler (1968) identified the entry barrier as a cost that must be borne by a new entrant to a particular market, but existing firms do not have to incur. It is this kind of cost that keeps the profits of the incumbents from falling to competitive levels. An industrial sector that enables costless entry and exit of firms is described as a "perfectly contestable industry" (Baumol *et al.*, 1982, p.5).

Bain (1956) identified three major types of barrier to entry, including absolute cost advantage, economies of scale and product differentiation. A market with a stronger barrier to entry tends to be less competitive because it contains fewer players, and hence is more concentrated in structural form (Bain, 1956). Sozen (1999) argued that the construction industry is an industry which is relatively easy to enter because of advance payments made by the client. A majority of contracts also provide a payment item for mobilisation to ensure that the contractor will not have to rely exclusively on progress payments to finance work (Richter and Mitchell, 1982). This is true as far as the contracts used by the Hong Kong Housing Authority which include a term "Preliminaries" to account for part of the cost for the initial site set-up.

Another key consideration that deters the new firm from entering into a profitable market is the cost of exit (Carlton and Perloff, 1990). If the potential entry is associated with a substantial loss in sunk cost by the new entrant in fixed asset investment, this may hamper the contestability of the industry, which contains fewer firms (Oster, 1999).

In addition, tendering theories suggest that demand and supply of construction projects, mark-up put in by construction contractors and accuracy of estimates might affect the chance of construction contractors to secure contracts, and its profitability (Runeson and Skitmore, 1999).

Burt (1983) looked at the way a business's autonomy is shaped by the existence of three factors - competitors, suppliers and customers. He noted that the more "structural autonomy" a company has in relation to these three types of factors, the higher its profit or, more precisely, profits tend to increase when there are few competitors but many suppliers and customers. For the competition experienced in the local public housing construction industry, there are substantial number of contractors and only one customer – the Hong Kong Housing Authority.

Chiang *et al.* (2001) in their study, identified three types of Government listed construction contractors in Hong Kong. First, "local" contractors refer to the indigenous local contractors who first started their business locally. Second, "foreign" contractors are those contractors that were previously included as the public List II contractors (eligible for contract value exceeding HK$30 million only). They are contractors who were once defined to be those "whose main presence and head office is outside Hong Kong", as defined by The Rules for Administration of Approved Contractors for Public Works (Government Gazette, 1992). They were then admitted to the list because of their performance outside Hong Kong. Finally, "localised foreign" contractors had their initial origins outside Hong Kong, but have since their first arrival established their main presence and local head offices in the territory.

Chiang *et al.* (2001) examined the market structure of four different sectors within the construction industry in Hong Kong, and showed the following ascending order of market concentrations: private building, public building, property development, and civil engineering. Their study argued that technological and capital requirements have imposed a strong barrier to entry into the civil engineering sector, resulting in a concentrated market. Conversely, the lack of technological demand and supply in the private building sector has led to easy market entry and exit. Construction contractors thus compete intensely on cost reduction rather than technology improvement, leading to poor construction safety and product quality. Previous studies by Johnson (1968), Tatum (1986) and Raftery *et al.* (1998) also illustrated the important role of technology in creating and sustaining the competitive advantages of civil engineering contractors.

Thus Chiang *et al.* (2001) recommended that the Hong Kong Special Administrative Region Government, being a major client of construction works and regulator of the industry, could assume a more active role in promoting the overall competitiveness of indigenous local contractors as their main business lies in the private building and public building sectors.

The sections below relate predictions on the variation of profitability of the industry with the various factors: mark-up with supply and demand, ease of entry and economic rents that could be earned by construction contractors.

4.4.1 Mark-up in relation to supply and demand of construction works and competition

One of the characteristics of the construction markets is rapid substantial change in demand (Low and Tan, 1996). For the industry as a whole, these changes may be 10% or more per year, and for individual markets, they may be even more substantial, sometimes reaching 50% or more in a year and these changes may be prolonged over several years (Runeson and Skitmore, 1999).

Construction contractors' mark-ups are not constant but change in response to changes in demand (Andrews and Brunner, 1975). Grinyer and Whittaker (1973), Gaver and Zimmerman (1977), Beeston (1982), Upson (1987), Skitmore *et al.* (1990), Harding (1992), and Shash and Abdul-Hadi (1992) all found that market conditions are an important determinant of mark-up strategy.

A study by Chan *et al.* (1996) covering all of a firm's projects over three decades also found a highly significant relationship between market conditions and actual profits on individual projects. The differences were far greater (± 26% to +35%) than anything that could be attributed to the numbers of tenderers or competitors alone, and the most likely factor were differences in mark-up strategy during different phases of the business cycle. Thus when demand drops or amount of work is small, contractors have to reduce its mark-up. It should also be noted that some of the price movements caused by rapid changes in demand are absorbed by changes in quality (Niss, 1965; Rajab, 1981).

To cater for changes in demand, the construction markets are characterised by projects where the short-term price elasticity of supply is lower than the long run elasticity (Ball *et al.*, 2000). This is because supply for the construction industry is to a varying degree dedicated to construction or its sub-sectors, so it takes time to increase or decrease its supply in response to change in demand. Such is seen mostly in the skills of the labour force, in the equipment needed to make building materials, supply of material and in construction-related plant (Ball *et al.*, 2000). The same factors apply also to contractors who have to build up its competence in the industry, and to have organisational structures and staff capable of tendering for and managing, often large construction projects, so that its ability to adjust productive capacity is greater in the long run (Chiang *et al.*, 2001).

The implication of this assumption is that construction prices (i.e. the cost of a construction project to the client) will rise and fall, with lags, in relation to changes in demand (Ball *et al.*, 2000). Suppliers of increasingly scarce resource are able to raise prices during upturns in demand but face falling prices during reduced demand (Greblyov *et al.*, 1999). Construction supply cannot immediately increase when demand rises because of the need to acquire some construction attributes/skills. Suppliers exit construction only slowly during reduced demand as there is a medium-term advantage in staying, given the sunk cost investment in construction-dedicated skills, but once gone, few could return because of skills atrophy and the costs of re-entry.

As proposed by Ball *et al.* (2000), to cater for the fluctuation in demand, mark-up of contractors has to be adjusted to take into account the workload of the industry, as well as the supply of material and labour. What that means is that in situation of reduced workload, contractors have to reduce mark-up to get jobs as price from suppliers might not fall concurrently. On the other hand, when workload surges, supply of material and labour may not increase in time and contractors might have to pay higher price to secure material and labour. In either case whether there is increase or reduction in workload, a mark-up strategy is essential to survive, and it is also for this reason there is substantial cases of cut-throat tenders resulting in poor quality of the end products (Moy and Tse, 1999; Niss, 1965; Rajab, 1981).

As far as competition between contractors, the competitive hypothesis implies that prices in various construction markets follow a similar pattern and the intensity of price competition between contractors has been blamed for many industry ills, particularly in scenarios where price considerations have been deemed paramount (Kumaraswamy and Palaneeswaran, 2000). Theoretically, firms will enter any market where there seems to be higher returns than elsewhere and through this process, risk-weighted returns in each sector of the construction industry will tend to be similar. As each sector of the construction market requires broadly similar inputs, although those inputs are still construction specific, prices should be determined by the total demand for all sectors across the industry rather than in one sector alone. Construction prices in individual markets, therefore, are a function of total demand rather than of demand in the particular sector itself (Ball *et al.*, 2000). Yet, because of the need for specific skills for a particular sector of the construction industry, construction prices still depend on the overall level of supply and demand within the particular sector of the construction industry (Andrews and Brunner, 1975).

4.4.2 Ease of entry and exit in construction markets

According to Ball *et al.* (2000), construction firms specialise in particular activities, according to location, the size of projects and the type of work undertaken. Only large firms can raise the financial resources necessary to undertake large projects. Teams dedicated to office building cannot be switched easily to civil engineering work (Runeson and Skitmore, 1999). Firms specialise on a regional basis and such specialisation generates benefits to a degree, but clients are always tempted to take a lower price from a firm that might be marginally less competent, either because it is a new entrant to the sector or because a competitor is switching resources to it above the optimal level (Ball *et al.*, 2000). Therefore freedom of entry is substantial – although clients may be subject to greater project risk with new entrants, cost advantages may easily outweigh this.

4.4.3. Construction firms have few means of earning economic rent

The modern construction firms have only limited plant and equipment (most is hired) and employ relatively few manual workers directly (Ball *et al.*, 2000). In fact, for most construction projects the construction firm is not the main contractor but the construction manager only (Madigan, 1997) – under various forms of contractual relation (project manager, fee, management contracting, etc.).

Even in design and build schemes when construction firms are the construction contractor, they are in practice the project and construction manager only, subcontracting most of the design and execution tasks (Madigan, 1997). The evolution to this state of affairs has enabled firms both to focus upon the activities where they have the greatest competitive advantage and to increase their financial flexibility (Ball *et al.*, 2000). However, at the same time it means that construction contractors have few chances to earn economic rent (defined as the surplus profit and payment over the normal rate of return that is required to attract capital into a particular occupation and is a return above the opportunity cost of an asset or service) (Carew, 2002).

Another common usage of economic rent in the management literature is to term it "added value" (Kay, 1996). Why should construction contractors have little opportunity to earn economic rent? There are several ways in which economic rent can be earned by firms, and they all imply the temporary or permanent existence of monopoly (Central Oklahoma Clearing House Association, 2002). Few, however, seem to have much effects in construction.

Firms may earn economic rent through innovation, by developing a new product, production method or marketing technique (Chaires, 2000). Competitors may take some time to catch up with the innovation, or patents may extend considerably the advantage accruing to the innovator (Ball, 1988. Initial innovators are not usually the ones to succeed, but rather the second round ones learning from the pitfalls of the first (Rosenberg, 1994). It is difficult to see that many construction firms could benefit from this form of economic rent on more than a temporary basis. They do not innovate in construction techniques, but rather apply innovations developed elsewhere by materials and plant producers and by construction related professions, especially engineers (Ball, 1988; Hillebrandt and Cannon, 1990; Hagedoorn, 1993). If they innovate in the organisation and management of production, competitors are in a position to pick up the technique quickly, as they imply neither re-tooling nor new marketing and distribution strategies as would be common, for example, in many manufacturing industries.

One area where economic rent in innovation is possible, for example, is in the supply-and-fixing of proprietary building materials: e.g. cladding and roofing systems (Akel *et al.*, 2001). Their patents do protect the construction firm, and reputation may sustain a long-term advantage. However, these aspects of construction are a small part of the whole.

Another potential source of economic rent is in marketing and this may take the form of a brand name or extensive marketing / distribution / sales networks (Kristensen and Zeitlin, 2000). Although construction firms are unsurprisingly keen on their reputation as an indicator of competence, brand names have little credence with construction clients, and construction firms do not have substantial fixed costs in marketing and sales (Kristensen and Zeitlin, 2000). New packaging of traditional construction and related activities are a partial exception and the explosion of facilities management over the past years is another case in question. Again, however, the ability to sustain such a competitive edge is likely to be short-lived (Lizieri *et al.*, 2001).

Attracting and keeping the best available skilled team is another potential source of economic rent. Whenever there is a shortage of highly skilled individuals, there is rapid escalation of salaries (Darrow, 1996). Construction management, however, is a less scarce, though still a highly skilled activity, and firms can hire and fire from the available pool of construction managers (Ball *et al.*, 2000). It is difficult to see the benefit of keeping the best team.

The classic source of economic rent is monopoly. The monopoly may arise through collusion or through some natural characteristic, which means that the largest producer is also the cheapest cost per unit producer (Cook, 2001). Monopolies have been found to exist in construction in the past, and some governments explicitly favour particular firms over others, either for corrupt reasons or because of "national leader" style strategies (Cook, 2001). None of them, however, has much relevance to the contemporary local situation in

Hong Kong, which has been a free and open market for foreign construction contractors (Works Branch, 1997).

There are five potential situations where economic rent can be earned in the construction industry, arising from specific characteristics of the industry itself (Ball *et al.*, 2000) and is shown in (i) to (v) below.

(i) Market advantage can occur for two reasons. The first is preferential market access, where firms of a particular nationality gain preferential access to specific overseas construction markets (Linder, 1991). This, of course, is important only for firms that work overseas. The second is capital market inefficiencies. Larger firms may have an advantage over smaller ones in that they can raise the funding necessary for performance bonds and participate in built-and-operate private finance initiatives in ways that smaller firms cannot. The capital market inefficiency arises because banks, or the insurance market, may not be able to monitor contractor performance well enough, and so rely on size as a proxy for competence and solvency.

(ii) Structural change may be a source of temporary economic rent when innovations occur in the organisational framework of construction industry (Ball, 1988). Firms that spot or help to create those changes may gain some temporary financial advantage. Contracting, for example, switched away from the traditional form of main contracting to more modern forms of project management and management contracting in the United Kingdom during the late 1970s and early 1980s (Ball, 1988). Firms that recognised those changes first could gain a temporary advantage, though others quickly would contest the new terrain, and would do so with any future development in the organisation of the industry. A similar trend is noted in Hong Kong for the more prestigious airport core projects in the last decade.

(iii) An aspect of construction, which does generate quasi-economic rent, arises with the pricing consequences of the construction cycle. During increase in demand, construction inputs, including those provided by firms, become scarce and their providers gain premium rates, containing short run economic rents, until input supply improves or, more commonly, the cyclic upswing falters and the input shortage ends (Chaires, 2000).

(iv) Taxation factors may encourage some firms to invest in a mix of construction and non-construction assets such as real estate development. Such factors, however, are of more relevance to the largest construction firms than the medium size ones.

(v) Land purchase by speculative housebuilders may be another source of economic rents. A growing literature in the United States and the United Kingdom suggests that the housing market is not informationally efficient (Case and Schiller, 1989; Schiller, 1993). The same may well be true of the land market with builders and developers, which can result in mis-pricing. This can occur because land purchasers become unrealistically optimistic about the prospects of the housing market in general or the development in question. As a result, housebuilders' profits and losses may show systematic variation, depending on the prevalence of current or previous over-optimism. Another example exists when a developer has privileged information regarding a land site not known in the general marketplace.

The purchase of land is for its source of building materials or for other reasons such as due to the booming property market. In some situation, close access to building materials may earn economic rent above the cost of imports because of transportation costs and supply uncertainties.

The scenario in Hong Kong is that construction contractors diversify into property development, as they have the expertise in the construction process and construct the property directly. From company reports of listed construction contractors in Hong Kong, all of them have a portion of investment in real estate. In fact of the approximately 608 listed companies in Hong Kong, 108 are classified under real estate development.

4.5 Summary

From hypothesis H1, the mean beta of construction contractors' stocks in Hong Kong in period 1996-2000 was not significantly different from non-construction business. Also from hypotheses H2A, H2B and H2C, the mean beta, P/E and price of stocks of contractors majoring in public housing construction were not significantly different from that of contractors majoring in non-public housing construction. Other calculations of profitability using company reports and competition of the public housing construction business were also carried out. The implication from this Chapter is that the public housing construction industry is not a lucrative business due to the ease of entry and the number of competitors. This is aggravated by the fluctuating workload or jobs tendered out by the Hong Kong Housing Authority.

Construction contractors have little chance to earn economic rent and in search for survival, major construction contractors in Hong Kong have to diversify into building material, or as construction manager, or into property development (Chiang *et al.*, 2002). Innovations have also been limited in the public housing construction industry, and in any case, such new techniques are short lived (Crane, 2002). Hence the public housing construction industry in Hong Kong is still proliferated with low skill construction techniques.

CHAPTER FIVE

5. INITIAL QUALITATIVE STUDY

Chapter Five presents the initial qualitative study to obtain the data used as the basis for formulating the initial survey questions and this was obtained through interview and other secondary source. The researcher interviewed several persons with details in Section 5.1.1 There is description on how themes in qualitative data are extracted from interview and secondary data. Use of computer programme NUD*IST to assist with the analysis is discussed. The index tree so formed helps to relate the initial relationships of some of the constructs in the pilot survey.

5.1 Qualitative Study

The qualitative study covered interview and information from newspapers.

5.1.1 Qualitative Interview

The researcher interviewed:

(i) the Principal Partner of a local architectural practice who was carrying out a consultancy contract for a Housing Authority building project. This practice has been in operation in Hong Kong for over 100 years and provides service to public organisations and private firms.

(ii) the Director of a Hong Kong Housing Authority Building Contractor capable of carrying contracts of unlimited value (Cat. NW2) and its project manager. This Contractor is listed on the Hong Kong Stock Exchange. In recent years, its business diversifies into real estate development in addition to contracting. Its board of directors consisted of local Chinese businessmen.

(iii) one Senior engineer and one engineer employed by the Hong Kong Housing Authority. The Senior Engineer joined the Housing Authority in 1984 as an engineer and attained his current position in 1989. The Engineer joined the Housing Authority in 1988. Both are involved with the design and contract administration of new public housing construction contracts. They witnessed the changes in the organisation setup of the Housing Authority in the last decade.

The discussion was centred on their views of the recent scandals with housing projects (Chugani, 1999), problems with the Hong Kong Housing Authority – structure, bureaucracy and risks with the Hong Kong Housing Authority contracts. The views of two of the employees of the Hong Kong Housing Authority provided also some insight on the culture of the organisation, and how is this compared with views of outsiders.

The discussions were recorded in Appendix A. It could be classified as a form of unstructured interview and it is the most widely used method of data collection (Bernard, 1994). Researchers discussed informally and here was minimum control over the informant's response. This method is very versatile and is being used to learn what questions to include on a pilot survey (Bernard, 1994).

5.1.2 Newspaper cuttings

There are also some newspaper cuttings included in the qualitative study. Such was interview by Reporters on key figures in the local construction industry as well as comments from the industry on various happenings. Details of the newspaper cuttings are provided in Appendices B.

5.2 Qualitative data

The qualitative interview is the task of discovering themes from abstract, often fuzzy, constructs which investigators identify before, during, and after data collection. These come from reviewing the literature and from already-agreed-upon professional definitions, from local common-sense constructs, and from researchers' values, theoretical orientation, and personal experience with the subject matter (Bulmer, 1979; Strauss and Naomi, 1987; Maxwell, 1996).

One of the techniques for discovering themes is based on an analysis of words which include word repetitions, key-indigenous terms, and key-words-in contexts (Ryan and Bernard, 2001). These word-based techniques draw on a simple observation to understand what people are talking about by looking at the words they use.

Words that occur a lot are often seen as being salient in the minds of respondents. D'Andrade (1995) noted that "perhaps the simplest and most direct indication of schematic organisation in naturalistic discourse is the repetition of associative linkages". He observed that "indeed, anyone who has listened to long stretches of talk, whether generated by a friend, spouse, workmate, informant, or patient, knows how frequently people circle through the same network of ideas".

Word repetitions can be analysed formally and informally. In the informal mode, investigators simply read the text and note words or synonyms that people use a lot. These repetitions indicated to investigators that these ideas were important, recurring themes in the respondent's life. The relationships among these ideas can be displayed by writing the concepts on a page of paper and connecting them with lines and explanations. Computer programs let a researcher do this kind of connect-the-dots exercise by computer.

A more formal analysis of word frequencies can be done by generating a list of all the unique words in a text and counting the number of times each occurs. Computers can easily generate word-frequency lists from texts and are a quick and easy way to look for themes. This information is used as clues for themes that would be used later in actually coding the texts.

The researcher collects all kinds of secondary data about the research topic, its participants, and their environment. This qualitative data can be found in archives, which are secondary sources, as: libraries, correspondence, filed documents, transcribed interactions, news, court documents, preliminary interviews, open ended questions on surveys, etc. Researchers also collect primary data as interviews, field observations and systematic tools for analysing these data are required.

In the past decade, computers are used to analyse textual data. NUD*IST was one of the first programs that allowed researchers to use graphical interface for projects. NUD*IST remains one of the best-supported programs for qualitative research.

Themes in the qualitative texts are being identified. NUD*IST is used to sort and array these themes. NUD*IST also helps to organise the data, keep track of documents, and finally interacts with the data on-line. NUD*IST is not only an efficient organising tool, it arrays the materials so that the themes could be seen in new ways. Documents are entered onto the computer programme. Coding is the main point and patterns were identified, and unstructured data can introduce a framework called in NUD*IST, a "tree".

5.3 NUD*IST 4 programme

Qualitative research uses a range of ways of discovering and exploring the meanings of unstructured data and to see patterns and explanations. It thus requires a combination of very different skills (Richards, 1998, p.11) for:

- efficient management of data;
- detailed knowledge and sensitive exploration;
- ability to create abstractions, sees patterns and interrogate emerging patterns.

"NUD*IST 4" by Qualitative Solutions and Research Pty. Ltd. (QSR) was used to analyse the collected information. QSR NUD*IST 4 is designed to allow researchers to manage data efficiently, but stay close to the data whilst gaining distance necessary for analysis (Richards, 1998, p.11). It offers tools for managing documents, creating ideas and managing categories and asking questions and building and testing theories about the data. These tools are interlinked, and move between the data and thinking about it is allowed.

5.4 Nodes, coding, text units and index system

According to Richards (1998), nodes are the containers for the researcher's thinking about the data, places to keep emerging ideas and their links with data. The index system can contain any number of nodes, at which one can do any amount of coding of documents and storing of ideas. Nodes are also the way the researcher asks many qualitative questions, about the intertwining of themes, or the occurrences of patterns. These are asked through the Text and Index Search tools, and nodes are the way the researcher identifies the text to be searched or restrictions to be placed on the search. Nodes are also the results of the questions the researcher asks; when searching. NUD*IST 4 saves the answer as a node for the researcher to continue to ask another question.

A node is described by its title, location and definition. Title and location is a must, but definition is optional. When a node is created it is given a title by the researcher or by NUD*IST 4. Each node in the Index Tree is given a hierarchical title to represent where it is.

5.5 Preliminary observation

The content of the interview and the information noted in the newspaper clippings were scanned initially by the researcher. The following preliminary views were observed:

- Keen competition (approaching cut-throat) in the public housing construction industry, high risk business;
- Low profit margin that could not cover all the unforeseeable and predictable risks, resulting in opportunistic behaviour and possibly corruption;
- Under the quality umbrella, both the Hong Kong Housing Authority staff and its contractors are subject to compliance with procedures stipulated by ISO9000. The amount of paper work is great, leaving not much time for the Hong Kong Housing Authority staff to check workmanship;
- The Housing Department is a big Government organisation with over 10 000 employees. Rules and procedures are too numerous to mention. Every staff has to abide by rules, and the organisation lacks the flexibility required in a modern business like public organisation that emphasis efficiency, customer care and customer satisfaction. Bureaucracy do exists in the Hong Kong Housing Authority and the Housing Department, and is not getting better;
- Culture in the Hong Kong construction industry that ignores quality, but just for a quick return;

- High proportion of middle men as subcontractors (or actually is just a broker) and lack of ethics resulting in numerous scandals and corruption;
- Recent down turn in economy and privatisation of housing estates management affects morale of the Hong Kong Housing Authority staff. Partnering spirit with contractors no longer exists;
- Stringent terms of contract imposed on contractors.

5.6 Nodes and index tree formed from the interview

The text-search key words adopted from the preliminary observations were: "Paperwork, ISO9000, Performance, Corruption, Lowest Tender, Margin and Subcontract". The number of documents included in the analysis is 10; comprising 3 interview scripts, 6 newspaper cuttings and 1 speech. All these were searched using one of the seven key words each time and number of occurrence of each of the key words in all the documents and the associated number of text units involved were:

Table 5.1 Results of texts search on interview scripts and newspaper cuttings

	No. of Document	No. of Text Units
Paperwork	3	3
ISO9000	2	2
Performance	2	4
Corruption	2	4
Lowest Tender	2	2
Margin	1	1
Subcontract	2	4

After the text search using key words, the basic hierarchy of the index tree can be set. The Index Tree organises nodes in "parent/child" relations, so any category can have a place, and its sub-categories can be placed under it. Nodes can be found by their numerical node address.

Nodes in the Index Tree are numbered by location. Each node has its own number, and also the number of its "parent" and "grandparent" and so on. (As an example if node (2 1 1) is the first sub-category of the first sub-category of the second node in the tree.) The various nodes assigned for the index tree are in Figure 5.1.

The stakeholders in public housing construction are taken as Contractor, Consultant, Hong Kong Housing Authority staff and the public. Based on the interview and the newspaper cuttings, five main categories appeared to be interrelated. These are:

- Paper Work created by ISO9000 and created by Performance Assessment;
- Competition;
- Corruption;
- Bureaucracy;
- Quality.

Figure 5.2 indicated the tentative relationships between hierarchy and events. For the Public, they are not involved directly or indirectly on the paperwork from ISO9000 as well as performance assessment. Hence, in their eyes, the paperwork does not constitute any particular meaning.

5.7 Links between the findings of Chapter 5 with Chapter 6

Hypothesis H3A - It is hypothesised that the business risks facing public housing construction contractors due to terms of contract (client factors) are perceived by public housing construction contractors to be significantly critical to its operation. In Chapter 6, to test Hypothesis H3A, it is necessary to develop the questions in the main survey and the themes in the qualitative study in Chapter 5 would be used.

The themes identified in Chapter 5 included keen competition / low profit margin in the construction industry, inflexible rules / procedures / bureaucracy in the Hong Kong Housing Authority, and stringent terms of contract imposed on contractors. All these would be used in Chapter 6 to develop the questions in the main survey regarding the perception of public housing construction contractors on the criticality of business risks from its client – the Hong Kong Housing Authority. The findings that business risks would be introduced by the clients of construction projects (so called client factors) under the terms of its construction contracts is in line with findings of Gordon (1994), Chua *et al.* (1999) and Shash (1998). Clients' staff would also affect outcomes of the project (Diekmann and Girard, 1995) and their interpretation of technical clauses, acceptance of alternative materials are also crucial (Ho, 2002).

The 10 questions under hypothesis H3A in the main survey are: (a1) insufficient information in tender, (a2) bureaucracy of client staff in making any technical or non-technical decisions, (a3) acceptance of design errors, (a4) hefty liquidated damages for any alleged delay to completion, (a5) subjective interpretation of contractual requirements on workmanship, (a6) inequitable contract terms / contract period, (a7) performance assessment system, (a8) quality management policy, (a9) award contracts based on price alone, (a10) corruption.

The theme of "bureaucracy" identified in the qualitative study is linked to questions (a1), (a2), (a3) and (a5) as these are mostly related to attitude of the staff of the Hong Kong Housing Authority. "Quality", "Paperwork from IS9000" and "Performance Assessment System" are linked to questions (a7) and (a8). "Corruption" is linked to (a10). "Competition" if substantial would favour the client who could impose inequitable terms in its contract and are linked to questions (a4) and (a6). "Quality" should be reflected on the desire of a client to award contract not based on price only and is therefore related to (a9).

5.8 Summary

This Chapter explained how the initial qualitative study by interview and newspaper cuttings was carried out to identify some of the themes to formulate some of the questions in the pilot survey and main survey regarding business risks created by the client – the Hong Kong Housing Authority. Based on the text search using computer software NUD*IST, key words from the interview and newspaper cuttings were identified. This included keen competition, low profit margin in the construction industry, inflexible rules, procedures and bureaucracy in the Hong Kong Housing Authority, lack of partnering spirit with contractors; stringent terms of contract imposed on contractors and corruption. The themes also provide an understanding of the environment in which the public housing construction contractors operate.

Q.S.R. NUD*IST Power version, revision 4.0.
PROJECT: Housing, User Lee Kin Wang, 8:17 p.m., Sept 8, 2000.

(1)	/ Contractor
(1 1)	/ Contractor / Paper Work
(1 1 1)	/ Contractor / Paper Work / ISO9000
(1 1 2)	/ Contractor / Paper Work / Performance Assessment
(1 2)	/ Contractor / Competition
(1 3)	/ Contractor / Corruption
(1 4)	/ Contractor / Bureaucracy
(1 5)	/ Contractor / Quality
(2)	/ Consultant
(2 1)	/ Consultant / Paper Work
(2 1 1)	/ Consultant / Paper Work / ISO9000
(2 1 2)	/ Consultant / Paper Work / Performance Assessment
(2 2)	/ Consultant / Competition
(2 3)	/ Consultant / Corruption
(2 4)	/ Consultant / Bureaucracy
(2 5)	/ Consultant / Quality
(3)	/ HA Staff
(3 1)	/ HA Staff / Paper Work
(3 1 1)	/ HA Staff / Paper Work / ISO9000
(3 1 2)	/ HA Staff / Paper Work / Performance Assessment
(3 2)	/ HA Staff / Competition
(3 3)	/ HA Staff / Corruption
(3 4)	/ HA Staff / Bureaucracy
(3 5)	/ HA Staff / Quality
(4)	/ Public
(4 1)	/ Public / Paper Work
(4 2)	/ Public / Competition
(4 3)	/ Public / Corruption
(4 4)	/ Public / Bureaucracy
(4 5)	/ Public / Quality

Figure 5.1 Node address and hierarchy for various stakeholders in public housing projects, as shown under NUD*IST 4

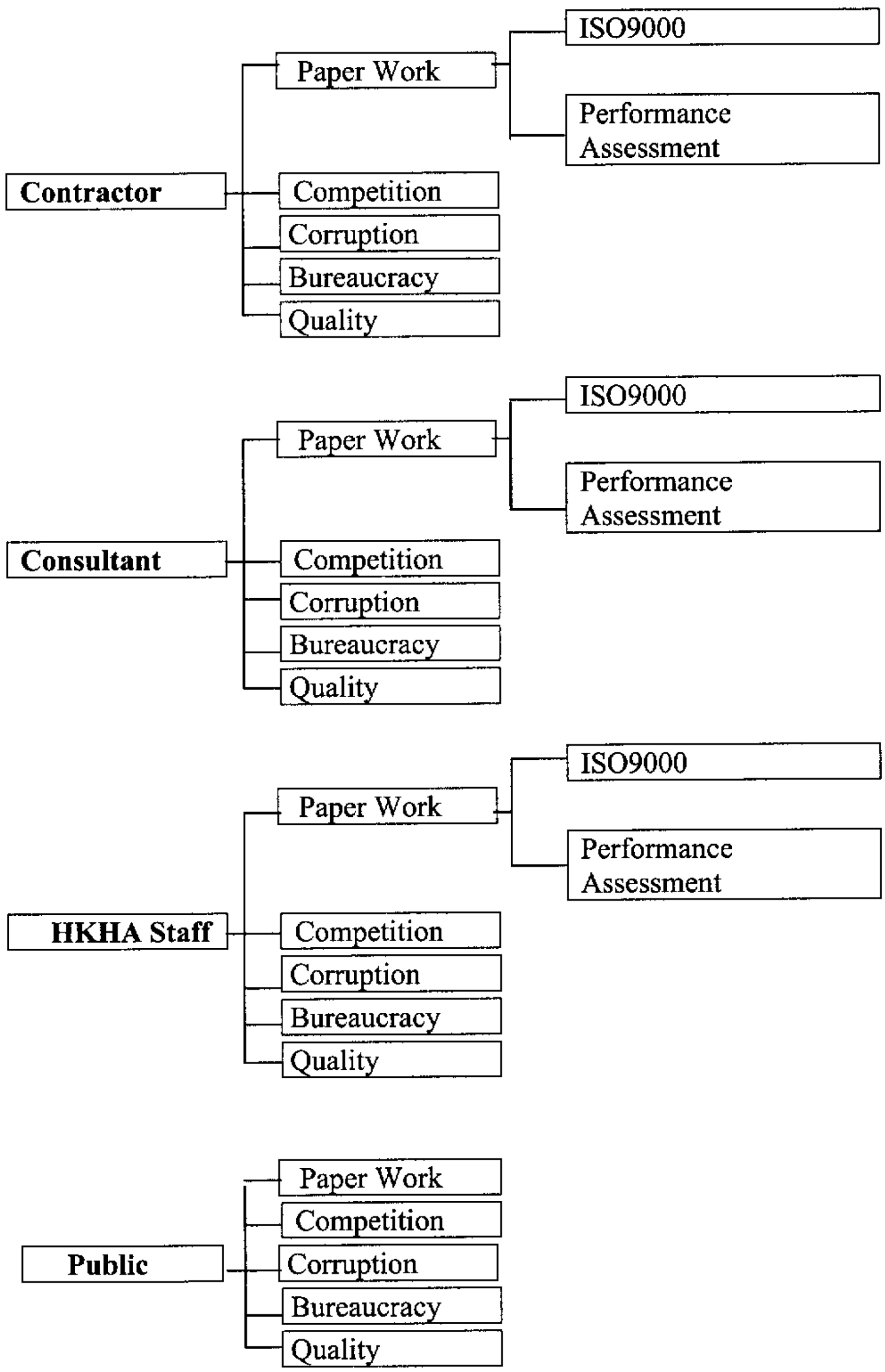

Figure 5.2 Hierarchy for various stakeholders and events in public housing projects

CHAPTER SIX

6. BUSINESS RISKS IN PUBLIC HOUSING CONSTRUCTION INDUSTRY

Chapter Six discusses in detail the framework for investigations based on previously proposed generalisations and the hypothesis to be tested. There are six groups of questions with 46 items for the public housing construction contractors and three groups of questions with 22 items for the subcontractors. The response rate of the actual surveys is found. The calculated reliability on the constructs is discussed. The face validity as well as the scales for survey measurement is explained.

6.1 Theoretical framework for investigation – main survey

From literature search, newspaper cuttings and interview with figures in the public construction industry, an understanding of the environment in which the public housing construction contractors operate emerges.

The environment refers to the discontinuous, dispersed and diverse nature of the construction industry (Tay, 1994; Rowlinson *et al.*, 1995). There is also uncertainty in turnover (Low and Tan, 1996), leading to high competition and construction contractors have to be flexible (Winch, 1989; Ngowi and Rwelamila, 1999). Figure 6.1 indicates the research framework where business risks of public housing construction contractors are the focus of the investigation. Around the focus are the business risks introduced by (i) the Hong Kong Housing Authority and its terms of contract (Gordon, 1994; Chua *et al.*, 1999), (ii) statutory requirements applicable to the construction industry, (iii) pecuniary fines and reprimand facing contractors, (iv) procurement of material and labour as well as staffing problems of the contractors (Diekmann and Girard, 1995).

The other focus is on how to manage and mitigate these business risks (Li *et al.*, 1999; Mattila and Abraham, 1998) and how effective are the mitigation measures. There is then suggestion on what are the improvement proposals and how effective are these improvement proposals to the problems (poor quality) of the public housing construction industry.

The research framework for the main survey is shown in figure 6.1, and for each of the areas, sub-hypothesis had been developed and then tested. Details are covered under Sections 6.3.1 to 6.3.6.

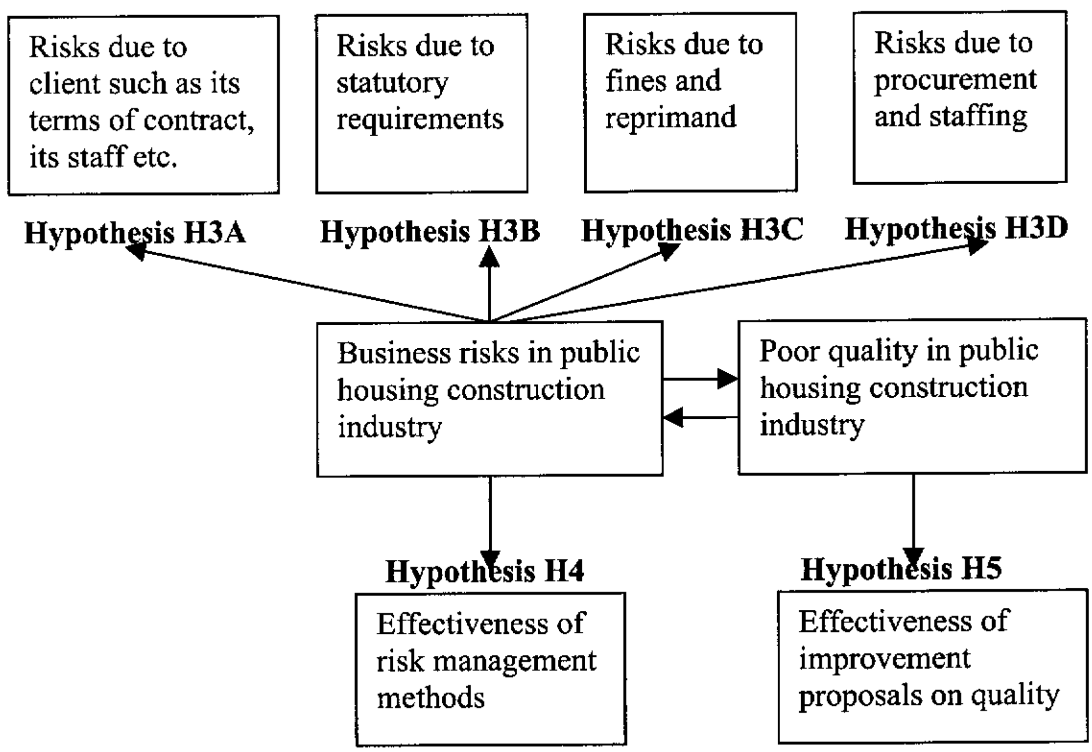

Figure 6.1 The research framework for the main survey

Hypothesis H3A looks at the business risk due to the terms of the building contract of the Hong Kong Housing Authority, as literature review indicated that this would affect the bidding strategy of the contractor. If the terms of contract were stringent, contractors would tend to put in a higher mark-up in its tender to cater for uncertainties (Shash, 1998).

Hypothesis H3B looks at the business risk created due to statutory requirements, and it has been reported that cost reductions can be achieved by avoiding restrictive labour legislation (Saboia, 1997). Thus statutory requirements are risks that construction contractors must face and try to mitigate. Hypothesis H3C extends the study to see what implications would have on construction contractors due to violation of statutory requirements. Are pecuniary fines critical or is that being taken into account as part of the operating expenses. On the other hand, there is non-pecuniary reprimand such as suspension from tendering. Is this of more concern to construction contractors that pecuniary fine?

Hypothesis H3D looks at the business risk associated with procurement of material and other services for successful completion of the public housing construction contracts. The duration of the construction contract is typically 30 months. Some of the material may not be required towards the end. To avoid possible price escalation, material might have to be procured in the early stage. Early delivery and subsequent storage would constitute problems. All these due to procurement are some of the business risks construction contractors must face and have means to mitigate (Mattila and Abraham, 1998). Staff turnover is another problem a business must face. Stable career for staff and low staff turnover could help to maintain the standard of services. Contractors must have proper staffing policy to address the issue (Chinowsky and Meredith, 2000).

Hypothesis H4 gives means to mitigate the risks due to procurement and staffing and its relative effectiveness as perceived by public housing construction contractors were tested. Hypothesis H5 gives suggestions to improve quality in the public housing construction and the effectiveness of the improvement proposals as perceived by construction contractors were tested.

In addition there were questions on the organisation and management structure of the construction contractors. The demographic information requested from contractors included:

- list of special plant, equipment, workshops held;
- number of full time employees as well as workers;
- turnover.

6.2 Theoretical framework for investigation – supplementary survey

It has been suggested that subcontracting is a mean of risk management and is particularly suitable to the business environment of the public housing construction in Hong Kong (Nobbs, 1993; Jamieson *et al.*, 1996; Lai, 2000). Public housing contractors subcontract works to subcontractors who may further subcontract works to other layers of subcontractors (Sozen and Kucuk, 1999).

Figure 6.2 indicates the research framework where business risks of public housing construction contractors are shifted to its subcontractors.

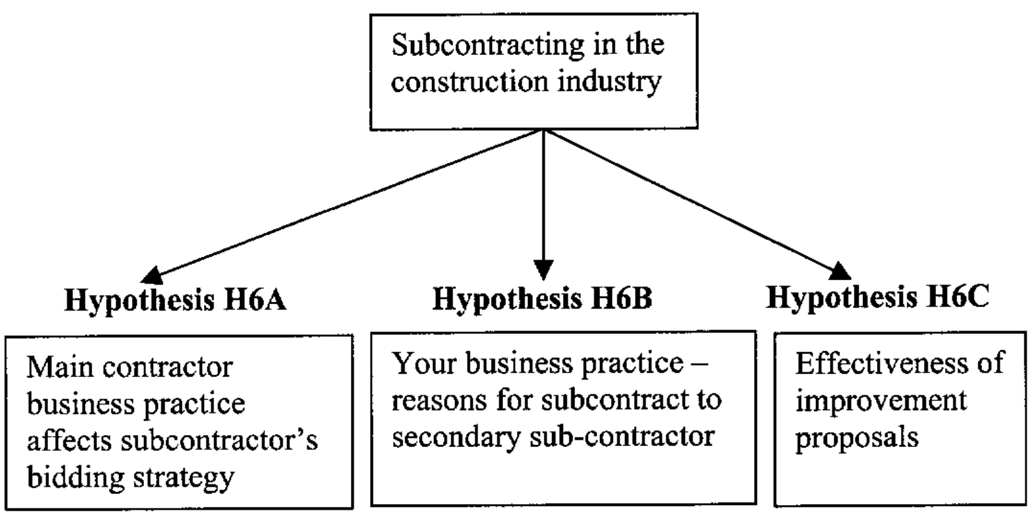

Figure 6.2 The research framework for the supplementary survey

6.2.1 Hypothesis 6A

Hypothesis 6A centres on how the business practice of contractors would affect the bidding strategy of its subcontractors.

The relationships between contractors and subcontractors had been studied by previous researches and it has been found price is not the only factor that governs the business transaction between the two parties (Hinze and Tracey, 1994). Hinze and Tracey's (1994) also reported that some subcontractors refuse to submit quotes to those construction contractors who have the reputation of bid shopping. Shash (1998) reported subcontractors are selective in getting involved in transactions with construction contractors, and they consider fairness on the part of the construction firm in its past dealings and particularly its compliance with common professional ethics to be of importance in this selection. Shash (1998) also reported that subcontractors quote similar prices for construction contractors with whom they have done work in the past, and that they increase the price of their quotations submitted to contractors with whom they have limited work experience by 5–10%. Dainty *et al.* (2001) also found out if legislation failed to ensure on-time payments to subcontractor, or to prevent construction contractors from unnecessarily withholding retention payments at the end of contracts, such practices commonly led to cashflow difficulties of subcontractors and to a breakdown in trust relations. To overcome this some subcontractors build in contingencies to their tender submissions to construction contractors to mitigate the risk of late payment.

Hence survey questions for testing Hypothesis 6A will be based on previous study but now as applied to the contractor/subcontractors relationships in Hong Kong.

6.2.2 Hypothesis 6B

The various reasons for subcontracting as noted in previous researches include (a) flexibility to respond to fluctuating workload (Rubery, 1988; Wilkinson and White, 1994) (b) core competency / access to technology (Lampel, 2000); lack of technical expertise (Wong and Fung, 1999); (c) reduction in overheads with core employees only (Doeringer *et al.*, 1991; Hendry, 1995).

It has been observed that further subcontracting to another layer of subcontractor is the normal practice locally (Chugani, 1999, Hong Kong Standard Editorial, 2000). Hypothesis 6B puts forward some of the reasons for subcontracting for testing in the local setting.

6.2.3 Hypothesis 6C

Hypothesis 6C investigates the effectiveness of quality improvement proposals for the construction industry as viewed by subcontractors. Due to different background, the views could be different from that of main contractors noted in the main survey.

6.3 The development of the hypotheses

6.3.1 Hypothesis H3A

H3A – It is hypothesised that business risks facing public housing construction contractors due to its client – the Hong Kong Housing Authority are perceived to be significantly critical to the operation of the contractor.

From the literature, it was observed that the ways clients demand their building projects would constitute business risks for the construction contractors. Based on initial qualitative study and pilot survey, 10 sub-hypotheses will be tested and the variables are developed with respect to various previous researches.

Sanvido *et al.* (1992) identified proper contractual arrangements as a critical success factor for construction projects. One main consideration in contractual arrangement is the identification of risk and its equitable allocation (Gordon, 1994). Chua *et al.* (1999) suggested that (i) adequacy and clarity of plans and technical specifications also contribute to success; (ii) any form of contractual relationship ought to be found along with consideration of realistic obligations and clear objectives; (iii) the provision for a formal resolution process in case of disputes is another consideration; (iv) there should also be contractual arrangements to provide motivation and incentives to the contracting parties. It is therefore essential to look at the terms of the contract currently used in the Hong Kong Housing Authority building contract document, and find out the industry's view whether these terms are fair and reasonable. Typical areas to be investigated will include provisions for cost adjustment when there are fluctuations in labour and material prices, extension of time due to delay and other unforeseeable factors, liquidated damages for delay in completion. Methods to deal with variations in scope of work are one of the issues. Terms of payment and retention moneys are another critical area, as cash flow is the essence of any business, and contractors will bid higher to allow for interest due to delayed payment under harsh payment terms (Shash, 1998). Variables derived for the sub-hypotheses are (a5) hefty liquidated damages for any alleged delay to completion at HK$100,000 per day, (a6) inequitable contract terms / contract period, (a7) performance assessment system, (a8) quality management policy, (a9) award contracts based on price alone.

Diekmann and Girard (1995) considered that issues involving people, process and projects characteristics are predictor of successful projects. Of these, issues involving people (client staff as well as contractor personnel) are most important. Obviously attitude of the Hong Kong Housing Authority staff would affect the outcome of the project, and so is their view on alternatives proposals, which were suggested by the industry as very conservative (Ho, 2002). Technical clauses on workmanship are subject to interpretation (Ho, 2002), and it is desirable to have an objective gauge. Variables derived are (a1) insufficient information in tender, (a2) bureaucracy of client staff in making any technical or non-technical decisions, (a3) acceptance of design errors, (a4) subjective interpretation of contractual requirements on workmanship.

The Hong Kong Housing Authority has list of approved suppliers for some critical building components and construction contractors are obliged to approach this. Apparently this is an area prompt to collusion, and is not conducive to introduction of new material and technology. Views of construction contractors on these aspects are important. Variable derived is (a10) corruption.

Contractors would take all these into account when deciding the level of contingency to their tender price. It is therefore necessary to verify that the setup / culture etc. (collectively known as client factors) would significantly affect the business risk of the contractor. A significant business risk is one that is considered as critical, very critical or extremely critical.

6.3.2 Hypothesis H3B

H3B – It is hypothesised that business risks facing public housing construction contractors due to statutory requirements are perceived to be significantly critical to the operation of the contractor.

Construction projects in Hong Kong are subject to statutory regulations, and most of this is due to its effects on the environment like noise, air emission and wastewater discharge.

Regulations restrict the operating hours, types of machinery and construction process. Quite often to meet contractual completion dates (failing which would be a hefty fines), contractors violate regulations and treat fines as part of their operating expenses (Saboia, 1997). Environmental Protection Department on noise and chemical wastes represent statutory obligations on the contractors. The variable derived is (b1) restriction to working hours for noisy site operations.

Requirements due to Statutory Authorities (Labour Department) on health and safety are also stringent requirements to protect workers. The variables investigated are (b4) provision of a safe working site and (b5) unexpected safety checks by Inspectors of the Labour Department.

Immigration Department on use of illegal workers represent statutory obligations on the contractors. Such are included as part of the contractual requirement in the contract document, and its impact on progress and timely completion of construction (hence cost) is again crucial (Saboia, 1997). The variables derived are (b2) restriction on the importation of overseas construction workers and (b3) criminal prosecution for employing illegal immigrants.

It is therefore hypothesised that statutory requirements would significantly affect the business risk of the contractor.

6.3.3 Hypothesis H3C

H3C – It is hypothesised that business risks facing public housing construction contractors due to pecuniary fines and reprimand for violating statutory requirements are perceived to be significantly critical to the operation of the contractor.

Follow on from Hypothesis H3B, violations of statutory requirements would usually result in pecuniary fines by Law Courts, as well as other reprimand by the Hong Kong Housing Authority or other Works Department of the Hong Kong Special Administrative Region Government. Poor performance may also result in suspension from tendering in public works projects or even other private sector jobs (Lee, 2001). The surveys requested information on contractor's view on the effect of pecuniary fines and reprimand on its operation.

The variables investigated are (c1) the amount of pecuniary fines, (c2) the period of suspension from tendering, (c3) poor reputation in the industry for conviction, (c4) loss of tendering opportunity in the private sector, due to poor reputation in the public sector.

6.3.4 Hypothesis H3D

H3D – It is hypothesised that business risks facing public housing construction contractors due to procurement and staffing are perceived to be significantly critical to the operation of the contractor.

Management of suppliers to get the proper materials and equipment are critical to the satisfactory completion of the projects, and so is the deployment of suitably experienced staff. It is hypothesised that procurement (Gransberg *et al.*, 1999; Mattila and Abraham, 1998) and staff problem (Chinowsky and Meredith, 2000) would significantly affect the operation of the contractors.

Problems associated with procurement will be tested by variables (d1) suppliers and subcontractors' bid is more than 5% higher than original cost estimate, (d2) incompetence of suppliers, (d3) poor performance of subcontractors. (d4) theft, fire and natural disasters caused losses and damage to material, or completed installation, or work-in-progress, (d5) limited number of specialist suppliers resulting in possible collusion by these suppliers, (d6) delay by Utilities.

Problems associated with staffing will be tested by variables (d7) turnover rate (over 10% per annum) of monthly paid staff, (d8) turnover rate (over 10% per annum) of monthly paid artisans, (d9) turnover rate (below 10% per annum) of monthly paid staff, (d10) turnover rate (below 10% per annum) of monthly paid artisans.

6.3.5 Hypothesis H4

H4 – It is hypothesised that the risk management methods which could be used to mitigate the business risks of the public housing construction industry would be perceived by public housing construction contractors to be significantly effective.

Risk management methods to mitigate business risks in the construction industry could include:

- Supply chain management and partnering (Gransberg *et al.*, 1999; Burnes and New, 1996)
- Supervision adopted for directly employed workers and for subcontractors (Saboia, 1997), incentive schemes for employees.

- Inventory control and scheduling techniques to optimise company resources and planning (Mattila and Abraham, 1998).

The variables derived are (e1) regular subcontractors with proven performance as business partners, (e2) increase number of subcontractors, (e3) long term supply contracts, (e4) subsidiary trading companies to secure regular and reliable source of material, (e5) record management, (e6) maintain a team of directly employed artisans.

Research development, training and staff development policy (Chinowsky and Meredith, 2000) are other risk management methods to mitigate business risks involving staff turnover, enhance staff skills and to retain competent staff. Staff should also be trained on quality initiatives, safety and environmental awareness amongst employees (Himes, 1995; Bresnen and Marshall, 2000). The variables derived could include: (e7) arrange regular training for directly employed artisans to upgrade their skills and safety awareness; (e8) arrange regular training for staff on technical matters and ethical standards; (e9) clear company policy for career advancement; (e10) clear company policy on quality and safety to inspire staff to provide quality installation and (e11) vision and mission statements to inspire on staff company goal and objectives are derived from previous researches.

6.3.6 Hypothesis H5

H5 – It is hypothesised that the quality improvement proposals which could be used to improve the quality of public housing construction would be perceived by public housing construction contractors to be significantly effective.

Measures are proposed that might improve quality in public housing. Cost to the Hong Kong Housing Authority for increased supervision (Sharma, 1997; Williamson, 1993, p.93), and cost to construction contractors to use directly employed labour (Ho, 2000) would be part of the surveys. Variables investigated are (e12) equitable terms in the Hong Kong Housing Authority contracts, (e13) award contract to good performers only.

View of construction contractors on the setup of Statutory Council to regulate standards and conduct of the industry was considered in the survey as well (Chugani, 1999). Registration of workers would be a cost to the community (Ho, 2000), and its effectiveness will have to be found from the surveys. Variables investigated are:(e14) setup registration system for construction workers after trade tests, (e15) strengthen site supervision by the Hong Kong Housing Authority, (e16) disallow uncontrolled subcontracting, (e17) setup Statutory Council.

6.3.7 Hypothesis H6A

H6A – It is hypothesised that the main contractor's business practice is perceived to be critical to the bidding strategy of subcontractors.

Main Contractor business practice affects the bidding strategy of subcontractors and there are factors affecting the subcontractor's bidding strategy. If a factor is considered as relatively critical, a higher level of contingency might be built into the bid (Shash, 1998; Dainty *et al.*, 2001). It is hypothesised that main contractor's business practice would significantly affect the bidding strategy of subcontractors.

The variables investigated are (a1) The non-existence of a formal written subcontract document, (a2) main contractor adopts flow-on tactic, (a3 subcontractor is paid only after the main contractor is being paid, (a4) to get all the payment for a completed job, subcontractor has to continue work for and paid later by the same main contractor in a new job, (a5) main contractor does not have staff to run the project, (a6) miscellaneous running expenses have to be borne by subcontractor solely, (a7) main contractor adopts bid shopping.

6.3.8 Hypothesis set H6B

H6B – It is hypothesised that the subcontractor's business practice is perceived to be relevant to its decision to further subcontract to secondary subcontractors.

Reasons are suggested for further subcontracting from a subcontractor who subcontracts works from a main contractor. It is hypothesised that these reasons will significantly affect the decision to subcontract (Shash, 1998; Macneil's 1978; Hinze and Tracey, 1994).

The variables investigated are (b1) lack of expertise, (b2) heavy workload, (b3) reduce risk of over expansion, (b4) maintain a minimum overhead, (b5) subcontract works to any subcontractors based on price only, (b6) no regular main contractor business partner, no regular subcontractors as business partners and (b7) the extent of subcontracting.

6.3.9 Hypothesis H6C

H6C – It is hypothesised that quality improvement proposals are perceived to be effective in improving the quality of construction.

There are proposals that might improve the quality of the new building construction. It is hypothesised that there are factors (Shash, 1998; Dainty *et al.*, 2001) that would significantly improve the quality of construction projects.

The variables investigated are (c1) registration system for construction workers, (c2) strengthen supervision of workers, (c3) strengthen site supervision by clients, (c4) disallow subcontracting (c5) setup of a registration system of contractors (c6) award contracts by performance and not just price alone, (c7) Main contractors should treat their subcontractors as business partners, (c8) standard subcontract documents with equitable terms for both main contractors and subcontractors.

6.4 Pilot survey

The pilot survey was formulated with input from the initial qualitative study and as a pre-test for the main survey. Areas of interest to the research are included in the pilot survey.

In the design of the survey, several points need to be fulfilled. Bernard (1994: 268-270) suggested rules to construct surveys. Some of these are relevant in this thesis:

- Be unambiguous and use vocabulary that respondents will understand clearly as the same word may mean different things (cognitive, political connotation and cultural).

- Do not take emotional stands in wording of questions.
- Keep unthreatening questions short but provide explanation to questions that are likely to intimidate respondents.
- People are sometimes explicit, expecting things to be spelled out clearly in the survey but there are respondents who accept more subtle ways of communication.
- Do not put false premises into questions.
- On controversial issues, specify the referent situation as much as possible in order not to offend respondents.
- It may be desirable to have Chinese translation to the surveys because some of the respondents being targeted are supervisory staff in a construction contractor. Their understanding of English may not be as good as their superior. Use of translation and back translation is essential to provide good survey questions, as this will ensure respondents would comprehend the ideas and concepts embodied in the study.
- Appropriate use of wording (already in the respondent's own national language) is also essential because this will again ensure there is no misunderstanding on the part of the respondent. The same word, sentence, ways of expression to different people will mean totally different things. It is also common that the same expression will have different meanings to different social class, in that there is a superficial meaning as well as a hidden meaning or an explanation understood by the particular group only.

Therefore thorough testing of the pilot survey and any subsequent amendment had been carried out to ascertain the effectiveness of the measuring instrument. The time required to complete the survey was also checked such that respondents should complete the main survey within 20 minutes, and the supplementary survey within 10 minutes. The pilot survey also helped to identify whether the questions asked in the inquiry were easy to understand. Attention has also been paid to the reliability, validity and sensitivity of the measurement (Zikmund, 1997, p.340).

6.5 Improvement for response rate to mailed surveys

To make the surveys worthwhile, it is essential that enough respondents return the survey. A total design method was proposed by Dillman, as quoted by Bernard (1994, p. 277-281), to improve response rate for mailed surveys.

- Use standard letter-sized paper and reduce this to a booklet;
- Do not put questions on either the front or back covers of the booklet. Leave the front cover for title that arouses interest and the back cover for a note thanking the respondent and inviting open-ended comments about the surveys;
- Layout the question in proper order, with the first one being directly related to the topic and this question is interesting, easy to answer and non-threatening. Put the general socio-economic and demographic question at the end of a survey;
- Construct the pages according to standard conventions;
- Keep mail surveys down to 10-12 pages, with no more than 125 questions;
- Send out the survey with a one-page cover letter;
- Package the survey, cover letter and reply envelope in another envelope for mailing to the respondent. The respondent's name and address must be typed on the mailing envelope;
- Set up clear contact procedures.

All these had been followed in the preparation of the pilot, main and supplementary surveys. Indeed this proved to be critical to improve the response rate.

6.6 Sample size and response rate

The main survey identified the Hong Kong Housing Authority construction contractors' and its staff as the appropriate target for the research inquiry. The surveys were administered to this group of the Hong Kong Housing Authority construction contractors with self-addressed envelopes in the first instance and further detailed follow up, if necessary, conducted subsequently through telephone.

Appendix F gives the response rate. Ninety-seven replies were received, representing a 29% response rate from 338 surveys sent out to all contractors on the Hong Kong Housing Authority approved list.

For the supplementary surveys, 339 surveys were sent. 157 reply was received and response rate is 46%. Details can be seen in Appendix G.

6.7 Reliability test of surveys

Reliability analysis was conducted on the returned survey. It allows the properties of measurement scales be studied and the items that make them up. The reliability analysis procedure calculates a number of commonly used measures of scale reliability and also provides information about the relationships between individual items in the scale. Intraclass correlation coefficients can be used to compute interrater reliability estimates.

One of the measures is Cronbach's Alpha. It measures internal consistency, based on the average inter-item correlation. As Nunally stated: In the early stages of research on predictor tests or hypothesised measures of construct, one saves time and energy by working with instruments that have a only modest reliability, for which a purpose reliability of 0.70 or higher will suffice (Nunally, 1978).

Does the survey measure response in a useful way? Reliability analysis can determine the extent to which the items in the survey are related to each other, and provides an overall index of the repeatability or internal consistency of the scale as a whole. Problem items identified should be excluded from the scale.

Cronbach's (1951) coefficient alpha is a measure of the internal consistency of a scale. A high alpha is desirable since it reflects that the items are homogeneous and thereby are measuring the same underlying property. As a correlation, alpha ranges in value from 0 to 1 (negative values can occur when items are not positively correlated with each other). Like other coefficients, alpha can also be squared to identify the proportion of variance it shares with other items. Based on this, DeVellis (1991) recommended an alpha below 0.60 as unacceptable; 0.60-0.65 undesirable; 0.65-0.70 minimally acceptable; 0.70-0.80 respectable; 0.80-0.90 very good; and if much above 0.90 excellent and the researcher should consider shortening the scale. When developing a scale to compare groups on some property, an alpha of 0.85 is recommended. Scales that will be used for diagnostic, employment, academic placement, or other important purposes should have higher reliabilities, in the 0.90s.

Alpha can also be used to identify poor variables that should be dropped, and those variables that do not contribute significantly to scale homogeneity that can be dropped to make the scale shorter. In addition to estimating internal consistency ("reliability") from the average correlation, the formula for alpha also takes into account the number of variables on the theory that the more variables, the more reliable a scale will be. That is, when the number of variables in a scale is higher, alpha will be higher even when the estimated average correlations are equal. Also, the more consistent within-subject responses are, and the greater the variability between subjects in the sample, the higher Cronbach's alpha will be. Finally, alpha will be higher when there is homogeneity of variances among variables than when there is not.

The alpha is a conservative measure, and sets an upper limit on reliability (Nunally, 1967). If it is too low, either the test is too short, or the variables share little in common. If the latter is the case, there is nothing to be gained with other tests of reliability since they will all be lower than alpha

The results of the main survey are shown in Table 6.1. Details can be seen in Appendix H2a.

Table 6.1 Reliability of each group of the main survey

Factors	Reliability (Alpha)
CLIENT FACTORS (a1-a10)	0.6122
FINES and PENALTY (c3-c4)	0.7235
STATUTORY REQUIREMENTS (b1-b5)	0.7742
PROCUREMENT and STAFF ING (d1-d10)	0.7634
RISK MANAGEMENT (e1-e11)	0.7794
QUALITY IMPROVEMENTS (e12-e18)	0.7557

Except for client factor which has an alpha of around 0.6122, the reliability of the other groups are above 0.7, and is considered as acceptable according to DeVellis (1991). For client factor the intention is to find out views of the industry on the practice of the Housing Authority. From the initial pilot survey and initial qualitative study, the constructs were derived. Nevertheless these were contentious questions, and diversified opinion was expected.

However, if some variables were removed, the reliability dropped further (question a2 bureaucracy of client staff, a4 client staff subjective interpretation, a6 inequitable contract terms and a8 ISO & paperwork.) The purpose of removing variables with lower correlations is to increase the homogeneity of variables in the scale, enhance reliability, and increase confidence in the stability of the measure. Reducing the scale by deleting too many variables can also lower alpha, and the alpha level should be monitored while tinkering with scale length and variable composition.

Table 6.2 Reliability of client factors by removing one of the item

Step	Variable	Alpha if variable removed
1 (Client Factors)	1	.6043
	2	.5766
	3	.5912
	4	.5563
	5	.6026
	6	.5873
Alpha=0.6180	7	.6184
	8	.5768
	9	.5945
	10	.6068

If variable a1 basic information in tender and a10 corruption were dropped, the alpha would be above 0.6. These are the variables that are likely to be the most contentious, and attracted widely diversified response. On the other hand by removing a2 bureaucracy of client staff, a4 client staff subjective interpretation, a6 inequitable contract terms and a8 ISO & paperwork, the reliability dropped to about 0.55 to 0.58. It may be possible to argue that the above four measured something in common, the organisation culture in the Hong Kong Housing Authority as noted by Rowlinson (2001) who stated the predominant culture of the organisation was a role culture, i.e. procedures and formal authority were seen as the mechanisms by which work was undertaken, rather than a task culture.

For the supplementary survey, the reliability of each group of variables is as Table 6.3. It can be seen that the alpha is 0.7958 for main contractor business practice, 0.7339 for your business practice and 0.7774 for quality improvement proposals.

When individual variables in the second group of survey (your business practice) is removed, the alpha dropped to as low as 0.65. One of the reasons is possibly due to the diversified opinion on why contractors have to subcontract part of its business. Details can be seen in Appendix I2a.

Table 6.3 Reliability of each group of the supplementary survey

Factors	Reliability (Alpha)
MAIN CONTRACTOR BUSINESS PRACTICE (a1-a7)	0.7958
YOUR BUSINESS PRACTICE (b1-b7)	0.7339
QUALITY IMPROVEMENT PROPOSALS (c1-c8)	0.7774

6.8 Validity of surveys

"Validity shows how good the measurement developed would measure the concepts the research intends to measure" (Sekuram, 1992, p.171). Validity can be assessed in a variety of ways including asking questions such as "Is there a consensus among my colleagues that my attitude scales measures what it is supposed to measure", "Does my measure correlate with others' measures of the 'same' concept" and answers to these provide evidence of the measure's validity (Zikmund, 1997, p. 342).

6.8.1 Face Validity

One of the approaches to validity is to determine whether the measure has face validity, and this is done through subjective agreement among professionals that a scale logically appears to accurately reflect what it purports to measure (Neuman, 1997, p.142). The main issues in this research were the opinions and attitudes of the public housing construction contractors with regard to risk of their public housing construction business. The survey was designed to get their opinion and attitudes. Several prominent members of the industry responded to the survey in the pilot survey and concurred that the responses had content validity. This according to Bailey and Pearson (1983) and Carmines and Zeller(1981) was a process that had ensured content validity.

6.8.2 Scales

The scale originally conceptualised in the surveys is continuous. According to Johnson and Creech (1983) who examined the measurement errors that occurred when variables that were continuous were operationalised in a series of ordinal categories, it was observed errors caused by using categories were not serious if more than four categories and large samples were used. With this in mind, the Likert scale is used to provide an ordinal measure of the respondents' attitude. Most of the responses required in the survey were in a 5-point scale, 1 to 5. The magnitude of the difference represented by the space between points 1 and 2 on the scale is the same as the magnitude of difference represented by the space between point 4 and 5. Any number can be added or subtracted from the scale but the magnitude of the difference is retained. It taps the differences, the order and the equality of the magnitudes of the differences in the variables. Hence mean, standard deviation, factor analysis and significance test of factors applicable for continuous scales were applied in the statistical analysis in Chapter 7.

6.9 Summary

This Chapter developed the theoretical framework from the literature review. and gave the frameworks for the main survey and the supplementary survey. The hypotheses were grouped into six sets for the main survey and three sets for the supplementary survey. The variables in each set were then developed.

Methods to improve response rate for the survey were presented and the response rate so arrived after the survey was completed. Reliability tests as indicated by Cronbach alpha were carried out on the surveys and the results indicated acceptable reliability for the seven sets of survey questions. Content validity was also mentioned and it was concluded that the variables measured what it intended to measure.

CHAPTER SEVEN

7. RESULTS and DISCUSSION

In Chapter Seven, discriminant validity by using factor analysis is described with detailed explanations of how factor analysis could be carried out. The survey results will be presented and there are discussions on the findings. Partnering as a mean to improve inter-organisation co-operation in the construction industry is suggested. There is also a case study to see how partnering was used in a local construction project.

7.1 Descriptive statistics

The descriptive statistics of the two sets of survey are shown in Appendices H1 and I1. It showed mean, standard deviation and variance of the various variables. There was also demographic information from the respondents.

The main survey was on perception of public housing contractors on the business risks of public housing construction and demographic information about the respondents and their organisation were obtained. The respondents were specialised in different trades of the public housing construction business. Of the 97 reply received, 41 is on building. The others 28 are specialist electrical and mechanical contractors. There are also 28 contractors which are specialised in more than one trade. More than half of these contractors has turnover over HK$400 million and employs over 100 full time staff. On the other hand, number of directly employed artisans is comparatively low (when looking at its turnover), with nearly 50% employing below 30 full time artisans. 11 of them did not employ any full time artisans. In fact this is a prelude to indicate works are generally not done by in house artisans but carried out by subcontractors. Nearly 80 % of the survey was completed by senior managers, deputy general managers and general managers. This gave a good representation of the views of the industry, and help to ensure good content validity (Carmines and Zeller, 1981).

The supplementary survey was on reasons for subcontracting from point of view of main contractors and subcontractors. Demographic information about the respondents and their organisation were obtained. Of the 157 replies received, respondents came from different trades of the construction industry. This gave a good coverage. More than half of these contractors has turnover below HK$40 million and about 40% employs below 25 full time staff. On the other hand, number of directly employed artisans is relatively higher, with nearly 50% employing up to 20 full time artisans. Only 19 of them did not have any full time artisans. About 60 % of the surveys were completed by senior managers, deputy general managers and general managers. This gives assurance of content validity of the surveys (Carmines and Zeller, 1981).

7.2 Factor analysis

Background of factor analysis

Construct validity was ensured through factor analysis, which examined interrelationships among the variables (47 variables of the main survey; 22 variables of the supplementary survey) and identified clusters of variables that were most closely linked together. It aided in the identification of or to confirm the accuracy of a theoretically developed construct and was used in developing instruments (Miles, 2000).

Cureton and D'Agostino (1983) described factor analysis as "a collection of procedures for analysing the relations among a set of random variables observed or counted or measured for each individual of a group". The purpose, they said, "is to account for the intercorrelations among n variables, by postulating a set of common factors, considerably fewer in number than the number, n, of these variables". Gorsuch (1983) reminded the reader that "all scientists are united in a common goal: they seek to summarise data so that the empirical relationships can be grasped by the human mind". The purpose of factor analysis, he said, "is to summarise the interrelationships among the variables in a concise but accurate manner as an aid in conceptualisation". Bryman and Cramer (1990) opined that factor analysis is "a number of related statistical techniques which help us to determine the characteristics which go together".

Factor analysis reduces attribute space from a larger number of variables to a smaller number of factors and as such is a "non-dependent" procedure (that is, it does not assume a dependent variable is specified). It will also determine the discriminant validity of the scale (Swaminathan *et al.*, 1999).

Garson (2002) further summarised factor analysis could be used for any of the following purposes:

- To reduce a large number of variables to a smaller number of factors for modelling purposes, where the large number of variables precludes modelling all the measures individually. As such, factor analysis is integrated in structural equation modelling (SEM), helping create the latent variables modelled by SEM. However, factor analysis can be and is often used on a stand-alone basis for similar purposes;

- To select a subset of variables from a larger set, based on which original variables have the highest correlations with the principal component factors;
- To create a set of factors to be treated as uncorrelated variables as one approach to handling multicollinearity in such procedures as multiple regression;
- To validate a scale or index by demonstrating that its constituent items load on the same factor, and to drop proposed scale items which cross-load on more than one factor;

- To establish that multiple tests measure the same factor, thereby giving justification for administering fewer tests;
- To identify clusters of cases and/or outliers;
- To determine network groups by determining which sets of people cluster together.

There are two types of factor analysis: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) (Trochim, 2002):

The former seeks to uncover the underlying structure of a relatively large set of variables. The researcher's initial assumption is that any indicator may be associated with any factors. This is the most common form of factor analysis. There is no prior theory and one uses factor loadings to intuit the factor structure of the data.

The latter seeks to determine if the number of factors and the loadings of measured (indicator) variables on them conform to what is expected on the basis of pre-established theory. Indicator variables are selected on the basis of prior theory and factor analysis is used to see if they load as predicted on the expected number of factors. The researcher's initial assumption is that each factor is associated with a specified subset of indicator variables. A minimum requirement of confirmatory factor analysis is that one hypothesise beforehand the number of factors in the model, but usually also expectations about which variables will load on which factors (Kim and Mueller, 1978). The researcher seeks to determine, for instance, if measures created to represent a latent variable really belong together.

Garson (2002) considered that factor analysis is suitable to look at the underlying attitudes which lead people to respond to the questions, say on a political survey. Examining the correlations among the survey items reveals that there is significant overlap among various subgroups of items - questions about a subject tend to correlate with each other, questions about other issues correlate with each other, and so on (Garson, 2002). With factor analysis, it is possible to investigate the number of underlying factors and, in many cases, to identify what the factors represent conceptually (Bryman and Cramer, 1990). Additionally, factor scores can be computed for each respondent, which can then be used in subsequent analyses such as building a logistic regression model to predict voting behaviour based on factor scores (Trochim, 2002).

SPSS has been used for data analysis and the factor loadings were found in a matrix labelled component matrix since Principal Component Analysis (PCA) was used.

To make the output more understandable, rotation is usually necessary to facilitate the interpretation of factors. Unrotated solutions are hard to interpret because variables tend to load on multiple factors. The sum of eigenvalues is not affected by rotation, but rotation will alter the eigenvalues of particular factors. There are available several methods of rotation: varimax, direct oblimin rotation, quartimax rotation and equimax rotation (Trochim, 2002).

According to Trochim (2002), varimax rotation is an orthogonal rotation of the factor axes to maximise the variance of the squared loadings of a factor (column) on all the variables (rows) in a factor matrix, which has the effect of differentiating the original variables by extracted factor. That is, it minimises the number of variables which have high loadings on any one given factor. Each factor will tend to have either large or small loadings of particular variables on it. A varimax solution yields results which make it as easy as possible to identify each variable with a single factor. This is the most common rotation option and has been adopted in this thesis.

Direct oblimin rotation is the standard method when a non-orthogonal solution is required, that is, one in which the factors are allowed to be correlated (Trochim, 2002). This will result in higher eigenvalues but diminished interpretability of the factors.

Quartimax rotation is an orthogonal alternative which minimises the number of factors needed to explain each variable (Trochim, 2002).

Equimax rotation is a compromise between varimax and quartimax criteria (Trochim, 2002).

Eigenvalue is also called as characteristic roots. The eigenvalue for a given factor measures the variance in all the variables which are accounted for by that factor. The ratio of eigenvalues is the ratio of explanatory importance of the factors with respect to the variables. If a factor has a low eigenvalue, then it is contributing little to the explanation of variances in the variables and may be ignored as redundant with more important factors (Kim and Mueller, 1978).

Thus, eigenvalues measure the amount of variation in the total sample accounted for by each factor. The eigenvalue is not the percent of variance explained but rather a measure of "amount" used for comparison with other eigenvalues. A factor's eigenvalue may be computed as the sum of its squared factor loadings for all the variables. The eigenvalues associated with the unrotated and rotated solution will differ, though their total will be the same (Kim and Mueller, 1978).

Kaiser's criteria (Dunteman, 1989) is used for determining the number of factors to be dropped. It drops all components with eigenvalues under 1.0 and it is the default in most computer programs.

Various approaches have been advocated with regard to criteria to apply when deciding variable loading on a particular factor. This is purely arbitrary, but common social science practice uses a minimum cut-off of 0.3 or 0.35. Norman and Streiner (1994) gave an alternative formula for minimum loadings when the sample size, N, is 100 or more: Minimum Factor Loading = 5.152 / (SQRT(N-2)). For N = approx. 100, minimum factor loading should be around 0.52. Similar suggestion of a factor loading of 0.50 for a sample size of 100, and 0.45 for a sample size of 150 are given by BMDP Statistical Software (BMDP, 1993). McCroskey and Young (1979) advocated a conservative approach suggesting that a variable be considered significant if it had a primary loading at 0.60 or higher on one factor, and no secondary loading above a value of 0.40 on any other factor. This combined with a "scree test" was advocated for determining the number of factor to retain. Stevens (1996) took a more liberal approach by concluding that "sample size" and "component saturation" are the most important issues when determining the reliability of the factors.

Richarme (2001) suggested that the sample size should be over 50 observations, with over 5 observations per variable and multicollinearity is generally preferred between the variables, as the correlations are key to data reduction. The two surveys in this thesis complied with this requirement.

Application of factor analysis in the current study

Due to the paucity of research in the public housing construction industry in Hong Kong, exploratory factor analysis was appropriate (as suggested by Ebersole (1999) for survey not subject to serious tests previously) to uncover the underlying structure of the constructs put forward to explain the attitude of public housing construction contractors on the business risks of their public housing construction business.

Exploratory factor analysis reduced the number of variables (47 in the main survey and 22 in the supplementary survey) to a smaller number of factors as suggested by Cureton *et al.*(1983). It had also assisted in the identification of or to confirm the accuracy of the theoretically developed construct (Miles, 2000). Furthermore as suggested by Swaminathan *et al.*(1999), it verified the discriminant validity of the scale.

Kaiser's Measure of Statistical Adequacy (MSA) is a measure of the degree to which every variable can be predicted by all other variables. An overall MSA of .80 or higher is very good, with a measure of under .50 deemed poor (Richarme, 2001). The MSA of the main survey was 0.529, and that of the supplementary survey was 0.733 and satisfied the minimum MSA criterion.

Factor loadings were used to intuit the factor structure of the data. The value of the factor loadings for inclusion for further analysis was based initially on factors with eigenvalues above 1. Then factors identified after extraction by principal component analysis and using varimax with Kaiser normalisation rotation were included only if the factor loading exceeded certain values using criteria suggested by BMDP Statistical Software (BMDP, 1993). Here 0.50 was adopted for the main survey and 0.45 for the supplementary survey.

There would also be cases when a number of variables were cross-loaded on two or more factors. Following the advice of Ferguson and Cox (1993), non-loading and cross-loading variables (where the difference in magnitude between loadings is less than 0.2) were removed.

Factor analysis results may be used for further analysis by the factor scores so generated or by summated scales based on the factor structure (Trochim, 2002). Factor analysis can also be strongly influenced by the presence of errors in the original data and for exploratory factor analysis, summated scores is preferred as it could preserve the variation in the data for further analysis (Hair *et al.*, 1992).

7.2.1 Factor analysis of the main survey

From Appendix H3, it is noted that there were 16 factors with eigenvalues greater than 1 by using principal component analysis with variamax rotation. After rotation and dropping factor with loadings smaller than 0.50, the following is observed in Table 7.2.1:

Table 7.2.1 Factor loadings of the main survey

Factors	Items	Loading
Factor 1	b1 – Noise Ordinance	0.625
	b2 – Employ overseas workers	0.538
	b3 – Prosecution illegal workers	0.688
	b4 – OH&S requirements	0.758
	b5 – Unexpected safety checks	0.761
Factor 2	d7 – Staff turnover over 10%	0.731
	d8 – Artisan turnover above 10%	0.814
	d9 – Staff turnover below 10%	0.757
	d10 –Artisan turnover below 10%	0.675
Factor 3	e5 – Record Mgt to deal with ISO	0.633
	e9 – Career prospect for staff	0.681
	e10 – Policy on quality & safety	0.808
	e11 – Have vision and mission	0.698
Factor 4	e6 – Employ direct labour	0.543
	e7 – Regular training for artisans	0.783
	e8 – Regular training for staff	0.759
Factor 5	e4 – Subsidiary trading company	0.574
	e14 – Registration of workers	0.502
	e16 – Uncontrolled subcontracting	0.566
	e17 – Setup statutory Council	0.791
	e18 – HA strengthen supervision	0.507
Factor 6	d2 – Incompetence of suppliers	0.829
	d3 – Performance subcontractor	0.746
Factor 7	e1 – Regular contractor as partner	0.760
	e3 – Long term material contract	0.711
	e4 – Subsidiary trading company	0.574

Factor 8	a4 – subjective interpretation a5 – HK$100,000 as LD a6 – Inequitable Contract Terms	0.782 0.501 0.550
Factor 9	c3 – Poor reputation c4 – No tendering in private sector	0.745 0.773
Factor 10	e12 – Equitable terms e13 – Award to good performers	0.629 0.829
Factor 11	d1 – Suppliers price above 5% d5 – Limited suppliers	0.671 0.769
Factor 12	a2 – Bureaucracy of Client Staff a9 – Award contract by price	0.713 0.640
Factor 13	a3 – Not accept design errors c1 – Breaching Statutory Requirement d4 – Fire, theft	0.527 -0.684 0.614
Factor 14	a7 – Performance Assessment a8 – ISO and paperwork	0.700 0.651
Factor 15	a1 – Basic Info. in Tender	0.841
Factor 16	c2 – Period of Suspension from tender	0.789
Dropped (Not loaded onto any factors discarded as minimum loading is below 0.50) (BMDP, 1993) a10 – Corruption d6 – Delay by utilities e2 – Increase number of subcontractor e15 – Strengthen self supervision		

From Table 7.2.1, of the 47 variables, 43 loaded onto 16 factors. 4 were dropped because of the factor loading below 0.50. Variable e4 loaded onto factor 5 and 7. As factor 5 is in quality improvement measure, variable e4 (Setup subsidiary trading company) would better be included in factor 7 for supplier management.

It is necessary to interpret the 16 factors to see the concepts / meaning being represented. A factor name should capture the underlying dimension which unifies the group of variables loading on that factor (Tabachnick and Fidell, 1996). Hair *et al.* (1992) suggested that factor names should be brief (one or two words) and should communicate the nature of the underlying construct. The most strongly loading variables were deemed most important when interpreting each factor (Tabachnick and Fidell, 1996; Hair *et al.,* 1992). Table 7.2.2 gave some suggestions.

Table 7.2.2 Initial factors naming of the main survey

Factors	
Factor 1	Statutory requirements
Factor 2	Staff problem
Factor 3	Risk management staff problem – staffing policy
Factor 4	Risk management staff problem – staff training
Factor 5	Improvement measures for construction industry
Factor 6	Suppliers problem
Factor 7	Risk management - supply chain management
Factor 8	Unfavourable contract terms
Factor 9	Poor performance ramifications
Factor 10	Revised contract terms
Factor 11	Suppliers problem
Factor 12	Client company Culture
Factor 13	Unforeseeable risks
Factor 14	Client quality perspective
Factor 15	Unfavourable contract terms
Factor 16	Penalty

Some empirical rules to keep or eliminate factors, as suggested by Ebersole (1999), were adopted. As the stability of factors with one or two only variables was questionable, additional variables from other similar factors should be grouped to support the construct or single variable factors should be eliminated. Ideally, the independent variables are normal and continuous, with at least 3 to 5 variables loading onto a factor.

On further inspection of the initial 16 factors, it was observed that some of these factors (and the variables attributing to the factors) could be combined.

When single variables are used to measure underlying perceptual dimensions, random and systematic error components of the equation are high. When multiple variables are used in the form of a summated scale, the summation process results in a portion of the random error "canceling out across variables", said Churchill (1979). Additionally, a major cause of systematic error in survey measures is that dimensions are measured with few variables. Generally, the more variables in a summed scale the more content validity the summed scale has and the less systematic error is associated with the measure. In addition individual variables often possess measurement error. According to Churchill (1979), "they produce unreliable responses in the sense that the same scale position is unlikely to be used by a respondent in successive administrations of an instrument". This source of error is "averaged out" when attributes measuring the same underling dimension are contained in a summated scale.

Further more, to ensure objectivity, a third person (a statistician) also went through the process for naming the factors. The combination of the initial factors was as below and ultimately 8 factors with 40 variables were proposed in Table 7.2.3.

Table 7.2.3 Revised factors naming of the main survey

Renamed Factors (Original factors)	Factors Name	Variables included	Variables Excluded
Factor A *(Factors 8, 12, 14, 15)*	Client factors	a1, a2, a3, a4, a5, a6, a7, a8, a9	
Factor B *(factor 1)*	Statutory requirements	b1, b2, b3, b4, b5	
Factor C *(Factor 9)*	Poor performance ramifications	c3, c4	
Factor D *(Factors 6, 11)*	Suppliers problem	d1, d2, d3, d5	
Factor E *(Factor 7)*	Supply chain management	e1, e3, e4	
Factor F *(Factor 2)*	Staff problem	d7, d8, d9, d10	
Factor G *(Factors 3, 4)*	Staff management – policy and training	e5, e6, e7, e8, e9, e10, e11	
Factor H *(Factors 5, 10)*	Improvement measures	e12, e13, e14, e16, e17, e18	
			c1, c2, d4

Factor 2 (Staffing problem based on variables d7, d8, d9, d10) reflects risk due to staffing and can stay. It was renamed factor F.

Factor 8 (Client factors based on variables a4, a5, a6), factor 12 (Client factors based on variables a2, a9), factor 14 (Client factors based on variables a7, a8) and factor 15 (Client factors based on variable a1) can be considered as based on the same concept. It was renamed factor A.

Factor 9 (Fines and penalty based on variables c3, c4) can be considered as penalty from non-compliance. It was renamed factor C.

Factor 6 (Suppliers problem based on variables d2, d3) and factor 11 (Suppliers problem based on variable d1, d5) can be considered as based on the same concept. It was renamed factor D.

Factor 3 (Risk management to staffing problem - Staffing policy based on variables e5, e9, e10, e11) and factor 4 (Risk management to staffing problem - staff training based on variables e6, e7, e8) can be considered as based on the same concept. It was renamed factor G.

Factor 5 (Improvement measures for construction industry based on variables e14, e16, e17, e18) and factor 10 (Revised contract terms based on variables e12, e13) can be considered as based on the same concept. It was renamed factor H.

Factor 13 (Client factor based on variable a3, fines and penalty based on variable c1 and fire, theft based on variable d4) was eliminated due to the negative factor loading of c1 and the difference in nature of variables a3 and d4.

Factor 16 (Fines and penalty based on variable c2) is based on a single variable and is dropped.

Once summed scales have been created based upon the findings of factor analysis, its reliability needs to be reassessed (Grapentine, 1995). The reliability of summated scales can easily be assessed via the calculation of coefficient alpha. The rationale behind the calculation of alpha is as follows: If all variables comprising a summated scale are indeed measuring the same underlying dimension, survey answers to those variables should be highly correlated among themselves. Low correlation between some variables would indicate that some attribute statements for a particular summated scale are not reliable measures of the underlying construct or dimension (Grapentine, 1995).

A reliability analysis was conducted for the new factors A to H to check the reliability scores. A summary is in Table 7.2.4. Details are in Appendix H2b.

Table 7.2.4 Reliability of each group of factors of the main survey

Renamed Factors	Factors Name	Variables	Alpha
Factor A	Client factors	a1, a2, a3, a4, a5, a6, a7, a8, a9	0.6047
Factor B	Statutory requirements	b1, b2, b3, b4, b5	0.7742
Factor C	Poor performance ramifications	c3, c4	0.7235
Factor D	Suppliers problem	d1, d2, d3, d5	0.6674
Factor E	Supply chain management	e1, e3, e4	0.6594
Factor F	Staff problem	d7, d8, d9, d10	0.7908
Factor G	Staff management	e5, e6, e7, e8, e9, e10, e11	0.7834
Factor H	Improvement measures	e12, e13, e14, e16, e17, e18	0.7521

From Table 7.2.4, all the alpha was over 0.6. According to DeVellis (1991), this is considered as acceptable.

7.2.2 Factor analysis of the supplementary survey

Table 7.2.5 presents factor loadings on each of the construct for the supplementary survey. Details are shown in Appendix I3.

Table 7.2.5 Factor loadings of the supplementary survey

Factors	Items	Loading
Factor 1	a1 – No formal contract	0.641
	a2 – Flow on tactic	0.687
	a3 – Pay sub after paid by Client	0.560
	a4 – Defer payment	0.547
	a5 – Rely solely on sub	0.636
	a6 – Sub to bear all expenses	0.723
	a7 – Bid Shopping	0.721
Factor 2	b2 – Due to workload	0.757
	b3 – No Risk of Over-expansion	0.812
	b4 – Minimise overhead	0.805
	b5 – Price only	0.649
Factor 3	c1 – Worker registration	0.790
	c2 – Strengthen own supervision	0.741
	c3 – Client strengthen supervision	0.663
Factor 4	a4 – Defer payment	0.546
	c6 – Award on quality not price	0.632
	c7 – Subs as business partner	0.649
Factor 5	c4 – Disallow subcontract	0.770
	c5 – Registry of Subcontractor	0.466
Factor 6	b1 – due to lack of expertise	0.775
b6 – No regular partner, c8 – Standard subcontract doc (Not loaded onto any factor as minimum loading is below 0.45) (BMDP, 1993)		

Inspection of the factors indicated that variable a4 loaded onto factor 1 and factor 4. According to Ferguson and Cox (1993), cross-loading variable (where the difference in magnitude between loadings is less than 0.2) was removed from factor 4.

It is necessary to interpret the 6 factors to see the concepts / meaning it is representing. The following was suggested:

Table 7.2.6 Initial factors naming of the supplementary survey

Factors	
Factor 1	Main contractor business practice
Factor 2	Subcontracting reason
Factor 3	Quality improvement proposals
Factor 4	Contract award strategy
Factor 5	Subcontractor as business partner
Factor 6	Subcontracting reason

On further inspection of these 6 factors, it was observed that some of these could possibly be combined. Using similar criteria as for the main survey, the proposition was as shown in Table 7.2.7.

Table 7.2.7 Revised factors naming of the supplementary survey

Renamed Factors	Factors Name	Variables	
(Original factors)		included	excluded
Factor A1 *(factor 1)*	Main contractor business practice	a1, a2, a3, a4, a5, a6, a7	
Factor B1 *(factors 2, 6)*	Subcontracting reasons	b1, b2, b3, b4, b5	b6
Factor C1 *(factors 3, 4, 5)*	Improvement measures	c1, c2, c3, c4, c5, c6, c7	c8

Factor 1 gave what subcontractor would do in its bid to cater for different business practice of main contractor. All 7 variables a1 to a7 loaded onto this factor and factor 1 was renamed as factor A1 – Main contractor business practice.

Factor 2 with variables b2 to b5 looked at the reason for subcontracting. Factor 6 contained only one single variable b1 but due to its high loading, it was combined with factor 2 to account for the reason for subcontracting. Both factors 2 and 6 were renamed as factor B1- Subcontracting reasons.

Factor 3 with variables c1, c2, c3; factor 4 with variables c6, c7 and factor 5 with variables c4, c5 suggested improvement measures to the problem of subcontracting in construction industry. The 3 factors were combined and renamed as factor C1 – Improvement measures.

It can be seen that these renamed factors A1, B1 and C1 reflected closely the underlying constructs as proposed when the supplementary survey instrument was formulated initially.

A further reliability analysis was conducted for the new factors A1 to C1 to check the overall reliability scores. A summary is in Table 7.2.8. Details are in Appendix I2b.

Table 7.2.8 Reliability of each group of factors of the supplementary survey

Renamed Factors	Factors Name	Variables	Alpha
Factor A1	Main contractor business practice	a1, a2, a3, a4, a5, a6, a7	0.7958
Factor B1	Subcontracting reasons	b1, b2, b3, b4, b5	0.7521
Factor C1	Improvement measures	c1, c2, c3, c4, c5, c6, c7	0.7573

From Table 7.2.8, the alpha was over 0.6. According to DeVellis (1991), this is considered as acceptable.

7.3 Other statistical tests for main survey

In order to facilitate further statistical analysis, responses to each of the variables comprising each of the eight factors in the main survey were summed as stated below to create new scales as suggested by Ebersole (1999). As a 5-point scale was adopted, the scale for a 9-variable factor would start from 1x9 to 5x9, i.e. from 9 to 45, and similarly for other renamed factors with different number of variables ranging from 2 to 9.

(i) Responses to the 9 variables a1, a2, a3, a4, a5, a6, a7, a8, a9 making up the factor A, labelled "Client factors", were summed to create a scale ranging from 9 to 45.

(ii) Responses to the 5 variables b1, b2, b3, b4, b5 making up the factor B, labelled "Statutory requirements", were summed to create a scale ranging from 5 to 25.

(iii) Responses to the 2 variables c3, c4 making up the factor C, labelled "Poor performance ramifications", were summed to create a scale ranging from 2 to 10.

(iv) Responses to the 4 variables d1, d2, d3, d5 making up the factor D, labelled "Suppliers problem", were summed to create a scale ranging from 4 to 20.

(v) Responses to the 3 variables e1, e3, e4 making up the factor E, labelled "Supply chain management", were summed to create a scale ranging from 3 to 15.

(vi) Responses to the four variables d7, d8, d9, d10 making up the factor F, labelled "Staff problem" were summed to create a scale ranging from 4 to 20.

(vii) Responses to the 7 variables e5, e6, e7, e8, e9, e10, e11 making up the factor G, labelled "Staff management – staffing policy and training", were summed to create a scale ranging from 7 to 35.

(viii) And lastly, responses to the 6 variables e12, e13, e14, e16, e17, e18 making up the factor H, labelled "Improvement measures for construction industry", were summed to create a scale ranging from 6 to 30.

Once this was done it was possible to explore the relationship between these factors (business risks, risk management and improvements etc.) and other variables.

The data from the survey was based on a 5-point scale as Table 7.2.9 and this scale with the attitudes assigned had been used by other researcher in assessing the relative criticality of risks and the relative effectiveness of risk mitigation methods in construction projects (Li *et al.*, 1999):

Table 7.2.9 Interpretation of the Scale in the Survey

Attitudes	SCALE				
	1	2	3	4	5
Criticality	Not critical	Slightly critical	Critical	Very critical	Extremely critical
Relevance	Not relevant	Slightly relevant	Relevant	Very relevant	Extremely relevant
Effectiveness	Not effective	Slightly effective	Effective	Very effective	Extremely effective

Each of the point 1 to 5 on the 5-point Likert scale corresponds to the attitudes of the respondents to the variables in the survey. The weight of 5 is assigned to indicate the highest agreement to the variable (Zikmund, 1997; p.357). The description is not to be understood literally as the respondents are not expected to tell their attitude in its literal sense (Trochim, 2000). As stated in the survey questionnaire in Appendix C, it indicates the degree of relative criticality, relative relevance or relative effectiveness of a certain variable as perceived and ranked by a respondent on a 5-point scale.

In the survey, the respondents are providing their opinion of the Hong Kong Housing Authority and their construction business which they are familiar with. As suggested by Luan (2003), it is acceptable to force an opinion rather than getting a neutral from the respondents as every respondent should be able to rank the relative criticality, relevance or effectiveness of a certain variable and the neutral point in the middle of the usual 5-point Likert scale is omitted.

7.3.1 Client factors (Factor A in Table 7.2.4)

To investigate the perception of public housing contractors on the business risks due to the client, the variables a1, a2, a3, a4, a5, a6, a7, a8, a9 were summed to form a single scale. The lists of problems faced are indicators for the construct - perceived risks of public housing construction business. The main hypothesis to be tested is that public housing construction contractors' perceptions of the business risks generated from their client are critical to its business.

The method used to test this hypothesis is significant testing of the mean. The data for the list of risks for 1 variable is as follows: 1 Not critical, 2 Slightly critical, 3 Critical, 4 Very Critical, and 5 Extremely critical. With 9 variables summated to form a single scale, the mean value is 9x3=27. If all the perceived risk is significantly larger than 27, it could be regarded as agreement with the statement. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix H4 Table A.

In the test the significance level α is 0.05 (one sided). The null hypothesis Ho will be rejected if $t > 1.66$ (for degree of freedom of average 90); or p-value is less than 0.05. The test procedure is:

For individual scale

Null Hypothesis

H3Ao : $\mu = 3$ the perceived risk is not critical

Alternative Hypothesis

$H3A_A$: $\mu > 3$ the perceived risk is critical

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not critical", "Slightly critical", "Critical", "Very Critical" and "Extremely Critical". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative criticality of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion of the Hong Kong Housing Authority which they are familiar with and instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively critical.

For summed scale

Null Hypothesis

H3Ao : $\mu = 27$ the perceived risk is not critical

Alternative Hypothesis

$H3A_A$: $\mu > 27$ the perceived risk is critical

Table 7.3.1 shows the results, and detail is at Appendix H4.

Table 7.3.1 Tests on perceived business risks from client

	t	df	Mean	Reject Ho	Perceived Risk Critical
Individual scale					
a1 – Basic Info. in Tender	3.260	95	3.33	yes	yes
a2 – Bureaucracy of Client Staff	8.396	95	3.80	yes	yes
a3 – Not accept design errors	15.070	95	4.19	yes	yes
a4 – subjective interpretation	10.426	95	3.33	yes	yes
a5 – HK$100,000 as LD	8.206	95	3.86	yes	yes
a6 – Inequitable Contract Terms	12.724	95	4.15	yes	yes
a7 – Performance Assessment	1.040	95	3.09	**NO**	**NO**
a8 – ISO and paperwork	-4.670	95	2.54	**NO**	**NO**
a9 – Award contract by price	9.110	95	3.95	yes	yes
Summed scale					
Client factors	13.878	93	32.85	yes	yes

From the result of the test of one sample mean it is found that variables a7 and a8 were not considered as critical. All the other variables were considered as critical. For the combined test for all the variables, the hypothesis was supported. This indicated, overall speaking, the business risks facing public housing construction contractors due to the client factors (the business practice of the Housing Authority) were perceived as critical.

The possible explanation for a7 not being considered as critical is that under current situation, the rating from the performance assessment does not affect future tendering opportunity from contractors, and they have to go through the tendering exercise again. If some cut-throat bids come in, it is still the lowest bidder be given the job. Hence until the system of contracts award changes, performance assessment does not have any real significance.

The performance assessment scoring system is an attempt to improve the quality management of public housing construction in Hong Kong. It is a mechanism for evaluating the effectiveness of a contractor's ability to deliver projects to specified standards. The Hong Kong Housing Authority thought this would be an effective assessment and incentive system for promoting continuous quality improvement. However, the analysis of PASS scores has indicated that the general level of quality has not been significantly improved. The above research observations tallied with the findings by Tam *et al.* (2000).

Tam *et al.* (2000) questioned the use of quality system and the performance assessment scoring system for public housing construction in Hong Kong. Based on the analyses of PASS scores and contractor performance, it was found that there were shortfalls in the system. The incentive for quality has to be related to real tangible benefits which the contractors could enjoy.

The practice of the construction quality assessment system (CONQUAS) in Singapore is different. According to Miles and Neale (1991), Singapore experienced similar poor quality problems in the early 1980s and the Construction Industry Training Board established CONQUAS in 1989 to assess the quality of building work. A year later, a premium scheme was introduced to provide tendering advantage of up to 5 percent or S$5 million (whichever is the lower) in public sector building tenders to those constructors who consistently achieved good-quality work as reflected by their high CONQUAS scores. The threshold for contractors was to achieve an average CONQUAS score above 65 points. For every point above this figure the contractor was given a premium of 0.2 percent up to a maximum of 5 percent (Miles and Neale, 1991). The scheme quickly became an incentive and encouraged contractors to strive for quality. Although the amount of the premium was only a small portion of the tender price, the incentive had been effective.

For a8, contractors usually take the impact of ISO9000 as something that could be left with a consultant. As long as things are tidied up at the audit and any non-conforming items revealed at the audit were resolved afterwards, impact of ISO is not really that insurmountable. This again tallied with the findings by Kam (1998). Kam reported that the actual achievements as a result of implementing these quality management systems, such as PASS, ISO9000 quality assurance system, quality awareness campaign, etc., were below original expectations. In fact ISO requires resources for implementation, and whilst it is a contractual requirement, it is not taken seriously because that does not affect directly contractors' business.

The mean for a3 alone is the highest. This could be related to civil service mentality anywhere in the world. Civil servants would prefer to lead an easy life and therefore contracts, as evolved over times, are becoming more voluminous with the intention to keep away all possibilities. If anything goes wrong, it is the problem of the contractors. Unequitable contract terms noted in the Hong Kong Housing Authority contracts include unreasonably high liquidated damages for delay, unrealistic construction period etc. The Hong Kong Housing Authority, after the piling scandal unveiled in 1999/2000, has already taken steps to address this. In a recent conference, the Hong Kong Housing Authority Chairman also stressed the way along this objective (Cheng, 2002).

For the combined tests, as 7 of the 9 variables were considered as significant, it is expected that overall perception of the business risks due to the Hong Kong Housing Authority was considered as critical.

7.3.2 Statutory requirements and poor performance ramifications (Factors B and C in Table 7.2.4)

It is hypothesised that statutory requirements would significantly affect the business risk of the contractor. From factor analysis, factor B included variable: b1 - restriction to working hours for noisy site operations, b2 - restriction on the importation of overseas construction workers, b3 - criminal prosecution for employing illegal immigrants, b4 - provision of a safe working site, b5 - unexpected safety checks by Inspectors of the Labour Department.

Violations of statutory requirements would usually result in reprimand by the Hong Kong Housing Authority or other Works Department of the Hong Kong Special Administrative Region Government. Poor performance may also result in suspension from tendering in public works projects or even other private sector jobs, and it is hypothesised that these were critical factors to the operation of the contractor. Factor C included variables c3 and c4.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not critical", "Slightly critical", "Critical", "Very Critical" and "Extremely Critical". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative criticality of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how operation of their business is affected and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively critical.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of risks are as follows: 1 Not critical, 2 Slightly critical, 3 Critical, 4 Very critical, and 5 Extremely critical. If the mean value of each of the perceived risk is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3.

The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix H4 Table A.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale

Null Hypothesis

$H3B_o$: $\mu = 3$ the perceived risk is not critical

Alternative Hypothesis

$H3B_A$: $\mu > 3$ the perceived risk is critical

For summed scale (for factor B with 5 variables)

Null Hypothesis

$H3B_o$: $\mu = 15$ the perceived risk is not critical

Alternative Hypothesis

$H3B_A$: $\mu > 15$ the perceived risk is critical

Table 7.3.2 shows the results, and detail testing is at Appendix H4.

Table 7.3.2 Tests on perceived business risks from statutory requirements

	t	df	Mean	Reject Ho	Perceived Risk Critical
Individual scale					
b1 – Noise Ordinance	.203	96	3.02	**NO**	**NO**
b2 – Employ overseas workers	-7.116	96	2.21	**NO**	**NO**
b3 – Prosecution illegal workers	-1.371	96	2.81	**NO**	**NO**
b4 – OH&S requirements	-.746	96	2.91	**NO**	**NO**
b5 – Unexpected safety checks	-3.797	96	2.61	**NO**	**NO**
Summed Scale					
Statutory requirement	-3.435	95	13.56	**NO**	**NO**

In the test the significance level α is 0.05 (one sided). For poor performance ramifications, the test procedure is:

For individual scale

Null Hypothesis

$H3C_o$: $\mu = 3$ the perceived risk is not critical

Alternative Hypothesis

$H3C_A$: $\mu > 3$ the perceived risk is critical

For summed scale (for factor C with 2 variables)

Null Hypothesis

$H3C_o$: $\mu = 6$ the perceived risk is not critical

Alternative Hypothesis

$H3C_A$: $\mu > 6$ the perceived risk is critical

Table 7.3.3 Tests on perceived business risks from poor performance ramifications

	t	df	Mean	Reject Ho	Perceived Risk Critical
Individual scale					
c3 – Poor reputation	5.086	94	3.56	yes	yes
c4 – No tendering -private sector	6.550	94	3.77	yes	yes
Summed scale					
Poor performance ramifications	6.598	94	7.33	yes	yes

Variables b1, b2, b3, b4 and b5 are not considered as significantly critical. Reasons possibly behind are that violation would mean a fine, if found breaching such. This may already be considered as part of the operating expenses. On the other hand, with poor reputation and loss of tendering opportunity, turnover would be substantially affected. Hence it explained why c3 and c4 should be critical factors.

Variable c1 asked how much fines are payable for breaching statutory requirements. Although this was not included in factor C, it was noted that 63% picked the lowest range of below HK$100,000 (the usual range of fine imposed by Law Courts for first offenders from construction industry.) It also explained why respondents considered b1, b2, b3, b4 and b5 not significantly critical, as they believed such amount was small, and would not significantly affect their operation.

On suspension from tendering, first offenders are usually given a 3 to 6-month voluntary suspension. When considered the project cycle, the tender stage of a typical public housing construction projects, from register of interest, issue tender and award would be over six months. Contractors know that they would be suspended if they had a series of conviction. They usually then put in a lower bid to secure a few jobs to live through the period of suspension from tendering. It has been suggested that a more stringent system of penalty should be involved to remove repeated offenders.

7.3.3 Procurement and staffing (Factors D and F in Table 7.2.4)

Management of suppliers to get the proper materials and equipment are critical to the satisfactory completion of the projects, and so is the deployment of suitably experienced staff. It is hypothesised that procurement and staff problem would significantly affect the operation of the contractors.

Variables investigated were those revealed from factor analysis. This is Factor D for variables: d1 - suppliers and subcontractors' bid is more than 5% higher than original cost estimate, d2 - incompetence of suppliers, d3 - poor performance of subcontractors, d5 - limited number of specialist suppliers resulting in possible collusion by these suppliers.

For factor F, these were variables: d7 - turnover rate (over 10% per annum) of monthly paid staff, d8 - turnover rate (over 10% per annum) of monthly paid artisans, d9 - turnover rate (below 10% per annum) of monthly paid staff, d10 - turnover rate (below 10% per annum) of monthly paid artisans.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not critical", "Slightly critical", "Critical", "Very Critical" and "Extremely Critical". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative criticality of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how operation of their business is affected and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively critical.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of risks are as follows: 1 Not critical, 2 Slightly critical, 3 Critical, 4 Very critical, and 5 Extremely critical. If the mean value of each of the perceived risk is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Table A in Appendix H4.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale

Null Hypothesis

H3Do : $\mu = 3$ the perceived risk is not critical

Alternative Hypothesis

$H3D_A$: $\mu > 3$ the perceived risk is critical

For summed scale (each with 4 variables)

Null Hypothesis

H3Do : $\mu = 12$ the perceived risk is not critical

Alternative Hypothesis

$H3D_A$: $\mu > 12$ the perceived risk is critical

Tables 7.3.4 and 7.3.5 show the results, and detail testing is at Appendix H4.

Table 7.3.4 Tests on perceived business risks from procurement

	t	df	Mean	Reject Ho	Perceived Risk Critical
Individual scale					
d1 – Suppliers price above 5%	3.839	95	3.36	yes	yes
d2 – Incompetence of suppliers	8.503	95	3.80	yes	yes
d3 – Performance subcontractors	13.52	95	4.16	yes	yes
d5 – Limited suppliers	6.080	96	3.69	yes	yes
Summed scale					
Suppliers problem	10.943	94	15.04	yes	yes

Table 7.3.5 Tests on perceived business risks from staffing

Individual scale					
d7 – Staff turnover over 10%	.669	96	3.06	**NO**	**NO**
d8 – Artisan turnover above 10%	-.749	96	2.93	**NO**	**NO**
d9 – Staff turnover below 10%	-4.946	94	2.53	**NO**	**NO**
d10–Artisan turnover below 10%	-5.420	94	2.46	**NO**	**NO**
Summed scale					
Staff problem	-3.294	93	10.99	**NO**	**NO**

From the result of the test of one sample mean it is found that d7, d8 are not considered as significantly critical, and so is d9 and d10. This appeared to be unexpected, as a higher turnover rate of staff should affect the operation more than a smaller turnover rate. What we could surmise is that contractors subcontract work as the normal norm. There is only minimum number of fixed staff.

7.3.4 Risk management (Factors E and G in Table 7.2.4)

Management measures to tackle business risks are required and these are investigated. We hypothesised that management measures would significantly reduce the business risks, if considered as effective.

As revealed from factor analysis, factor E looked at risks management due to suppliers. The variables studied were: e1 - regular subcontractors with proven performance as business partners, e3 - long term supply contracts, e4 - subsidiary trading companies to secure regular and reliable source of material.

Factor G looked at risks caused by ISO and staffing. Variables studied were: e5 - record management, e6 - maintain a team of directly employed artisans, e7 - arrange regular training for directly employed artisans to upgrade their skills and safety awareness, e8 - arrange regular training for staff on technical matters and ethical standards, e9 - clear company policy for career advancement, e10 - clear company policy on quality and safety to inspire staff to provide quality installation, e11 - vision and mission statements to inspire on staff company goal and objectives.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not effective", "Slightly effective", "Effective", "Very Effective" and "Extremely Effective". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative effectiveness of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how effective the risks of their business is mitigated and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively effective.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of risks are as follows: 1 Not effective, 2 Slightly effective, 3 Effective, 4 Very effective, and 5 Extremely effective. If the mean value of each of the measures is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Table A in Appendix H4.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale

Null Hypothesis

H4Ao : $\mu = 3$ the risk management is not effective

Alternative Hypothesis

$H4A_A$: $\mu > 3$ the risk management is effective

For summed scale (Factor E with 3 variables)

Null Hypothesis

H4Ao : $\mu = 9$ the risk management is not effective

Alternative Hypothesis

$H4A_A$: $\mu > 9$ the risk management is effective

For summed scale (Factor G with 7 variables)

Null Hypothesis

H4Bo : $\mu = 21$ the risk management is not effective

Alternative Hypothesis

H4B$_A$: $\mu > 21$ the risk management is effective

Tables 7.3.6 and 7.3.7 show the results, and detail testing is at Appendix H4.

Table 7.3.6 Tests on perceived effectiveness of risk management to mitigate risks from procurement

	t	df	Mean	Reject Ho	Risk manage-ment Effective
Individual scale					
e1 – Regular contractor as partner	7.692	95	3.64	yes	yes
e3 – Long term material contract	-3.783	95	2.59	NO	NO
e4 – Subsidiary trading company	-5.182	95	2.43	NO	NO
Summed scale					
Supply chain management	-1.472	96	8.65	NO	NO

Table 7.3.7 Tests on perceived effectiveness of risk management to mitigate risks from staffing

Individual scale					
e5 – Record Mgt to deal with ISO	-5.007	95	2.56	NO	NO
e6 – Employ direct labour	-1.612	95	2.82	NO	NO
e7 – Regular training for artisans	2.019	95	3.19	yes	Yes
e8 – Regular training for staff	5.958	94	3.45	yes	Yes
e9 – Career prospect for staff	7.812	96	3.53	yes	Yes
e10 – Policy on quality & safety	6.460	96	3.54	yes	Yes
e11 – Have vision and mission	3.285	96	3.29	yes	Yes
Summed scale					
Staff management	3.49	94	22.4	yes	yes

Variable e2 - increase number of subcontractors, is not included after the exploratory factor analysis. Reasons possibly behind are that if subcontractors are just another layer in multi-layer subcontracting, it would not be effective unless the subcontractors have been managed properly as part of the supply chain (Dainty *et al.*, 2001).

Variables e3, e4 and e6 are not considered as significantly effective. Reasons behind are possibly due to the fluctuating workload, and make any long term planning for a contractor impossible. In a previous study by Akel *et al.* (2001), it was observed that contractors try to maintain its profitability and competitiveness by even out workload in aspects of material supply and physical work on site. In supply of building material, a typical plant to manufacture building material may operate two 8-hour shifts per day, five days per week, during non-peak seasons. Three shifts, instead of two, are used during the peak season to meet seasonal customer demand to accommodate such market variability. For physical work on site, it is also possible by working more closely with construction owners to reduce its workflow variability and thereby be more competitive and profitable.

The response for variable e4 (setup subsidiary trading company) may also be explained by Porter's proposition of vertical integration. Vertical integration assures the construction contractor that it will receive available supplies in tight periods from its subsidiary or that the subsidiary can always sell the products to other contractors in periods of low overall demand (Porter, 1980). If there is a major long term in-house supplier to a contractor, it should be able to plan better with lower risk of interruptions, elimination of changes in suppliers, and lower risk of being caught in a situation in which prices in excess of average market prices must be paid to meet an emergency (Akel *et al.*, 2001).

Vertical integration can improve the ability of the contractor to differentiate itself from others by offering a wider slice of value added service under the control of management (Porter, 1980). This aspect allows a contractor to differentiate itself from its competitors by providing specialised products, not normally available at competitive prices. A contractor may sometimes increase its overall return on investment by vertically integrating. If the stage of production into which integration is being contemplated has a structure that offers a return on investment greater than the opportunity cost of capital for the firm, then it is profitable to integrate, even if there are no economies of integration (Porter, 1980). After all, the barriers for entry into the industry have always been low (Sozen and Kucuk, 1999). There is also no proprietary technology and no large capital requirement to enter the business, although bonding capacity is an issue (Akel *et al.*, 2001). As mentioned, by integrating construction with other business, a construction contractor could gain an opportunity to learn more about what drives the delivery-to-market of its product and service and gain constructability knowledge that it can incorporate into its designs. The benefits achieved from aforementioned raise mobility barriers and give the integrated firm some competitive advantages over the un-integrated firm, in the form of higher prices, lower risk, or lower costs (Porter, 1980).

Whilst there are advantages for vertical integration, this research indicated a different view of public housing construction contractors on setting up its own material supply subsidiary. The possible reasons might be since material suppliers tend to serve more outside contractors than just the in-house contractor, it exerts high bargaining power in the construction industry. The low entry barriers in the construction industry allow any such material supplier, rather than construction contractor, to potentially forward integrate (Akel *et al.*, 2001). For example, mechanical equipment suppliers could enter the mechanical subcontractor market. Conversely, a construction contractor's forward integration into other construction related business does not elevate mobility and entry barriers, and possibly explain the survey results in which public housing construction contractors do not consider the set-up of subsidiary trading company for building material.

Variable e6 is expected because direct labour has all along been perceived as a relatively non-effective way in the construction industry due to unstable workload and relative high overheads for direct labour (McWilliams and Gray, 1995; Jones *et al.*, 1997) .

For e5, ISO is not considered as critical risk from Table 7.3.1 (variable a8 under Factor A) and hence proper record management was not significantly effective.

Variable e1 is considered as effective and the same result was got from the supplementary survey.

The other risk management measures (e7 to e11) are considered effective as expected as indicated from other researches (Gransberg *et al.*, 1999; Mattila and Abraham, 1998; Chinowsky and Meredith, 2000), but a bit of caution is required on variable e7 as the t value is slightly larger than 1.645. A slight change would affect the conclusion drawn. This supported the view that the construction industry is sceptical on the use of direct labour and hence training on artisans employed.

7.3.5 Quality improvement (Factor H in Table 7.2.4)

Measures are proposed that might improve quality in public housing, and it is hypothesised that these measures are significantly effective to improve quality of public housing.

From factor analysis, factor H looked at effectiveness of quality improvement proposals. Variables investigated are: e12 - equitable terms in the Hong Kong Housing Authority contracts, e13 - award contract to good performers only, e14 - set up registration system for construction workers after trade tests, e16 - disallow uncontrolled subcontracting, e17 - set up Statutory Council, e18 - strengthen site supervision by the Hong Kong Housing Authority.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not effective", "Slightly effective", "Effective", "Very Effective" and "Extremely Effective". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative effectiveness of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how effective the risks of their business is mitigated and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively effective.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of improvement proposals are as follows: 1 Not effective, 2 Slightly effective, 3 Effective, 4 Very effective, and 5 Extremely effective. If the mean value of each of the proposals is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix H4 Table A.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale:

Null Hypothesis

$H5o: \mu = 3$ the improvement proposal is not effective

Alternative Hypothesis

$H5_A: \mu > 3$ the improvement proposal is effective

For summed scale (Factor H with 6 variables)

Null Hypothesis

$H5o: \mu = 18$ the improvement proposal is not effective

Alternative Hypothesis

$H5_A: \mu > 18$ the improvement proposal is effective

Table 7.3.8 shows the results, and detail testing is at Appendix H4.

Table 7.3.8 Tests on perceived effectiveness of quality improvement proposals for public housing

	t	df	Mean	Reject Ho	Quality Proposals Effective
Individual scale					
e12 – Equitable terms	6.331	96	3.62	yes	yes
e13 – Award to good performers	3.954	96	3.62	yes	yes
e14 – Registration of workers	1.551	96	3.16	**NO**	**NO**
e16 – Disallow Uncontrolled subcontracting	1.833	96	3.21	yes	yes
e17 – Setup statutory Council	-.091	96	2.99	**NO**	**NO**
e18 – HA strengthen supervision	-.297	96	2.97	**NO**	**NO**
Summed scale					
Improvement measures	3.141	95	19.39	yes	yes

Variables e14, e17 and e18 are not considered as significantly effective. The possible reason is the belief in the industry that work load, and the share of the cake is more important. Hence quality improvement proposals that do not appear to have a direct tangible effect (equitable contract terms, award to good performers and strengthen its own supervision) are not favoured by the industry.

Registration of workers might be good in the long run, but unless it is specified that contractors has to employ a fixed proportion of registered workers in each contract, the industry might view this as a further increase in cost by hiring registered workers. Again industry sees subcontracting as a form of risk management by reduction of overheads in response to fluctuating workload. There has always been serious objection to disallowing of subcontracting, but some form of control might be effective to improve quality. Hence disallow uncontrolled subcontracting was perceived as relatively effective.

Self-regulation as other professions through the setup of a Building Council to regulate the operation of the industry might be very difficult when considering the immense variety of skills levels, trades in the construction industry as well as the different firms participated in the industry. This explains the response obtained from the survey.

It is also interesting to see the industry's disagreement of strengthening supervision by the Hong Kong Housing Authority. This fits with the agency theory that opportunism will occur and it will never be able to successfully supervise one's agent without incurring huge transaction costs (Sharma, 1997; Williamson, 1993, p.93). The better way then of course is to have equitable terms so that risks are shared equally by the principal and the agent. This is consistent with the test revealed from e12. A partnering (equitable share of risk) concept has been introduced about two years ago by another non-government organisation operating an urban railway system. In its recent construction projects, it stated that the amount of claims from contractors had been reduced substantially from another of its previous railway project.

7.4 Other statistical tests for supplementary survey

For the supplementary survey, similar to what had been created from individual scales, summed scales were formed and the following was carried out:

(i) Responses to the 7 variables a1, a2, a3, a4, a5, a6, a7 making up the factor A1, labelled "Main contractor business practice", were summed to create a scale ranging from 7 to 35.

(ii) Responses to the 5 variables b1, b2, b3, b4, b5 making up the factor B1, labelled "Subcontracting reasons", were summed to create a scale ranging from 5 to 25.

(iii) Responses to the 7 variables c1, c2, c3, c4, c5, c6, c7 making up the factor C1, labelled "Improvement measures", were summed to create a scale ranging from 7 to 35.

7.4.1 Main contractor business practice (Factor A1)

Main Contractor business practice affects the bidding strategy of subcontractors and there are factors affecting the subcontractor's bidding strategy. If a factor is considered as extremely critical, a higher level of contingency might be built into the bid. It is hypothesised that main contractor's business practice would significantly affect the bidding strategy of its subcontractors.

From factor analysis, factor A1 was identified. The variables included in factor A1 were: a1 - The non-existence of a formal written subcontract document, a2 - main contractor adopts flow-on tactic, a3 - subcontractor is paid only after the main contractor is being paid by the client, a4 - to get all the payment for a completed job, subcontractor has to continue work for and paid later by the same main contractor in a new job, a5 - main contractor does not have staff to run the project, a6 - miscellaneous running expenses have to be borne by subcontractor solely, a7 - main contractor adopts bid shopping. Each of the scenario can be tested separately and forms a sub part of the main hypothesis.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not critical", "Slightly critical", "Critical", "Very Critical" and "Extremely Critical". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative criticality of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how critical is their business affected and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point, it is acceptable to force an opinion, for everyone in the survey should be able to tell whether a certain variable is relatively critical.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of risks are as follows: 1 Not critical, 2 Slightly critical, 3 Critical, 4 Very critical, and 5 Extremely critical. If the mean value of each of the perceived risk is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix I4 Table A.

In all the test the significance level α is 0.05 (one sided). The null hypothesis Ho will be rejected if $t > 1.66$ (for degree of freedom of average 150). The test procedure is as below and results in Table 7.4.1:

For individual scale

Null Hypothesis

H6Ao : $\mu = 3$ the perceived risk is not critical

Alternative Hypothesis

$H6A_A$: $\mu > 3$ the perceived risk is critical

For summed scale (with 7 variables)

Null Hypothesis

H6Ao : $\mu = 21$ the perceived risk is not critical

Alternative Hypothesis

$H6A_A$: $\mu > 21$ the perceived risk is critical

Table 7.4.1 Tests on perceived business risks from main contractor business practice

	t	df	Mean	Reject Ho	Main Contractor Business Practice Critical
Individual scale					
a1 – No formal contract	14.201	153	4.17	Yes	Yes
a2 – Flow on tactic	11.439	154	3.97	Yes	Yes
a3 – Pay sub after paid by Client	8.555	154	4.17	Yes	Yes
a4 – Defer payment	4.481	154	3.52	Yes	Yes
a5 – Rely solely on sub	4.659	154	3.48	Yes	Yes
a6 – Sub to bear all expenses	3.199	154	3.34	Yes	Yes
a7 – Bid Shopping	8.801	154	3.86	Yes	Yes
Summed scale					
Main contractor business practice	11.106	154	26.11	Yes	Yes

From the result of the test of one sample mean it was found that all the variables were considered as critical. Obviously a subcontractor is at the mercy of the main contractor, and it is natural to expect the general consensus.

For the summed scale, the factor A1 was also found to be critical.

Details of the test results of the main contractor business practice are shown in Appendix I4.

7.4.2 Your business practice (Factor B1)

Reasons are suggested for further subcontracting from a subcontractor who subcontracts works from a Main Contractor. It is hypothesised that these factors will significantly affect the decision to subcontract. From factor analysis, factor B1 was revealed. The variables included in factor B1 are: b1 - lack of expertise, b2 - heavy workload, b3 - reduce risk of over expansion, b4 - maintain a minimum overhead, b5 - subcontract works to any subcontractors based on price only.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not relevant", "Slightly relevant", "relevant", "Very relevant" and "Extremely relevant". (See also Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative relevance of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how relevant the use of subcontracting is associated with their business and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively relevant.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of risks are as follows: 1 Not relevant, 2 Slightly relevant, 3 Relevant, 4 Very relevant, and 5 Extremely relevant. If the mean value of each of the perceived construct is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix I4 Table A.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale

Null Hypothesis

H6Bo : $\mu = 3$ the reason for subcontract is not relevant

Alternative Hypothesis

$H6B_A$: $\mu > 3$ the reason for subcontract is relevant

For summed scale (with 5 variables)

Null Hypothesis

H6Bo : $\mu = 15$ the reason for subcontract is not relevant

Alternative Hypothesis

$H6B_A$: $\mu > 15$ the reason for subcontract is relevant

Table 7.4.2 shows the results, and detail testing is at Appendix I4.

Table 7.4.2 Tests on perceived relevance of your business practice for subcontracting

	t	df	Mean	Reject Ho	Your Business Practice Relevant
Individual scale					
b1 – due to lack of expertise	4.724	155	3.46	Yes	Yes
b2 – due to workload	-5.073	155	2.51	**NO**	**NO**
b3 – Reduce risk of over-expansion	-1.831	155	2.80	**NO**	**NO**
b4 – Minimise overhead	-2.874	155	2.69	**NO**	**NO**
b5 – Price only	-2.269	155	2.76	**NO**	**NO**
Summed scale					
Subcontracting reasons	-2.11	155	14.23	**NO**	**NO**

From the results, the main reasons for subcontracting are lack of expertise (b1). Other reasons are not considered as significantly relevant.

When a t-test is carried out for the factor B1, the overall result was shown to be not relevant.

The critical importance of subcontracting to the success of construction projects has long been recognised. Gray and Flanagan (1989), in their comprehensive study of subcontracting, concluded that it would account for an increasing proportion of total construction workload. This is because construction contractors use subcontracting as a means of surviving the volatility of the construction business cycle.

In another study by Costantino (2001) some reasons were suggested for subcontracting in the commercial and residential construction in the United States. In his survey 11 different reasons for subcontracting were presented on a five-point scale to respondent contractors. The strongest agreement was found in the need for reducing liability exposure (4.22). This factor was followed by reduced overhead cost (3.87), reduced overall construction cost (3.78), market volatility (3.48), faster construction time (3.35), reduced equipment / maintenance cost (3.30), value to the owner (3.27) and better workmanship (3.09). The high ranking given to liability concerns reflects the fact that in the last 20 years the United States construction industry has witnessed a steady growth of claims and legal actions (Collier, 1996). Construction contractors, therefore, have been using subcontracting to shift liability risks, as stated before.

For variables b5 (Price only), it is necessary to explain this behaviour by reference to the nature of the business transaction between construction contractor and its subcontractors.

The tasks of subcontractors in the transaction may appear straightforward, but further consideration of their role shows that they have to concurrently engage in numerous preparation, production and scheduling tasks across many different projects (Tommelein and Ballard, 1998).

The characteristics of the business transactions between construction contractors and subcontractors indicate that social embeddedness can have significant implications in the co-ordination of these transactions (Granovetter, 1985, 1992). Furthermore, research studies that explore construction contractor–subcontractor transactions (Macneil, 1978; Eccles, 1981; Beardsworth *et al.*, 1988; Hinze and Tracey, 1994; Shash, 1998) also provide strong evidence that social embeddedness is in charge in these transactions. For example, Macneil's (1978) pioneering research on construction contractor–subcontractor transactions identified the subtle operation of social embeddedness in these transactions, and showed that price only is not the only governing mechanism on which parties rely. The research study reported by Eccles (1981) revealed that construction contractors and subcontractors jointly restrict access to these transactions: construction contractors tend to rely on a few subcontractors in each trade and tend to establish long term relationships with them, and similarly subcontractors mostly prefer to work with a rather small set of contractors with whom they establish long term and flexible relationships.

According to Kale and Arditi (2001), restricting access to transaction relationships increases the frequency of transactions between existing parties and enables them to learn from one another to overcome problems caused by newness (i.e. learning new roles, co-ordination problems, developing trust and communication routes, etc.). Kale and Arditi (2001) further pointed out organisational learning at inter-organisational boundaries enables organisations to overcome liabilities of newness, and hence facilitates the co-ordination and integration of complex construction operations. The importance of inter-organisational learning becomes more apparent because of the fact that construction projects are carried out under intense time constraints (Mulholland and Christian, 1999), and because timeliness in construction operations can be achieved by the co-ordination and integration of the many autonomous organisations' efforts. Such interorganisational learning that grows over the course of frequent relationships makes the transaction between the construction contractor and the subcontractor highly asset specific, since the liability of newness clock is set to zero every time a new subcontractor is engaged for a different project (Kale and Arditi, 2001).

Hinze and Tracey's (1994) research study indicated a number of important issues surrounding construction contractor–subcontractor transactions that can also be attributed to the concept of social embeddedness. They reported that some subcontractors refuse to submit quotes to those construction contractors who have the reputation of bid shopping.

In another inquiry of construction contractor–subcontractor transactions, Shash (1998) reported similar observations. Subcontractors are selective in getting involved in transactions with construction contractors, and they consider fairness on the part of the construction firm in its past dealings and particularly its compliance with common professional ethics to be of importance in this selection. Shash (1998) also reported that subcontractors quote similar prices for construction contractors with whom they have done work in the past, and that they increase the price of their quotations submitted to contractors with whom they have limited work experience by 5–10%. Dainty *et al.* (2001) also found out if legislation failed to ensure on-time payments to subcontractor, or to prevent construction contractors from unnecessarily withholding retention payments at the end of contracts, such practices commonly led to cashflow difficulties of subcontractors and to a breakdown in trust relations. To overcome this some subcontractors build in contingencies to their tender submissions to construction contractors to mitigate the risk of late payment.

Past transactions provide subcontractors with information on construction contractors' fairness in terms of prompt payment of amount due, representing the subcontractor's interest during the course of construction operations, and co-ordination and communication behaviour (Hinze and Tracey, 1994; Shash, 1998). This information in turn influences a subcontractor's decision for getting into a transaction with a construction contractor.

Building upon the preceding arguments, it could be suggested that having relationships of high quality with subcontractors is positively associated with a construction contractor's economic performance. Thus the finding in this thesis that price only is not the relevant reason for subcontracting agrees with results of previous studies, and so is the importance of reliable subcontractors as regular business partners.

Without subcontractors as regular business partners, there will be a lack of trust between the transacting parties which will lead to adversarial working relationships (Dainty *et al.*, 2001). Indeed, the cultural issue of mistrust between the parties was seen as a fundamental barrier to the increased understanding of each other's needs and further supply chain integration. In terms of finding solutions to the lack of integration within construction supply chains, subcontractors must be integrated formally into communication and reporting structures within the project organisational structure (Dainty *et. al.*, 2001). Subcontractors saw this as an effective way of allowing them to establish the closer relationships for better supply chain integration.

7.4.3 Quality improvement proposal (Factor C1)

There are possibilities that might improve the quality of the new building construction. It is hypothesised that there are factors that would significantly improve the quality of construction projects.

From factor analysis, factor C1 was revealed. The variables included were: c1 - registration system for construction workers, c2 - strengthen supervision of workers, c3 - strengthen site supervision by clients, c4 - disallow subcontracting, c5 - set up of a registration system of contractors, c6 - award contracts by performance and not just price alone, c7 - Main contractors should treat their subcontractors as business partners.

In the survey, a 5-point Likert scale is used. Each of the point 1 to 5 on the scale corresponds to "Not effective", "Slightly effective", "Effective", "Very Effective" and "Extremely Effective". (See also

Table 7.2.9.) The respondents are not telling their attitude in its literal sense (Trochim, 2000). Rather it indicates the degree of relative effectiveness of a certain variable as perceived by a respondent on a 5-point scale. It should also be noted that the respondents are providing their opinion on how effective the risks of their business is mitigated and these are things which they are familiar with. So instead of the normal Likert Scale with a neutral point in the middle of the 5-point scale, it is acceptable to force an opinion, for everyone in the survey should be able to either agree or disagree that a certain variable is relatively effective.

The method used to test the set of hypothesis is significant testing of the mean. The data for the list of improvement proposals are as follows: 1 Not effective, 2 Slightly effective, 3 Effective, 4 Very effective, and 5 Extremely effective. If the mean value of each of the proposals is significantly larger than 3, it could be regarded as agreement with the statement. Therefore for each of the sub-hypothesis, it will be accepted or rejected depending on whether its mean value is significantly greater than 3. The method to test is the t-test for the means. To ensure the validity of the t-test for mean, normality test for the data was conducted, and the data were found to fit normal distribution, as shown in Appendix I4 Table A.

In the test the significance level α is 0.05 (one sided). The test procedure is:

For individual scale

Null Hypothesis

$H6C_o$: $\mu = 3$ the improvement proposal is NOT effective

Alternative Hypothesis

$H6C_A$: $\mu > 3$ the improvement proposal is effective

For summed scale (with 7 variables)

Null Hypothesis

$H6C_o$: $\mu = 21$ the improvement proposal is not effective

Alternative Hypothesis

$H6C_A$: $\mu > 21$ the improvement proposal is effective

Table 7.4.3 shows the results, and detail testing is at Appendix I4.

Table 7.4.3 Tests on perceived effectiveness of quality improvement proposals for construction projects

	t	df	Mean	Reject Ho	Quality Proposals Effective
Individual scale					
c1 – Worker Registration	6.261	153	3.56	Yes	Yes
c2 – Strengthen Own Supervision	11.248	153	3.90	Yes	Yes
c3 – Client Strengthen Supervision	7.468	153	3.62	Yes	Yes
c4 – Disallow subcontract	-5.336	154	2.41	**NO**	**NO**
c5 – Registry of Subcontractor	4.407	152	3.41	Yes	Yes
c6 – Award on Quality not price	12.561	153	4.06	Yes	Yes
c7 – Subs as Business Partner	12.983	154	4.05	Yes	Yes
Summed scale					
Improvement measures	9.913	154	25	Yes	Yes

The independent sample t tests indicated that contractors included in the Hong Kong Housing Authority and Works Bureau list have a different view with contractors not included in the list on "Disallow subcontracting". This is expected because the former contractors usually have higher turnover than the latter. They would rely to a substantial degree to subcontract their work. For the smaller contractor, they are usually the subcontractors already and directly employ workers. Hence they are less affected by the proposal to disallow subcontracting.

The results of question c6 and c7 were in line with the observation for that from variable b5. In other words price is not the critical reason for subcontracting. What is more important is to have subcontractors as regular business partners.

Whilst c8 was excluded after the factor analysis, Sozen (1999) found a significant negative correlation between the extent of the use of written contracts and the frequency of problems associated with physical progress in a project, whereas the extent of the use of verbal contracts varies directly with the frequency of physical progress problems. In a similar manner, there is a significant positive correlation between the use of verbal contracts and the frequency of control problems associated with physical progress.

The situation in Hong Kong might be different due to the predominance of small firms locally, who still use traditional Chinese management practice. Words of mouth are sufficient for a business transaction.

7.4.4 Comparison of the means of Listed and Non-listed contractors

In the supplementary survey, there are respondents being in the approved lists of contractors of the Hong Kong Housing Authority or the Works Bureau of the Hong Kong SAR Government. Of the about 150 reply, there are about 115 from listed contractors (all categories) and the rest are not-listed. It would be desirable to see whether there is any significant difference in the response to the 3 sets of questions. Independent samples t test were carried out, with details in Appendix I5. For comparison, it is assumed that the variance of the two groups is equal.

Here μ_1 is defined as mean of response for not-listed contractors and μ_2 is defined as mean of response for listed contractors

At significance level α of 0.05, the test procedure is:

Null Hypothesis

$H_o: \mu_1 = \mu_2$

Alternative Hypothesis

$H_A: \mu_1 \neq \mu_2$

Table 7.4.4 shows the results, and detail testing is at Appendix I5.

Table 7.4.4 Independent tests on mean between Non-listed and Listed Contractors

	Mean			t	p -2 tail significance (0.05)		Reject Ho
	Not-List	List	Differ-ence				
a1 – No formal contract	4.05	4.21	0.16	-0.816	0.407	ns	No
a2 – Flow on tactic	3.97	3.97	0.00	0.041	0.964	ns	No
a3 – Pay sub after paid by Client	3.92	3.75	-0.17	0.843	0.420	ns	No
a4 – Defer payment	3.74	3.44	-0.30	1.275	0.254	ns	No
a5 – Rely solely on sub	3.51	3.47	-0.04	0.198	0.842	ns	No
a6 – Sub to bear all expenses	3.31	3.34	0.03	-0.155	0.878	ns	No
a7 – Bid Shopping	4.03	3.80	-0.23	1.041	0.321	ns	No
b1 – due to lack of expertise	3.72	3.38	-0.34	1.602	0.130	ns	No
b2 – due to Workload	2.64	2.47	-0.17	0.769	0.443	ns	No
b3 – No Risk of Over-expansion	3.05	2.72	-0.33	1.371	0.184	ns	No
b4 – Minimise Overhead	3.03	2.58	-0.45	1.711	0.072	ns	No
b5 – Price Only	2.97	2.69	-0.28	1.122	0.244	ns	No
c1 – Worker Registration	3.79	3.49	-0.30	1.387	0.155	ns	No
c2 – Strengthen Own Supervision	4.05	3.85	-0.20	1.066	0.282	ns	No
c3 – Client Strengthen Supervision	3.71	3.59	-0.12	0.529	0.552	ns	No
c4 – Disallow subcontract	3.00	2.21	-0.79	2.968	0.002*	**s**	**Yes**
c5 – Registry of Subcontractor	3.55	3.37	-0.18	0.879	0.388	ns	No
c6 – Award on Quality not price	4.26	4.00	-0.26	1.489	0.182	ns	No
c7 – Subs as Business Partner	4.24	3.98	-0.26	1.474	0.176	ns	No

Follow on from Table 7.4.4, it can be seen that in the independent samples t test, the mean of c4 is different in the listed and non listed contractors. This can be explained by the fact that listed contractors can have contracts direct with the Government, and most of the time they do not have to rely on subcontracting. For non-listed contractor, they have to rely on jobs from main contractor, but being of smaller set-up might have a small group of directly employed workers. Hence their attitude on subcontracting is different from the listed contractors.

7.5 Comparison of improvement proposals in the two surveys

The comparison regarding views on improvement proposals in the main and supplementary surveys is as Table 7.5 below.

Table 7.5 Comparison of responses on improvement proposals of the 2 surveys

Survey	Variables in Improvements	t	df	p value	Mean	Reject Ho	Quality Proposals Effective
Main	e12 – Equitable terms	6.331	96	0.000	3.62	Yes	Yes
Sup	c7 – Subs as business partner	12.983	154	0.000	4.05	Yes	Yes
Main	e13 – Award to good performers	3.954	98	0.000	3.62	Yes	Yes
Sup	c6 – Award on quality not price	12.561	153	0.000	4.06	Yes	Yes
Main	e14 – Registration of workers	1.551	96	0.124	3.16	**No**	**No**
Sup	c1 – Workers registration	6.261	153	0.000	3.56	Yes	Yes
Main	e16 – Disallow Uncontrolled subcontracting	1.833	96	0.045	3.21	Yes	Yes
Sup	c4 – Disallow subcontract	-5.336	154	0.999	2.41	**No**	**No**
Main	e17 – Setup statutory Council	-0.091	96	0.928	2.99	**No**	**No**
Sup	c5 – Registry of subcontractor	4.407	152	0.000	3.41	Yes	Yes
Main	e18 – HA strengthen supervision	-0.297	96	0.767	2.97	**No**	**No**
Sup	c3 – Client strengthen supervision	7.468	153	.000	3.62	Yes	Yes

Some possible reasons for difference in opinions in questions e14 (main survey) and c1 (supplementary survey) are suggested. For the smaller contractor, they are usually the subcontractors and directly employ workers. If the workers are directly employed, under current labour legislation in Hong Kong, it is difficult to deduct wages due to substandard work. For public housing construction contractors, they are the big players who subcontract work to another firm. If the subcontractor did not perform, they can always withhold payment. This becomes commercial dispute, and can resort to determination in law courts. This suggests that the public housing construction contractors are less concerned whether workers are registered or not.

Variables e16 (main survey) and c4 (supplementary survey) basically measure similar things on whether to disallow subcontracting would be effective for quality improvement. The public housing construction contractors agreed that uncontrolled subcontracting caused problems, and by disallowing uncontrolled subcontracting, there should be quality improvement. For the other group of respondents, they opined to disallow subcontracting would not improve quality simply because subcontracting is a mean to provide flexibility to cope with uneven workload in the construction industry. Unless subcontracting is made illegal, there is no way to stamp it out.

For e17 (main survey) - Setup statutory Council, public housing construction contractors are sceptical about the setup of Statutory Council. It was mentioned due to the immense variety of trade in the construction industry, it would be a mammoth task to regulate all of this. In addition from previous research by Chiang *et al.* (2001), it was noted the following ascending order of market concentrations in the local construction industry: private building, public building, property development, and civil engineering. The study argued that technological and capital requirements have imposed a strong barrier to entry into the civil engineering sector, resulting in a concentrated market. Conversely, the lack of technological demand and supply in the private building sector has led to easy market entry and exit. Construction contractors thus compete intensely on cost reduction rather than technology improvement, leading to poor construction safety and product quality. Entry to the market for construction of public buildings is relatively easy, and hence there is a proliferation of subcontractors who wanted to have a share. These subcontractors might be the first layers in the subcontracting chain, or the second, third layer. With the setup of Statutory Council, there will be rules to govern the industry, and might stamp out some of the "brokers" who do not have the actual setup to carry out the construction activities. Thus there is reservation from public housing construction contractors on the setup of the Statutory Council.

For variable c3 (supplementary survey) - Client strengthen supervision, it is obvious that with increased supervision, opportunistic behaviour of contractors would decrease with improvement in quality. For public housing construction contractors, their response on e18 (main survey) - HA strengthen supervision is a bit different. Due to the relatively larger contract sum being considered by public housing construction contractors (when compared with that for contractors' turnover reported in the supplementary survey) it will never be able to successfully supervise one's agent without incurring huge transaction costs. The better way then of course is to have equitable terms so that risks are shared equally by the principal and the agent. This is a positive way to reduce opportunistic behaviour, leading to win-win solution.

7.6 Regression

Regression analysis was used to determine for (a) the main survey which variables predict extent of fines and reprimand (as dependent variables) on public housing contractors and (b) the supplementary survey which variables predict extent of subcontracting.

In the main survey, variable c1 asked what is the amount of fines payable for breaching statutory requirements which would be considered as critical to the contractors. It was noted that 63% of respondents picked the lowest range of below HK$100,000 (the usual range of fine imposed by Law Courts in Hong Kong for first offenders from construction industry.) By regression, the intention was to find out whether any of the independent variables b1 to b5 in the main survey would be associated with the extent of fines considered as critical to the business of the contractors. On suspension from tendering, first offenders are usually given a 3- to 6-month voluntary suspension. Variable c2 asked contractors what period of suspension from tendering would be critical for its business. By regression, the intention was to find out whether any of the independent variables b1 to b5 would predict the period of suspension most likely considered as critical to contractors' business.

In the supplementary survey, variable b7 asked contractors the extent of subcontracting adopted. By regression, the intention was to find out whether any of the independent variables bl to b5 would predict the extent of subcontracting most likely accepted by contractors. Previous research indicated the critical importance of subcontracting to the success of construction projects (Gray and Flanagan, 1989) and in their comprehensive study of subcontracting, concluded that it would account for an increasing proportion of total construction workload.

In another study by Costantino (2001), 11 different reasons for subcontracting were presented on a five-point scale to respondent contractors. The strongest agreement was found (a) in the need for reducing liability exposure; (b) by reduced overhead cost, (c) reduce overall construction cost, (d) market volatility, (e) faster construction time, (f) reduced equipment / maintenance cost, (g) value to the owner, and (h) better workmanship. The high ranking given to liability concerns reflects the fact that in the last 20 years the United States construction industry has witnessed a steady growth of claims and legal actions (Collier, 1996). Construction contractors, therefore, have been using subcontracting to shift liability risks, as stated before.

It is therefore the intention to find out through regression whether the extent of subcontracting can be predicted from any of the variables b1 to b5.

7.6.1 Main survey

From the tests, with b1 to b5 as independent variables and c1 as dependent variable, it was noted none of the independent variables could significantly predict c1. Result was as shown in Table 7.6.1.

Table 7.6.1 Regression results of c1 Vs b1-b5

Model 1	beta	t	Sig. (p)
Constant		3.202	.002
b1	-.017	-.137	.891
b2	.078	.661	.510
b3	-.132	-1.031	.305
b4	.035	.211	.834
b5	.072	.436	.664

For the test with b1 to b5 as independent variables and c2 as dependent variable, it was noted variable b4 is the only significant predictor as shown in Table 7.6.2.

Table 7.6.2 Regression results of c2 Vs b1-b5

Model 1	beta	t	Sig. (p)
Constant	.219	5.609	.000
b1	-.070	-.647	.519
b2	.028	.261	.795
b3	-.149	-1.238	.219
b4	.035	2.132	.036*
b5	-.246	-1.656	.101

* significant at 5%

Variable b4 was related to contractors' obligation to provide a safe working sites for their workers as well as subcontractors. According to a speech given by the Secretary for Works of the Hong Kong Special Administrative Region Government (Lee, 2001), in 1999 and 2000, the annual accident rates for public works contracts were 55 and 46 accidents per 1,000 workers respectively. This was reduced to 33 accidents per 1,000 workers in 2001, representing a reduction of 28% of accident rates as compared with that in 2000. Nevertheless there is still a continuous need to raise the safety awareness of site personnel, in particular construction workers, and to enhance management at site level especially on safety and tidiness to reduce accidents.

Apparently site safety burden is on construction contractors and this is of most concern to them due to the high incidence of safety violations in public works construction sites and the resulting consequences of suspension from tendering for violations as stipulated by the Housing Authority (Hong Kong Housing Authority, 1999a)

7.6.2 Supplementary survey

In the supplementary survey, variable b7 asked contractors the extent of subcontracting adopted. By regression, the intention was to find out whether any of the independent variables b1 to b5 would predict the extent of subcontracting most likely accepted by contractors.

The results were shown in Tables 7.6.3 and 7.6.4.

Table 7.6.3 Regression results of b7 Vs b1-b5 at 0.5%

Model 1	beta	t	Sig. (p)
Constant		8.337	.000**
b1	.068	0.859	.391
b2	.183	2.004	.047
b3	.310	3.993	.000**
b4	.126	1.284	.201
b5	.171	2.070	.040

* * significant at 0.5%

Table 7.6.4 Regression results of b7 Vs b1-b5 at 5%

Model 1	Beta	t	Sig. (p)
Constant		5.916	.000
b1	.048	0.613	.541
b2	.161	1.763	.080
b3	.248	3.015	.003*
b4	.056	0.532	.596
b5	.171	2.070	.040*

* significant at 5%

It was observed the extent of subcontracting could be attributed to reduce risk of over expansion at time of low business (variable b3) and price only submitted by subcontractors (variable b5).

From previous studies by other researchers, the critical importance of subcontracting to the success of construction projects has long been recognised. Gray and Flanagan (1989), in their comprehensive study of subcontracting, concluded that construction contractors use subcontracting as a means of surviving the volatility of the construction business cycle. Of this, survival through the unstable workload is the most important (Low and Tan, 1996). Liability is another concern (Collier, 1996) as construction contractors use subcontractors to share and shift some of the liability. Roles of subcontractors are also becoming important because subcontractors have to concurrently engage in numerous preparation, production and scheduling tasks across the projects (Tommelein and Ballard, 1998). The International Labour Organisation, in its 2001 Report, also suggested that subcontracting will continue as a mean to shift risks from main contractor to subcontractors (International Labour Organisation, 2001).

The importance of subcontractors can also be explained by reference to the nature of the business transaction between construction contractor and its subcontractors. Research studies that explore construction contractor–subcontractor transactions (Macneil, 1978; Eccles, 1981; Beardsworth *et al.*, 1988; Hinze and Tracey, 1994; Shash, 1998) provided strong evidence that social embeddedness is in charge in these transactions. The research study reported by Eccles (1981) also revealed that construction contractors tend to rely on a few subcontractors in each trade and tend to establish long-term relationships with them. He found similarly, subcontractors mostly prefer to work with a rather small set of contractors with whom they establish long term and flexible relationships.

As far as price is concerned Macneil's (1978) pioneering research on builder contractor–subcontractor transactions showed that price is not the only governing mechanism on which parties rely. Hinze and Tracey's (1994) research study indicated some subcontractors refuse to submit quotes to those construction contractors who have the reputation of bid shopping. Shash (1998) also reported that subcontractors quote similar prices for construction contractors with whom they have done work in the past, and that they increase the price of their quotations submitted to contractors with whom they have limited work experience by 5–10%. Dainty *et al.* (2001) also found some subcontractors build in contingencies to their tender submissions to construction contractors to mitigate the risk of late payment, if legislation failed to ensure on-time payment to subcontractors.

Restricting access to transaction relationships increases the frequency of transactions between existing parties and enables them to learn from one another to overcome problems caused by newness, i.e. learning new roles, co-ordination problems, developing trust and communication routes, etc. (Kale and Arditi, 2001). Organisational learning at inter-organisational boundaries enables organisations to overcome liabilities of newness, and hence facilitates the co-ordination and integration of complex construction operations. Moreover the importance of inter-organisational learning becomes more apparent because of the fact that construction projects are carried out under intense time constraints (Mulholland and Christian, 1999), and because timeliness in construction operations can be achieved by the co-ordination and integration of the many autonomous organisations' efforts (Kale and Arditi, 2001).

7.7 Ordered probit using ordered categories as dependent variables

According to Lea (2001), for a dependent variable which is measured on an ordinal scale, linear regression, strictly speaking, should not be used to examine it. However, in practice, so long as the dependent variable has a reasonable number of levels, regression will work perfectly adequately. If the dependent variable is dichotomous, discriminant analysis or logistic regression could be used. However if the dependent variable has 3 to perhaps 6 different levels, ordinary linear regression may give misleading results. Ordered probit analysis is desirable. It uses maximum likelihood methods, and finds the best set of regression coefficients to predict values of the logit-transformed probability that the dependent variable falls into one category rather than another.

The above econometric framework to predict whether a firm is a Government listed contractors has been tested. Another test is to predict, alternatively, using such econometric framework the extent of subcontracting.

The underlying principle for such tests is explained as the following. Response choices in an opinion survey or similar instruments often appear as a discrete choice set rather than a continuous one (Yoshida, 2000). Discrete choice variables fall into two categories: the first is an ordered variable; the second is an unordered variable and econometric methods to analyse discrete choice variables have been developed recently (Maddals, 1983; Ben-Akiva *et al.*, 1985; Greene, 1999). Variables obtained by questions such as the rating and the degree of satisfaction etc. often appear as discrete on a Likert-type rating scales. An ordered probit model can facilitate an analysis of the Likert-type data (Greene, 1999).

In the supplementary survey, of the 157 respondents, some are (i) listed contractors with the Hong Kong Housing Authority only; (ii) listed contractors with the Works Bureau of the Hong Kong Special Administrative Region Government only; (iii) listed contractors with the Hong Kong Housing Authority and Works Bureau and (iv) not listed. From the survey response, it is intended to try to predict what would more likely constitute the answer to the survey from listed contractors (which would more likely subcontract works to subcontractors) and non-listed contractors (which would more likely be subcontracting works and act as subcontractors). The response to the questions in the supplementary survey appeared as discrete rather than continuous and such multiple response choices to these questions had been transformed into the Likert-type rating scales 1 to 5. The ordered-probit model, which can make full use of every response choices, is statistically more efficient than the just a straight "Yes" or "No" using binary probit model. Therefore, the ordered-probit model is employed in this study.

The choice model of respondents can be formulated by using equation under the following form:

Category of contractors = Function of (Main contractor business practice, Your business practice, Quality improvement proposals, Turnover, No. of employees, No. of artisans, Approximate area of workshop, Approximate amount of plant).

Where: Category is 0 for contractors listed under the Hong Kong Housing Authority and Works Bureau (39 firms from the 157 reply);

Category is 1 for contractors listed under Works Bureau only (5 firms from the 157 reply);

Category is 2 for contractors listed under the Hong Kong Housing Authority only (58 firms from the 157 reply);

Category is 3 for contractors non-listed (55 firms from the 157 reply).

Table 7.7.1 The 4 Categories of Construction Contractors in Hong Kong

	Listed with Both	Works Bureau only	Housing Authority only	None
Category	0	1	2	3
Number	39 firms	5 firms	58 firms	55 firms

Four categories are used because major contractors in Hong Kong which have the opportunities to bid for Government construction projects must be listed with the Works Bureau (for all non-public housing government projects) or the Hong Kong Housing Authority (for public housing projects only). For tendering on private sector projects, there is no need to be listed with the

Works Bureau or the Hong Kong Housing Authority. Quite often, major contractors have to get listed with the Works Bureau as well as the Hong Kong Housing Authority. Of course there are also firms which are listed with the Works Bureau or the Hong Kong Housing Authority only, but NOT both. Table 7.7.1 indicates this.

For Test in Appendix I8 to evaluate the extent of subcontracting, the general form is:

Extent of subcontracting = Function of (Main contractor business practice, Your business practice, Quality improvement proposals, Turnover, No. of employees, No. of artisans, Approximate area of workshop, Approximate amount of plant).

where Category is 0 for extent of subcontracting below 20 %
Category is 1 for extent of subcontracting 20-40 %
Category is 2 for extent of subcontracting 41-60 %
Category is 3 for extent of subcontracting 61-80 %
Category is 4 for extent of subcontracting over 80%

The general ordered probit model is formulated as follows:

$$y^* = \beta'\chi + \varepsilon \qquad \text{Equation 7.7.1}$$

y^* is unobserved and thus can be thought of as the underlying tendency of an observed phenomenon, and it is assumed that ε is normally distributed with zero mean. β' is a vector of unknown parameters, and χ is a vector of respondent's characteristics. What is observed is:

$$\begin{aligned} y &= 0, \ \textit{if} \ y^* \leq \mu_0 \ (=0), \\ &= 1, \ \textit{if} \ \mu_0 \leq y^* \leq \mu_1, \\ &= 2, \ \textit{if} \ \mu_1 \leq y^* \leq \mu_2, \end{aligned}$$

.

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$= J, \textit{ if } \mu_{j-1} \leq y^*,$ Equation 7.7.2

where y is observed in J number of ordered categories, and the μs are unknown threshold parameters separating the adjacent categories to be estimated with β. The first threshold parameter, μ_0, is typically normalised to zero, so that there are j-1 parameters to estimate. With the normal distribution, the following probabilities are observed,

$$\text{Prob } (y = j) = \Phi(\mu_j - \beta\chi) - \Phi(\mu_{j-1} - \beta\chi) \quad \text{Equation 7.7.3}$$

where $\Phi(\mu_j - \beta\chi)$ denotes the standardised cumulative normal distribution. In order for all the probabilities to be positive, the requirement must be,

$$0 < \mu_1 < \mu_2 < \cdots < \mu_{j-1},$$

Here, the status of contractors (Government listed contractors or otherwise) and the range of works being subcontracted are the dependent variables in test 1 and test 2 (detailed at Appendix I6) respectively. The independent variables are ordered choice sets with five categories. Response choices to the question are classified as "not critical or not relevant or not effective" (y = 0), "slightly critical or slightly relevant or slightly effective" (y = 1), "critical or relevant or effective"(y = 2), "very critical or very relevant or very effective" (y = 3), and "extremely critical or extremely relevant or extremely effective" (y = 4). The probability predicted is:

$$\begin{aligned}
&\text{Prob } (y = 0) = \Phi(-\beta'\chi), \\
&\text{Prob } (y = 1) = \Phi(\mu_1 - \beta'\chi) - \Phi(-\beta'\chi), \\
&\text{Prob } (y = 2) = \Phi(\mu_2 - \beta'\chi) - \Phi(\mu_1 - \beta'\chi), \\
&\text{Prob } (y = 3) = \Phi(\mu_3 - \beta'\chi) - \Phi(\mu_2 - \beta'\chi), \\
&\text{Prob } (y = 4) = 1 - \Phi(\mu_3 - \beta'\chi), \qquad \text{Equation 7.7.4}
\end{aligned}$$

The log-likelihood function (Equation 7.7.5) can be derived by defining, for each individual, $d_{ij} = 1$ if alternative *j* is chosen by individual *i*, and 0 if not.

$$\ln L = \sum \sum d_{ij} \ln \text{Prob}\,(y_i = j) \qquad \text{Equation 7.7.5}$$

Software LIMDEP was used for the ordered probit analysis.

Output from the program is self-explanatory, but there are two things to be aware (Greene, 1999). Before LIMDEP embarks on the analysis, it does an approximate linear regression, and reports the results. It's easy to read these by mistake instead of the results required. Secondly, it is necessary to recode the dependent variable so it starts from level 0, otherwise the message "Insufficient variation in dependent variable" will appear.

There are four points which can be inferred from the ordered probit analysis as with other regression-type analyses (Maddals, 1983; Ben-Akiva *et al.*, 1985; Greene, 1999):

- How well does the model account for the data?

  The most useful process is to examine the classification table produced at the end of the analysis, comparing actual group membership with membership predicted on the basis of the model. As well as giving a measure of goodness of fit (what proportion of cases were correctly predicted) this may alert the researcher to problems with the analysis - for example if the model does not predict any cases in one or more of the categories.

- Is the overall relationship between the (Independent Variables) IVs and the (Dependent Variables) DV significant?

This is addressed by the log-likelihood ratios (LLR) for the model. The LIMDEP output will include the log likelihood ratio for the null model, in which the coefficients for all regressors are taken as zero, and also for the fitted model. The difference between these two LLRs, multiplied by two, is distributed like chi-squared with degrees of freedom equal to the number of IVs, and so can be used to test the overall significance of the model. A group of regressors to a model can be tested in the same way.

- What is the effect of an individual IV on the DV in the presence of all the other IVs?

  LIMDEP gives regression coefficients which can be interpreted in the usual way, though note that as in logistic regression it gives the effects of a unit increase of the IV on the log odds of the DV taking a higher value, not on the DV itself.

- Is the effect of an individual IV significant in the presence of all other IVs?

  This is tested by a *t* value associated with each IV, exactly as for linear regression. Note that unlike SPSS's Logistic Regression command, it is a *t* rather than a chi-squared test statistics that is produced. The mathematics of this means that marginally significant values should be regarded with caution where sample sizes are small.

The Tests at Appendix I7 was to predict the likelihood of a contractor being a Government listed contractor or otherwise. In Test 1, the significance level was 0.189 and suggested the responses to the surveys were not a good model to predict the behaviour of the different type of contractors. In Test 2, c1 to c8 were removed from the test and the overall significance level was 0.08, a much better improvement. In Test 3, b1 to b6 were excluded, and the overall significance level was 0.56. In Test 4, a1 to a7 were removed, and the overall significance level was 0.348. In Test 5, d4 to d8 were removed, and the overall significance level is 0.126.

From the above, it is possible then to suggest responses from d4 to d8, a1 to a7 and b1 to b6 could be used to predict the likelihood of a firm being a Government listed contractor or just unlisted contractors. The implication from this is that business practice of main contractor and subcontractor could be the empirical indication of whether a contractor is a listed contractor which has a higher tendency to subcontract works to subcontractors. On the other hand, non-listed contractors in Hong Kong usually have to get a part of its work from listed contractors.

In Appendix I8, the dependent variable is b7, the extent of subcontracting for a firm. Tables 7.7.2 to 7.7.4 summarise the test variables, the coefficients, t ratios and p values of the 3 tests. In the 3 tests, the intention is to try to determine the relationships between b7 and all the other variables.

Tables 7.7.2 Order Probit Test for extent of subcontracting (Independent variables, d4-d8, b1-b5, a1-a7)

Variables	Variables	Coefficients	t-ratio	p-value
d4	d4	0.0002	0.177	0.8597
d5	d5	-0.0001	-0.003	0.9978
d6	d6	-0.0010	-0.032	0.9741
d7	d7	0.0005	0.012	0.9908
d8	d8	0.0012	1.356	0.1751
b1	b1	0.0420	0.514	0.6075
b2	b2	0.1256	1.245	0.2132
b3	b3	0.1615	1.861	0.0627
b4	b4	0.0681	0.694	0.4879
b5	b5	0.1869	2.087	0.0369*
a1	a1	-0.0006	-0.005	0.9958
a2	a2	-0.0938	-0.784	0.4329
a3	a3	-0.0014	-0.013	0.9894
a4	a4	0.0191	0.225	0.8221
a5	a5	-0.0262	-0.245	0.8066
a6	a6	0.0386	0.387	0.6991
a7	a7	0.0686	0.718	0.4730

* Significant at 5% level.

Tables 7.7.3 Order Probit Test for extent of subcontracting (Independent variables, d4-d8, a1-a7, b1-b5, c1-c8) .

Variables	Coefficients	t-ratio	p-value
d4	0.0001	0.123	0.9024
d5	-0.0006	-0.017	0.9861
d6	-0.0010	-0.027	0.9782
d7	0.0005	0.011	0.9916
d8	0.0013	1.408	0.1590
a1	0.0253	0.216	0.8294
a2	-0.1085	-0.87	0.3844
a3	-0.0224	-0.195	0.8453
a4	0.0419	0.476	0.6344
a5	-0.0269	-0.258	0.7965
a6	0.0120	0.109	0.9134
a7	0.0813	0.76	0.4471
b1	0.0077	0.081	0.9354
b2	0.0992	0.871	0.3838
b3	0.1812	1.959	0.0502
b4	0.1100	1.04	0.2985
b5	0.1792	1.958	0.0503
c1	-0.0015	-0.033	0.9733
c2	-0.0002	-0.002	0.9986
c3	-0.0016	-0.013	0.9897
c4	0.0350	0.398	0.6907
c5	0.0023	0.029	0.9770
c6	-0.0262	-0.201	0.8409
c7	0.1604	1.344	0.1790
c8	-0.1673	-1.604	0.1086

Tables 7.7.4 Order Probit Test for extent of subcontracting (Independent variables, d4-d8, b1-b5).

Variables	Coefficients	t-ratio	p-value
d4	0.0002	0.161	0.8719
d5	0.0000	0.001	0.9994
d6	-0.0010	-0.035	0.9722
d7	0.0006	0.015	0.9877
d8	0.0010	1.124	0.2612
b1	0.0523	0.719	0.4718
b2	0.1278	1.349	0.1774
b3	0.1302	1.521	0.1282
b4	0.0657	0.696	0.4867
b5	0.1732	2.012	0.0442*

* Significant at 5% level

Table 7.7.5 Summary of Significance level from ordered probit analysis

Table	Tests	Dependent Variable	Independent Variables.	Significance Level
7.7.2	1	b7	d4-d8, a1-a7, b1-b5	0.0001953
7.7.3	2	b7	d4-d8, a1-a7, b1-b5, c1-c8	0.0008139
7.7.4	3	b7	d4-d8, b1-b5	0.0000841

From the 3 tests, it would appear test 3 provides a better prediction for b7 with the best significance level. From test 1 and 3, independent variable b5 has a p-value of smaller than 0.05 and is significant. In other words, the extent of subcontracting can best be predicted by the price quoted by subcontractors. This is supplementary to the findings in paragraph 7.4.2 that price only is not the relevant reason for subcontracting.

The observation from ordered probit analysis is similar to that done in paragraph 7.6 using regression and variables b3 and b5 are the predictors that could best predict extent of subcontracting.

7.8 Partnering in construction industry in Hong Kong

With the quality problems in the public housing construction industry, the industry has been trying to find out if there is a better way to deal with inter-organisation co-operation. Overseas experience as reported by Jaafari (1997) and McGeorge and Palmer (1997) also pointed out that the need for reform within the industry is acute with a growing pressure for organisational, operational, structural, and cultural transformation. Various means have been proposed, and partnering is a method that might resolve some of the problems in the local construction industry. A non-government organisation in Hong Kong has pioneered the use of partnering in the local construction industry.

7.8.1 Local construction industry partnering example

The researcher spent three months (November 2001 and January 2002) under a full-time industrial attachment with a local non-Government organisation, the Mass Transit Railway Corporation Ltd. (MTRCL), to look at how partnering was practised. This is about a local infrastructure project due for opening initially in end December 2002 (Tseung Kwan O Extension project – a 15 km extension of the underground transit system into a suburban neighbourhood in the eastern side of the Kowloon peninsula).

The researcher spent full time working with the project management team on site, and attended meetings at all levels from the top management meeting to site co-ordination meeting within MTRCL as well as with contractors. Numerous discussions were held with MTRCL site staff, contractors' representatives, suppliers, subcontractors and workers. Notes were taken and observations on their daily activities were recorded. Some time was also spent on MTRCL's design office to see how they co-operate with design consultants at the onset of each project.

Local construction project procurement has traditionally followed the route of pre-qualification of suitable contractors and an award to the lowest price tenderer with an acceptable offer (Tam, 1992). Within this strategy, the MTRCL has pioneered the use of progress-related payment milestones, which, together with a proactive approach to settlement of claims, has contributed significantly to maintaining satisfactory progress during construction. In line with study by Diekmann *et al* (1995), MTRCL's policy has always been to allocate to contractors only those risks which they are capable of managing. This has resulted in development of trust and fairness in the relationships between contractors and MTRCL, leading to lower overall tender prices. Those risks which remain with MTRCL, such as unforeseen ground conditions, are identified and actively managed by the experienced project team.

At the commencement of the Tseung Kwan O Extension project, MTRCL introduced the concept of "Partnering" into its relationship with contractors. Initially this focussed on developing a spirit of teamwork and shared objectives between the MTRCL's project management staff and the contractors. Regular partnering meetings were held with contractors and workshops were arranged with external facilitator. A partnering charter was developed and a partnering triangle was established as in figure 7.1.

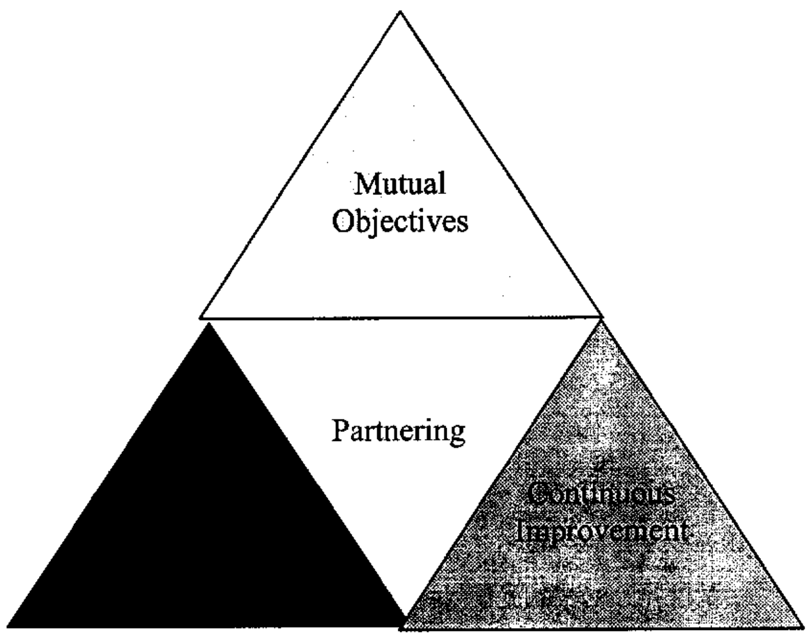

Figure 7.1 Partnering triangle MTRCL (2001)

MTRCL's staff and contractors' staff were requested to complete a questionnaire each month to express views on the other party of how close each individual's expectations were achieved. Similar questionnaires were adopted for construction contractors and all the specialist contractors on the same site. Scores were evaluated and anything noticed that would hinder co-operation was resolved immediately at meetings.

Partnering tips were prepared to facilitate the diffusion of the concepts and practice. These are (Mass Transit Railway Corporation Ltd., 2002):

- Our outward behaviours are influenced by inward beliefs;
- Values and attitudes have to be transformed into co-operative behaviours at all times for partnering to be effective;
- Our ability to influence others depends upon their perception of our willingness to help them meet their needs;
- A Team is a group of people doing something together. It is the "together" that makes the Team and not the "something";
- Co-operation is a more profitable strategy than confrontation;
- Treat others' organisations as you would have them treat yours;
- Trust is the basis of all good business relationship-so build it;
- Good communication builds trust in the relationship;
- Go for win/win or walk away – don't pretend.

MTRCL staff was encouraged to give early response to contractors' submission so that time could be saved in approval of working drawings and materials submissions. The contractual turn around time of four weeks was drastically reduced to around one week. This helped the contractors substantially.

In some of the more sophisticated contracts such as signalling and telecommunications, schemes had to be developed to tailor suit the project. The contractors' project teams were assigned suitable accommodation at the MTRCL project site office and sit next to the MTRCL's project team. Any discussion on technical issues could be effected as soon as possible and decisions made early to enable manufacture to proceed. Time for exchange of correspondence was reduced significantly.

There were also quarterly meetings between MTRCL's Project Director and the directors of contractors. This would resolve any conflict between MTRCL's project management team with the contractor's counterpart. This would eradicate personal conflicts and personality clashes amongst project team members of MTRCL and contractors.

Following the successful implementation of this stage, the partnering concept progressed to a new stage where incentivisation agreements were reached with nearly all contractors for completion of the works, 18 months in advance of the completion date. Very few claims are outstanding and the total project budget has been reduced by 40% from the initial provision. As stated by Carlisle (2001), in one of the tunnelling contracts by a French Contractor, there was saving of around HK$40 million which can directly attribute to partnering, as this contractor was invited to contribute design suggestions for one of the underground station and tunnel. Its suggestion was to redesign the "cut-and-cover" box into a top-down diaphragm wall construction and provided much of the savings, which will be split between MTRCL and the contractor. It also reduced the construction time by five weeks.

MTRCL's experience suggested that partnering does not replace rigorous application of the specification nor does it preclude firm measures in resolving claims. It is not a reason to accept poor workmanship or excuses for delay. It does require a commitment from both sides at all levels to apply their respective skills together to achieve the common objectives, indeed the task culture.

Notwithstanding the above, MTRCL has identified areas for further improvement. These include adoption of limits on extent of subcontracting, specified reductions on waste and greater use of recycled materials.

The need for commitment from the top has been stressed to the corner stone for the success of partnering, and should also be cascaded down the construction supply chain to contractors and its subcontractors and workers (Barlow and Jashapara, 1998). Whilst there was success, there were still some problems with the partnering adopted by the MTRCL. The points noticed by the researcher were:

Commitment from some of the contractors was not particularly strong, and especially for its subcontractors possibly because they saw no real tangible monetary benefits and such was in line with previous study by Wong (1999). In fact there had been one or two cases of strikes because subcontractors were not paid on time. "Pay when paid" is a typical scenario in the construction industry anywhere in the world and as noted by previous researches it has always been detrimental to the site progress and quality of work (Shash, 1998; Hinze and Tracey, 1994).

Some of the MTRCL's staff considered that partnering was an additional burden on them to solve the problems of contractors and such problems, in their opinion, should be resolved by the contractors themselves.

The client had to have a strong project management team which assumed all the co-ordination efforts on site. Such was found to be very expensive, up to nearly 15% of the project cost.

Notwithstanding the above, the partnering was considered as successful. For further infrastructure project, MTRCL plans to implement a further development of the "Partnering" approach, which is to award construction contracts for certain complex transit stations on a Target Cost approach, rather than the traditional procurement method. This will take the following form (Mass Transit Railway Corporation Ltd., 2002):

- initial tender to prequalified contractors comprising outline details and summary quantities;
- assessment based on technical and financial factors;
- shortlist to two tenderers;
- 3-4 months further design by each tenderer in conjunction with MTRCL design team, maintaining confidentiality, to optimise the design;
- second tender stage, based on technical and financial factors;
- selection of Contractor and establishment of project risk register and target cost;
- commencement of construction;
- completion of design, based on chosen method of construction, by MTRCL design team and Contractor.

This method of employing construction contractors will bring further improvement in efficiency to the design process of MTRCL. It will ensure that quality of the contractor's management team becomes a factor in the assessment process and will give incentives to both the client and the contractor to reduce the total cost of the project.

7.9 Problems of the Hong Kong Housing Authority

The Hong Kong Housing Authority has mandated the accreditation of all its construction contractors to ISO9000, but from this research, contractors do not take ISO9000 as critical as noted in the survey. On the other hand respondents to the survey rated questions a2 (Bureaucracy of Client Staff), a3 (Not accept design errors) and a4 (Subjective interpretation) as significant. Does this imply something?

Tenner and DeToro (1994, p.31) defined quality as "a basic business strategy that provides goods and service that completely satisfy both internal and external customers by meeting their explicit and implicit expectations". In international standard ISO9000:2000, the standardised definition of quality refers to all those features of a product (or service) which are required by the customer (ISO9000, 2000). Both definitions shared things in common. Within both there is an unstated assumption that not everything will work correctly all of the time. There is a certain level of malfunction which is acceptable. Usually, it costs more to achieve high levels of reliability and much more to achieve the highest levels. This applies particularly to construction projects.

There has been much debate on the suitability of ISO9000 quality management system when applied to the construction industry. Seymour and Low (1990), Low (1993) and Shammas-Toma *et al.* (1996) had all argued that the conditions of the construction industry do not lend itself to the successful implementation of a formal quality management system like the ISO9000. They contended that it leads to a stifling of initiative, increased confrontation and excess cost and paperwork, which ultimately reduce rather than enhance quality. Indeed, quality assurance such as the ISO9000 has been viewed by many as no more than an administrative burden that encumbrances the company both financially and culturally (Jaafari, 1996).

On the contrary, there have been many examples of construction organisations applying the ISO9000 quality system and successfully reaping benefits such as better quality, efficiency and co-ordination between clients and contractors. The negative impacts of ISO9000 in relation to stifling of initiative and increased confrontation were also observed to be absent following a survey and interview of various United Kingdom construction firms (Moatazed-Keivani *et al.*, 1999).

Interview-surveys conducted by the CIRIA (1996) and Moatazed-Keivani *et al.* (1999) to gather the perceptions and experiences of the United Kingdom construction industry both concluded that the implementation of ISO9000 and its predecessor, BS5750, had contributed to some improvement for firms by increasing their management efficiencies and overall image of the company. However ISO9000 also brought with them increased bureaucracy, paperwork cost and time consumption. Many other similar surveys (Jones *et al.*, 1997; Tang and Kam, 1998; Leung *et al.*, 1999) have also been conducted with mixed findings.

As suggested by MTRCL, obstacles to achieving the required quality on construction projects arise in the following areas (Mass Transit Railway Corporation Ltd., 2002):

- General Obstacles - lack of knowledge, contractual difficulties and correctly defined needs or pre-requisites;
- Organisational Obstacles - inefficient organisation, indistinct responsibilities and unsatisfactory working procedures;
- Personnel Obstacles - lack of competence, lack of insight, human errors and personality deficiencies.

With the diverse views on the suitability of ISO9000 in the construction industry, there could be problems which arise due to inherent situations of the Hong Kong Housing Authority and the construction process associated with its public housing construction projects, particularly those projects with many contract interfaces. The findings from this research shared some of the propositions by MTRCL (personnel obstacles) and suggested the quality of the individuals involved (client staff in particular) and their willingness to work together is highly important to achieve the required product quality. This observation was also in line with research by Egbu (1999) and Chan (2000) which put project management action of project team and effectiveness of construction team leader as significant factors to predict quality of building projects. The implied needs to achieving quality - namely clear communications, good working relationships, unequivocal commitment to achieving project goals and response to "outside" concerns must be met (Sanvido *et al.*, 1992). These are not items which can be specified in contractual terms. From conception through design, construction, testing and commissioning, this "right approach" must be adopted and it requires qualities in the management and design teams of the client (Jaselskis and Ashley, 1991) which do not appear in ISO9000 requirements, namely:

- engineering creativity;
- professional competence;
- unequivocal commitment;
- insight to assess the implied needs.

Whilst methods may be deployed to extract the benefit from these qualities (systems engineering; risk analysis, etc.) the methods alone cannot generate them. They exist in the quality of the design and construction team assembled for the project only (Jaselskis and Ashley, 1991).

A successful approach to construction project management can only be found as follows (Chua *et al.*, 1999):

- thorough preparation;
- technically competent staff;
- clearly defined responsibility and accountability;
- clear reporting lines;

- rapid decision making at all levels;
- well-defined but flexible procedures.

The Hong Kong Housing Authority has technically competent staff, but appeared to have failed in the other aspects. The demand for newly completed flats resulted in tremendous pressure, and it is prudent to say there has not been enough preparation and study. The Hong Kong Housing Authority shortened the construction period (Moy and Tse, 1999), but was found afterwards creating problems for contractors and the construction period has to be reverted back to the previously adopted period (Hong Kong Housing Authority, 2000). The worse problem stems from the last 2; and in particular procedures. The Hong Kong Housing Authority has too well defined but totally inflexible procedure as reported in Hong Kong Standard Editorial (2000). "At the department, paper is treated as more important than substance", they said. Furthermore, "Staff directly responsible for construction quality spends most of their time at a desk in Housing Department headquarters".

7.9.1 Partnering in the Hong Kong Housing Authority

To respond to the criticism from the public housing construction industry, the Hong Kong Housing Authority had introduced partnering as a trial in a few projects. Its Chairman claimed that it has already taken action to share the risk on piling works and other aspects: liquidated damages have been halved and contract periods extended; engineer design will be used where appropriate, and on existing contracts, the Hong Kong Housing Authority is looking at providing extra contractual relief where unforeseen ground conditions have been encountered (Cheng, 2002).

He further advised there will be a review of the Hong Kong Housing Authority conditions of contract to ensure that there is equitable risk sharing since contracts should reflect the partnering agreements that are emanating from the partnering workshops to be held on every new project.

Cheng (2002) stressed the Hong Kong Housing Authority partnering implies avoidance of disputes, and means good communication, a common understanding of mutual expectations and a common will to resolve problems together, irrespective of whose problem it is. In addition, mutual trust will take time to build and that means face-to-face communication as well as effective communication facilitated by common goals, good business results, and a pride in what was done.

Cheng (2002) emphasised that professional pride in the buildings created means integrity and a job well done from the planning and design, through to the fixing of steel and the tiling of walls. Construction sites should care for human life and the dignity of the workforce, resulting in homes built which owners and tenants are proud of.

Cheng (2002) considered the Hong Kong Housing Authority drives will include research and development; encouragement of new construction techniques and materials; more innovative procurement to sustain long term continuity with partners; and the increased use of information technology in the construction industry. He concluded that this sustained evolution can only be achieved through "Partnership".

In Hong Kong Housing Authority perspective, the key components for a successful partnership are (Cheng, 2002):

- common understanding of mutual expectations;
- procurement processes which reward quality;
- equitable sharing of risk;
- expeditious decision-making to avert disputes;
- co-operative and pragmatic approach to problem solving;
- speedy and efficient dispute resolution and contract settlement;
- investment in training and technology;
- professional pride in all that were done.

7.9.2 The Hong Kong Housing Authority Partnering – Views of contractors

Since end 2000, some of the public housing contractors had undergone partnering sessions for a few Hong Kong Housing Authority construction projects. There was different degree of achievements.

The usual arrangement, after contracts are awarded, is a one and a half-day partnering workshop which was conducted with an external facilitator. A partnering charter was signed and implemented by all parties including the Hong Kong Housing Authority's staff, contractor, subcontractors and suppliers. Monthly meetings were conducted to review improvement or otherwise of all the agreed share objectives and actions taken.

This partnering was characterised by the following observations (Ho, 2002):

- Clients was involved in project core teams to signal their commitment to partnering;
- Design and construction are starting to be integrated and streamlined;

- Designers are working with contractors to improve design;
- Adversarial attitudes between teams remain but moving towards humanities under the legal and contractual framework;
- Professionals were empowered to use best practice defined by their own professional bodies and education;
- There was little change in the workers, except allowed to work more consistently with fewer interruptions;
- There might be cost savings, time savings but quality did not change yet.

With all the above, contractors still thought the first generation of partnering was worthwhile because some humanities were brought into the bureaucracy of the Hong Kong Housing Authority and there was of course better understanding of the client and contractor which was most beneficial to the projects (Ho, 2002).

After the various piling scandals in previous Hong Kong Housing Authority projects, every Hong Kong Housing Authority project team was reluctant to make any decision which deviates from approved drawings or specifications even though it would be an improvement. It was not uncommon that minor decisions were passed back to very senior level, and there was no incentive to improve the process. With introduction of partnering, it was observed that the Hong Kong Housing Authority project team took a lead to bring matters back to the design standards team, and the partnering culture had helped to get that happen (Ho, 2002).

Site forums conducted by the Hong Kong Housing Authority were a success as relevant stakeholders were all gathered together to resolve practical issues.

The partnering culture needs to be cultivated throughout the organisation to make this works and this is another cultural change.

Finally contractors opined that the trial partnering could be improved, as partnering was brought in after contracts were awarded and it is further proposed that the contractor should be involved early in the process giving advice on buildability in construction design, construction method and advising on construction costs (Ho, 2002). Ho (2002) also observed that by bringing in contractors early, the cost and time should roughly be the same as similar buildings constructed using the traditional competitive procurement system.

7.9.3 The Hong Kong Housing Authority Partnering – Will it succeed?

The views on the Hong Kong Housing Authority led partnering in paragraph 7.9.2 (unwillingness on project staff to make decisions etc.) was not unusual as predicted by previous research in public sector construction partnering in the United Kingdom.

The public sector in the United Kingdom spends approximately £22 billion (Meikle, 1997) on construction and maintenance contracts each year. Therefore, by far, it is the most important single customer in the United Kingdom construction industry. (This is a similar scene in Hong Kong.) Because of this, arguably, it is government rather than the industry which sets the rules for customer-supplier interactions as far as public sector construction contracts are concerned.

However such was not observed in the United Kingdom public sector. As Erridge (1998) stated, there had been a marked reluctance on the part of government departments and other public bodies to enter into longer-term and closer relationships with suppliers. This seemed somewhat puzzling superficially since United Kingdom Government had always been interested in value for money and this had been pursued relentlessly since 1979 (Ferlie *et al.*, 1996, p.30-55). With the election of a Labour administration in 1997, there was still the same aim (Meikle, 1997). Given that construction partnering, as a minimum, claimed to offer reduced costs and improved quality, it was natural to believe that the public sector in the United Kingdom would have been keen to promote it (Burnes and Dale, 1998).

Within the private sector construction market in the United Kingdom, the concept of construction partnering has become hugely influential over the past 15 years (Burnes and Dale, 1998; Carlisle and Parker, 1989; Hines, 1994; Lamming, 1993). It has reached the level of orthodoxy rather than being merely an interesting concept (Burnes and New, 1996).

In an attempt to understand why the public sector had been less than enthusiastic about partnering in construction projects, research by Burnes and Coram (1999) examined the purchasing policies and practice of the United Kingdom central government departments in relation to construction contracts and services.

The research indicated whilst there had been some encouragement for closer, and more long-term collaboration as observed in the study, in reality government departments in United Kingdom seemed to be stuck in a short-term, win-lose orientation. Such was a result of four factors as suggested by Burnes and Coram (1999): (a) the lack of experience among both purchasers and providers of long-term partnership arrangements; (b) the risk-aversive nature of the Civil Service; (c) the pressure on departments from ministers to minimise risk; and (d) government guidelines on competitive tendering which make it difficult to enter into long-term agreements.

The above observations tally with that noticed by public housing construction contractors in Hong Kong. It would therefore be interested to see how the Hong Kong Housing Authority could overcome this, and in particular (b) and (c), which are cultural issues. Some critics actually suggest that public sector service should be privatised, otherwise organisation cultures would never be changed. The MTRCL could overcome this due to it being setup initially as a private enterprise, and organisation culture is markedly different from the usual Hong Kong Special Administrative Region Government Departments.

The Hong Kong Housing Authority should rely on its previous experience with that prospective partner (a quality construction contractor) and with reference to the potential partner's compliance with the Hong Kong Housing Authority's expectations in a new contract (Hinze and Tracey, 1994; Shash, 1998). These experiences must be noted and retained through learning. This way, the Hong Kong Housing Authority can address the hazards of opportunism by developing trust (i.e. the belief that the quality contractor's word is reliable, that it will fulfil its obligations in a future contract), co-ordination routines and effective communication processes (Dainty *et al.*, 2001). The impact of relationships with a quality contractor becomes more evident and emerges as an important strategic factor in co-ordinating future construction contracts where the Hong Kong Housing Authority and its contractors cannot solely rely on a price mechanism and/or a contract (Williamson, 1993, p.93). Thus the advantages of maintaining relationships with quality contractors and the transactions that promote, establish and sustain good relationships could be preserved and maintained (Dainty *et al.*, 2001).

Having said that, the Hong Kong Special Administrative Region Government guidelines on competitive tendering and corruption prevention make it difficult to enter into long-term partnership with quality contractors and this is difficult to be overcome. The reason is simply because there is the need to be accountable for public expenditure, to promote competition with value for money and to avoid criticism for favouritism to any particular contractors and allegation of corruption (Burnes and Coram, 1999). It was suggested that unless public expenditure regulations in civil service were changed (Erridge, 1998), there did not appear to be any major break through for civil servants to risk their career to have a long-term partnership with particular contractors or quality contractors. A balance or a mechanism should be set up to keep the ideals of the partnering spirit as well as the need to be accountable and be impartial when spending public moneys.

7.10 Summary

This Chapter reported the analysis of the data collected in the 2 surveys. The descriptive statistics were first presented. There was then factor analysis to examine which of the variables in the survey to be included in each of the factors. One sample t-test was then carried out to test each of the variables as well as the factors formed from the summed scales of all the different variables. The results of the two surveys were compared. Regression was carried out on some of the variables. Ordered probit analysis further supplemented the results from regression. There was then the case study on partnering adopted in a local subway construction project. Partnering, as now adopted by the Hong Kong Housing Authority was considered and its effectiveness discussed.

CHAPTER EIGHT

8. CONCLUSIONS

Chapter Eight presents conclusions from the study. Some recommendations are put forward as well as the limitation of the study. Issues for further research are also presented.

8.1 General remarks

The aim of the research has been to identify whether public housing construction in Hong Kong is a risky business, and it has not been possible to verify this quantitatively through the share prices of listed contractors. The reason is possibly due to the small number of listed construction contractors in Hong Kong. In terms of turnover, most of them derive some of their business from areas other than public housing construction. Nevertheless return (before tax) on turnover of construction business is low, at around 2% to 3%.

On the other aspects of the research, there is consensus from public housing contractors that Government departments (e.g. Hong Kong Housing Authority and Housing Department) are bureaucratic and hinders business transaction. The mentality of the civil service is risk aversive and officers prefer to do less to avoid mistakes. They tend to follow rules and procedures, no matter how irrational or inhumane some of these are. Changes could only be coming from the top management, rather than the current belief that different level of staff should be the owners of the relevant business process and have the ability and decision to adapt to suit the expectations of all the stakeholders.

Construction contractors and its subcontractors can have long term partnership as risk management but that is not the case with the Hong Kong Housing

Authority and its public housing construction contractors. The reasons have been suggested in Chapter 7. Superficially this is something difficult to be overcome, and requires new thinking, ideas, commitment and drive to overcome. Hopefully the Hong Kong Housing Authority is aware of this, and if the reforms can be introduced successfully, it could be a win/win for all the stakeholders. In particular the tax payers in Hong Kong will be benefited as they had in the past foot the bills for rectification of most of the defective public housing construction works in the last two decades.

The conclusions drawn from the various parts of the study are as below.

8.1.1 Profitability

From Chapter 4 Section 4.3, it has been identified that the percentage return on turnover of construction contracts in public housing is generally low compared with civil engineering contracts. Hence most of the construction contractors in Hong Kong are not limited to one particular area of business and have diversified into many other businesses. This is required to reduce the risk inherent with the construction business.

Public housing contractors are subject to uneven workload and they employ various ways to mitigate the risks and subcontracting is one of the widely adopted means and has been a business strategy for survival. Whilst contractors need to be flexible, they are aware that price with its subcontractors should not be the main reason for selection of a particular subcontractor. Regular business partners should be positively associated with its economic performance.

8.1.2 Results of main survey

The results from the eight factors of the main survey are as below:

Table 8.1 Summary of results of main survey

Factor A – Client Factors	**Perceived Risk Critical**	
	Individual	**Overall**
a1 – Basic Info. in Tender	yes	yes
a2 – Bureaucracy of Client Staff	yes	
a3 – Not accept design errors	yes	
a4 – subjective interpretation	yes	
a5 – HK$100,000 as LD	yes	
a6 – Inequitable Contract Terms	yes	
a7 – Performance Assessment	NO	
a8 – ISO and paperwork	NO	
a9 – Award contract by price	yes	
Factor B – Statutory requirement	**Perceived Risk Critical**	
	Individual	**Overall**
b1 – Noise Ordinance	NO	NO
b2 – Employ overseas workers	NO	
b3 – Prosecution illegal workers	NO	
b4 – OH&S requirements	NO	
b5 – Unexpected safety checks	NO	
Factor C – Poor performance ramifications	**Perceived Risk Critical**	
	Individual	**Overall**
c3 – Poor reputation	yes	yes
c4 – No tendering in private sector	yes	
Factor D – Suppliers problem	**Perceived Risk Critical**	
	Individual	**Overall**
d1 – Suppliers price above 5%	yes	yes
d2 – Incompetence of suppliers	yes	
d3 – Performance of subcontractors	yes	

d5 – limited suppliers	yes	
Factor F – Staff problem	**Perceived Risk Critical**	
	Individual	**Overall**
d7 – Staff turnover over 10%	NO	NO
d8 – Artisan turnover above 10%	NO	
d9 – Staff turnover below 10%	NO	
d10 – Artisan turnover below 10%	NO	

Factor E – Supply chain management	**Risk management effective**	
	Individual	**Overall**
e1 – Regular contractor as partner	yes	NO
e3 – Long term material contract	NO	
e4 – Subsidiary trading company	NO	
Factor G – Staff management	**Risk management effective**	
	Individual	**Overall**
e5 – Record Mgt to deal with ISO	NO	yes
e6 – Employ direct labour	NO	
e7 – Regular training for artisans	yes	
e8 – Regular training for staff	yes	
e9 – Career prospect for staff	yes	
e10 – Policy on quality & safety	yes	
e11 – Have vision and mission	yes	

Factor H – Improvement measures	**Quality proposals effective**	
	Individual	**Overall**
e12 – Equitable terms	yes	yes
e13 – Award to good performers	yes	
e14 – Registration of workers	NO	
e16 – Disallow Uncontrolled subcontracting	yes	
e17 – Setup statutory Council	NO	
e18 – HA strengthen supervision	NO	

The conclusions of the test results are:

For Factor A, it is found that two of the variables a7 and a8 were not supported. All the other variables were supported and considered as critical. The possible explanation for a7 not being considered as critical is that under current situation, the rating from the performance assessment does not give tendering advantage for contractors with high assessment. If some cut-throat bids come in, it is still the lowest bidder be given the job. Hence until the system of contracts award changes, performance assessment does not have any real significance. The incentive for quality has to be related to real tangible benefits which the contractors could enjoy.

Variables b1, b2, b3, b4 and b5 under Factor B are not considered as significantly critical. Reasons possibly behind are that violation would mean a fine. This might already be considered as part of the operating expenses. On the other hand with poor reputation and loss of tendering opportunity (Factor C), turnover would be substantially affected. Hence it explained why c3 and c4 were perceived as critical.

From the result of the test of one sample mean it is found that d7, d8 are not considered as significantly critical, and so is d9 and d10. This appeared to be unexpected, as a higher turnover rate of staff should affect the operation more than a smaller staff turnover rate. Possible reason is that contractors subcontract work as the normal norm. There is only minimum number of fixed staff.

Variables e3 and e4 are not considered as significantly effective. Reasons behind are possibly due to the fluctuating workload, and make any long term planning for a contractor impossible.

Variable e6 is expected because direct labour has all along been perceived as a non-effective way in the construction industry due to unstable workload and relative high overheads for direct labour.

For e5, ISO is not considered as a critical risk and hence proper record management is not significantly effective.

The other risk management measures (e7 to e11) are considered effective. This supported the view that the construction industry is sceptical on the use of direct labour and hence training on artisans employed.

Under Factor H Improvement Measures, variables e14, e17 and e18 are not considered as significantly effective. The possible reason is the belief in the industry that work load, and the share of the cake is more important. Hence quality improvement proposals that do not appear to have a direct tangible effect (equitable contract terms, award to good performers and disallow uncontrolled subcontracting) are not favoured by the industry.

Registration of workers might be good in the long run, but unless it is specified that contractors has to employ a fixed proportion of registered workers in each contract, the industry might view this as a further increase in cost by hiring registered workers. Again industry sees subcontracting as a form of risk management by reduction of overheads in response to fluctuating workload. There has always been serious objection to disallowing of subcontracting, but uncontrolled subcontracting has been blamed for the cause of the problem. Hence contractors perceived that disallow uncontrolled subcontracting might be effective to improve quality.

It is also interesting to see the industry's disagreement of strengthening supervision by the Hong Kong Housing Authority. This fits with the agency theory that opportunism will occur and it will never be able to successfully supervise one's agent without incurring huge transaction costs. The better way then of course is to have equitable terms so that risks are shared equally by the principal and the agent. This is consistent with the test revealed from e12.

8.1.3 Results of supplementary survey

The conclusions drawn from the supplementary survey are summarised below.

Table 8.2 Summary of results of supplementary survey

Factor A1 – Main contractor business practice	**Perceived Risk Critical**	
	Individual	**Overall**
a1 – No formal contract	yes	yes
a2 – Flow on tactic	yes	
a3 – Pay sub after paid by Client	yes	
a4 – Defer payment	yes	
a5 – Rely solely on sub	yes	
a6 – Sub to bear all expenses	yes	
a7 – Bid Shopping	yes	

Factor B1 – Subcontracting reasons	**Reasons Relevant**	
	Individual	**Overall**
b1 – Due to lack of expertise	yes	NO
b2 – Due to workload	NO	
b3 – Reduce risk of over-expansion	NO	
b4 – Minimise overhead	NO	
b5 – Price only	NO	

Factor C1 – Improvement measures	Improvement Effective	
	Individual	Overall
C1 – Worker Registration	yes	yes
c2 – Strengthen Own Supervision	yes	
c3 – Client Strengthen Supervision	yes	
c4 – Disallow subcontract	NO	
c5 – Registry of Subcontractor	yes	
c6 – Award on Quality not price	yes	
c7 – Subs as Business Partner	yes	

From the results, the business risks as viewed by subcontractors in its business transaction with main contractors are the inequitable terms stated in a1 to a7. This observation is consistent with that from the main survey.

For variable b1, relevant reason for subcontracting is lack of expertise. Variables b2, b3 and b4 – workload, reduce risk of over expansion and minimise of overheads are not considered as significantly relevant reasons for subcontracting. In variable b5, price is considered as not the relevant reason for subcontracting, and this agrees with results found in variables a9, d3 and e12 of the main survey.

8.1.4 Comparison of results of the two surveys

The comparison regarding views on improvement proposals in the two surveys is as Table 8.3 below.

Table 8.3 Comparison regarding views on improvement proposals

Survey	Variables in Improvements	Quality Proposals Effective
Main	e12 – Equitable terms	Yes
Sup	c7 – Subs as business partners	Yes
Main	e13 – Award to good performers	Yes
Sup	c6 – Award on quality not price	Yes
Main	e14 – Registration of workers	**No**
Sup	c1 – Workers registration	Yes
Main	e16 – Disallow Uncontrolled subcontracting	Yes
Sup	c4 – Disallow subcontract	**No**
Main	e17 – Setup statutory Council	**No**
Sup	c5 – Registry of subcontractor	Yes
Main	e18 – HA strengthen supervision	**No**
Sup	c3 – Client strengthen supervision	Yes

Some possible reasons for difference in opinions in variables e14 (main survey) and c1 (sup. survey) are suggested. For public housing construction contractors, they are the big players who subcontract work to another firm. However, for the smaller contractors, they are usually the subcontractors and directly employ workers. If their subcontractors did not perform, the public housing construction contractors can always withhold payment. For the smaller contractors with directly employed workers, it is not easy to deduct salary for poor performance from directly employed workers. This suggests that subcontractors want workers registration so that skills of workers can be ascertained.

Variables e16 (main survey) and c4 (sup. survey) basically measure similar things. The public housing construction contractors agreed that uncontrolled subcontracting caused problems, and by disallowing uncontrolled subcontracting, there should be quality improvement. For the subcontractors, they opined disallow subcontracting would not improve quality simply because subcontracting is a mean to provide flexibility to cope with uneven workload in the construction industry.

Unless subcontracting is made illegal, there is no way to stamp it out.

For e17 (main survey) - Setup statutory Council, public housing construction contractors are sceptical about the setup of a Statutory Council. With the setup of a Statutory Council, there will be rules to govern the industry, and might stamp out some of the subcontractors (brokers) who do not have the actual setup to carry out the construction activities. Thus there is reservation from public housing construction contractors on the setup of the Statutory Council.

For variable c3 (supplementary survey) - Client strengthen supervision, it is obvious that with increased supervision, opportunistic behaviour of contractors would decrease with improvement in quality. For public housing construction contractors, their response on e18 – Hong Kong Housing Authority to strengthen supervision is a bit different. Due to the relatively larger contract sum in public housing construction contracts (when compared with that for contractors' turnover reported in the supplementary survey), it will never be able to successfully supervise the contractor without incurring huge transaction costs. The better way then of course is to have equitable terms so that risks are shared equally by the principal and the agent. This is a positive way to reduce opportunistic behaviour, leading to win-win solution.

8.1.5 Results and implications of the observations from questions related to subcontracting

One of the main themes of this research is on subcontracting as a form of risk management, and the subcontractor, as a business partner whose performance is important to the success of the main contractor. 6 variables in the main survey were related to this.

For the supplementary survey, variables b5 and c7 are looking at similar themes of the importance of subcontractors as regular business partners. Price should always not be the main criteria for subcontracting.

The summary of these is in Table 8.4 below.

Table 8.4 Summary of results of main and supplementary survey relating to subcontractors as business partners

Main survey

Factor A – Client Factors	**Perceived risk critical**
a6 – Inequitable contract terms a9 – Award contract by price	Yes Yes
Factor D – Suppliers problem	**Perceived risk critical**
d3 – Performance of subcontractors	Yes
Factor E – Supply chain management	**Risk management effective**
e1 – Regular contractor as partner	Yes
Factor H – Improvement measures	**Quality proposals effective**
e12 – Equitable terms e16 – Disallow uncontrolled subcontracting	Yes Yes

Supplementary survey

Factor B1 - Reasons for subcontracting	**Your business practice relevant**
b5 – Price only	NO
Factor C1 – Improvement measures	**Quality proposals effective**
c7 – Subs as business partner	Yes

The findings from the 6 variables in the main survey and the 2 variables from the supplementary survey are consistent and point to the need to have equitable terms between client / contractors. Such can also apply to contractors and subcontractors. Award of contract by price is not a good way to provide quality. Due to the need for risk management, performance of subcontractors is critical, and so are subcontractors as a regular partner. Contractors are in favour of the ban on uncontrolled subcontracting, i.e. contractors with just an empty shell and who sublet all the work are causing problems to the construction industry. This is the practice that must be addressed.

8.1.6 Regression

For the main survey, the intention was to find out whether any of the independent variables b1 to b5 would be associated with the extent of fines (variable c1) considered as critical to the business of the public housing contractors.

From the tests, with b1 to b5 as independent variables and c1 as dependent variable, it was noted none of the independent variables could significantly predict c1.

On suspension from tendering, first offenders are usually given a 3- to 6-month voluntary suspension. Variable c2 asked contractors what period of suspension from tendering would be critical for its business. By regression, the intention was to find out whether any of the independent variables b1 to b5 would predict the period of suspension most likely considered as critical to its business.

For the test with b1 to b5 as independent variables and c2 as dependent variable, it was noted variable b4 is the only significant predictor as shown in Table 7.6.2 in Chapter 7.

Variable b4 was related to contractors' obligation to provide a safe working sites for their workers as well as subcontractors. According to a speech given by the Secretary for Works of the Hong Kong Special Administrative Government (Lee, 2001), in 1999 and 2000, the annual accident rates for public works contracts were 55 and 46 accidents per 1,000 workers respectively. This was reduced to 33 accidents per 1,000 workers in 2001, representing a reduction of 28% of accident rates as compared with that in 2000. Nevertheless there is still a continuous need to raise the safety awareness of site personnel, in particular construction workers, and to enhance management at site level especially on safety and tidiness to reduce accidents. Site safety is a burden on construction contractors and this is of most concern due to the high incidence of safety violations in public housing construction sites and the resulting consequences of suspension from tendering for violations as stipulated by the Hong Kong Housing Authority.

In the supplementary survey, a variable was on the % of works being subcontracted. A regression analysis was carried out to find out what were the most likely predictors to predict the extent of subcontract. Here the dependent variable is b7 (Subcontract amount); the independent variables are b1 to b5.

At 0.5% significance level, it is noted that b3 (no risk of over-expansion) is significant as predictors. At 5% significance level, it is noted that b3 (no risk of over-expansion) and b5 (price is the only consideration) are significant as predictors.

Macneil's (1978) pioneering research on construction contractor–subcontractor transactions showed that price is not the only governing mechanism on which parties rely. Hinze and Tracey's (1994) research study indicated some subcontractors refuse to submit quotes to those construction contractors who have the reputation of bid shopping. Shash (1998) also reported that subcontractors quote similar prices for construction contractors with whom they have done work in the past, and that they increase the price of their quotations submitted to contractors with whom they have limited work experience by 5–10%. Dainty *et al.* (2001) also found some subcontractors build in contingencies to their tender submissions to construction contractors to mitigate the risk of late payment.

Building upon the preceding arguments, it could be suggested that having relationships of high quality with subcontractors is positively associated with a contractor's economic performance. Thus the finding in this thesis that price is not the critical reason for subcontracting agrees with results of previous studies, and so is the importance of having reliable subcontractors as regular business partners.

This also strengthens the need for practising the idea of partnering in construction industry, because partnering, as a form of inter-organisation co-operation is well suited to the asset specific nature of construction.

8.2 Recommendations

Whilst there are different views from the industry on how to improve the quality of the public housing construction industry, the problem lies mainly on the proliferation of multi-layer subcontracting, the lack of training for construction workers and the fluctuating workload in the industry. There is also no tendering advantage for public housing contractors that strive to maintain quality.

It is suggested that workers should be registered in the first instance. With a proper register, the manpower demand can be predicted more accurately and proper training be planned to suit the development of the construction industry. The Government should set the lead and specify in future contract that a high percentage of the employed workers must be registered. This will gradually stamp out low skill casual workers predominant in the industry.

As subcontracting cannot be outlawed, some form of regulation is essential. Without subcontractors as regular business partners, there will be a lack of trust between the transacting parties which will lead to adversarial working relationships (Dainty *et al.*, 2001). Indeed, mistrust between the parties was seen as a fundamental barrier to the increased understanding of each other's needs and further supply chain integration. In terms of finding solutions to the lack of integration within construction supply chains, subcontractors must be integrated formally into communication and reporting structures within the project organisational structure. Subcontractors see this as an effective way of allowing them to establish the closer relationships for better supply chain integration.

Subcontractors should be registered for the special skills they have. Code of practice should be promulgated and firms or individuals found to violate would be sanctioned or even deregistered. Further detailed study is needed.

Whilst the Hong Kong Special Administrative Region Government cannot regulate the workload of the private sector, it can control the amount of public sector construction work to be tendered each year to give a more even workload in the industry. This will allow contractors better planning and makes it easier to employ a core of permanent workers who could control the workmanship on site.

8.3 Limitations of Study

A number of limitations of this study need to be recognised. The first was the lack of sufficient data to verify the profitability of the local construction contractors and convenience sampling had to be used with its limitations (Galloway, 1997). The number of listed construction companies was 27 in June 2000 and not all of them had its main business with the Hong Kong Housing Authority. Its size, history and scope of business vary. It had also been difficult to locate financial information on the turnover of listed construction contractors under various activities (construction, trading, property development and others). Some data was available from published company reports but precise classifications were not readily available.

For the main survey regarding perception of public housing contractors on the risks due to its client (variables a1 to a10), the reliability of the instrument (see Table 6.1) was about 0.6122 and is low since a value of 0.7 is desirable (Nunally, 1978). These variables were considered as contentious and respondents might be reluctant to voice out their true opinion and criticise the Hong Kong Housing Authority. Some further interview or even focus groups might be desirable to find out the diversified opinion of respondents and problem items identified should be excluded from the survey.

8.4 Issues for further research

The results summarised in the research revealed quite a number of unresolved areas that might result in quality improvement in the industry, but whether these are effective and how can it be implemented warrants further study. Some of the items worthy of further research are suggested.

8.4.1 Culture

It has been suggested partnering could improve quality in construction projects, but the main experience is abroad. MTRCL has applied that to its infrastructure project locally, and so is such approach proposed by the Hong Kong Housing Authority in its consultative document (Hong Kong Housing Authority, 2000) issued to the public after the various scandals were unveiled. However risk aversive attitudes of the civil service and organisation culture in public organisations all hinder its application (Burnes and Coram, 1999).

Cultural difference between Chinese and Western construction project management staff could also affected its implementation. Attitudes of the construction workers would likewise be critical also. It could be a good research topic to see how partnering could be applied locally.

8.4.2 Equitable procurement method

Due to workload fluctuation, the need to be flexible is important to maintain competitiveness and survival for construction contractors. This rules out to a great extent the banning of subcontracting in the local construction industry. Under the agency theory, opportunism always occurs and it is beneficial to look into more equitable type of procurement method in the public sector construction industry.

The MTRCL's target cost approach might be one of the possibilities, and there are the so-called maximum guaranteed price, but for simpler, less complicated superstructure construction as public housing rather than major civil works, some other form of procurement might be necessary to stem out the unrealistic cut-throat bidding.

The Hong Kong Housing Authority proposes contract award by past performance, and the development of an objective system, if successful, would surely be giving significant impact to the industry. This warrants further research in how public organisation can link procurement with performance such that taxpayers' moneys are spent equitably and without any possible loophole for corruption.

The two-envelope method adopted for consultants selection (Drew *et al.*, 2002) might also be considered with modification for contractors selection. Contractor's tender could consist of technical submissions in one envelope and shall include previous contract performance. The tender price will be in another separated envelope. The technical submissions and the tender price are converted to scores, and these scores are then multiplied by predetermined weightings (usually price 7 and technical 3) and aggregated. To preserve the desired influence of the predetermined weightings, the technical submissions score and tender price score variability differences need to be balanced; otherwise, when aggregated, one variable will end up dominating the other, especially when the price weighting is much higher than the technical weighting. If such adjustments are not undertaken, it seems that in many cases the contractor selection becomes biased in favour of the lowest price rather than the technical.

According to Drew *et al.* (2002), important influences that contribute to the price-technical score variability imbalance include cutthroat price and non-serious price (which increases price variability). They further observed that if the client is able to distinguish between cutthroat, serious and non-serious price, then it is suggested that firstly the contractors submitting cutthroat and non-serious price should be disregarded and a normalisation approach (in which the contractor's technical and tender price scores are re-scaled to fall between unity and zero) should then be applied. On the other hand, Drew *et al.* (2002) found out if the client is unable or unwilling to distinguish between cut-throat, serious and non-serious price, then aggregating on the basis of the price and technical score rankings appears to be the best method. Approaches to the correction of the price–technical score variability need to be found out, and is an ideal topic for future research.

8.4.3 Statutory Council

Skills required in the public housing construction industry is low when compared with other infrastructure projects. This, as mentioned in

Chapter 4 of this thesis, would result in a perfectly contestable industry and would be very competitive (Bain, 1956). To survive, cut-throat bidding appears inevitable and public housing construction contractors have to survive by maintaining a small overhead and by subcontracting to a great extent. This is further aggravated in the last year when the economy of Hong Kong was in deep trouble. Due to pressure from the private developers in year 2001, the Hong Kong Housing Authority reduced the construction of the public housing. In announcing annual results, one of the major listed public housing construction contractors said: "The decline in the public housing sector and the construction industry in general has been faster and more severe than expected. The recent announcement to suspend the sale of Home Ownership Scheme (HOS) flats for ten months and to cap annual sales of HOS units at 9,000 units thereafter till end of March 2006 has immediately and substantially reduced works opportunities. In the past year, the Hong Kong Housing Authority has been offering much fewer tendering opportunities. The property market has remained sluggish, causing demand and margin for construction materials to continue to fall. As the number of private sector projects has also declined, more construction companies are bidding for government projects and further drag down the profit margin, with some of them bidding below cost at times" (Shui On Construction and Materials Limited, 2001).

To regulate the industry and to avoid bidding below cost, some form of Statutory Council to setup workmanship standards may be desirable. The way it applies to the construction industry, as compared to other professions (doctor, lawyer, dentist, accountant etc.) is yet to be explored. In the survey in this research, there are opposing views between main contractors and subcontractors on this. The main reasons need to be investigated so that some compromise could be reached.

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Appendix A

Initial Qualitative Study

Record of Interview 1

Date of Discussion

24 May 2000

Present

Mr. ABC, Principal Partner, a local architectural practice
Mr. DEF, Director, a Hong Kong Housing Authority Contractor
Mr. HIJ, Project Manager, a Hong Kong Housing Authority Contractor

Mr. DEF

Profit margin for public housing is no more than 2 %.
Points system now being adopted cannot reflect accurately the standard of workmanship. There is serious bureaucracy at HA and people are just more concerned on the paper work than actual site work.

Mr. ABC

An incident where a report is required at short notice. In accordance with Hong Kong Housing Authority procedure, delayed submission should be warned. A warning letter was issued by the Hong Kong Housing Authority staff, irrespective of the fact that the request was late.

Mr. DEF

Award of tender based on past performance should be helpful to screen out non-performers, but a fair assessment is necessary.
Good workmanship is subjective.

Appendix A

An increased in supply of flats must be matched with overall supply of resources. Hong Kong Housing Authority does not treat construction contractors as co-operating partners.

Mr. HIJ

If there is any delay, Hong Kong Housing Authority deducts payment first. Only will payment be reinstated after extension of time is granted. This has serious effect on the cash flow of contractors.

Mr. ABC

Granting of extension of time is not straight forward, and has to go through lots of procedure.

Mr. HIJ

Hong Kong Housing Authority has been becoming very rigid, and very inhuman ever since the adopt of ISO9000 standards.

Most of their site staff had to spend nearly all the time to fill in forms required by the Authority. This included performance assessment under their points system. Apparently some sites were picked up randomly each day, and site staff had to complete the assessment and pass back the results electronically on the same date. For site staff, they will have to give some demerit points to contractors; otherwise it would be difficult to explain to their superior why every aspect of the assessment passed the benchmark. They might also be suspected of collusion with contractors. Hence assessment is not really totally impartial.

Award of contract based on performance is yet to be tested, inspite recent criticism that award by price alone is not conducive to quality improvement. It is still possible that contractors with poor performance can submit a bid low enough to circumvent the system.

Appendix A

Initial Qualitative Study (Cont'd)

Record of Interview 2

Date of Discussion

12 June 2000

Present

Mr. XYZ, Building Services Engineer, New Works, Hong Kong Housing Authority

Interviewer - Researcher

Mr. XYZ

Hong Kong is now being led by merchants. People flocked around Chief Executive and made noise.

Constant cut of benefits. Also fundamental welfare such as medical and education is everyone's right.

Housing Authority is being led by non-technical people, and they are only care about cost effectiveness.

Hong Kong Housing Authority staff now no longer felt sorry for mistakes, and they just let things be.

Half of the time is spent in writing reports and paper work. Portable computer has been introduced recently by senior management and sites are picked randomly every day. A complete assessment of the performance of the contractor on the picked sites is needed, and all data has to be sent back via telephone lines to central computer.

Appendix A

Regrettably the scheme has not been tested thoroughly and created even more stress and paper work for site staff.

Would not do anything extra, nor introduce new material for fear of branded as favouritism to certain contractor.

Although said by Chairman of the Hong Kong Housing Authority that Hong Kong Housing Authority staff can reject the lowest tender, no one will do that since it is difficult to justify why to reject lowest offer, bearing in mind firms that are permitted to tender were all prequalified. It would be difficult to argue to reject a tender from some of this approved contractors because their price is low. People would ask, if this firm is NOT acceptable, why was they invited to tender in the first instance. The painless way is to accept lowest offer.

Contractors could not meet at bad times and try to use substandard material and shoddy workmanship.

Appendix A

Initial Qualitative Study (Cont'd)

Record of Interview 3

Date of Discussion

26 June 2000

Present

Mr. LMN, Senior Building Services Engineer, New Works Section, Hong Kong Housing Authority

Interviewer - Researcher

Mr. LMN

Problem with low bid of contractors has been prevailing for a long time. Hong Kong Housing Authority cannot reject contractor with lowest bid, using excuse that they might not perform. This is because Hong Kong Housing Authority only invites bids from firms that have been pre-assessed as being qualified.

The tendency is then for these approved contractors to shop for someone who is prepared to take up the whole job, and pay them a commission. They will pass everything to their subcontractor.

The approved contractors act as brokers, and subcontract to another.

If at times when there are serious fluctuations in labour and material, contractors could not make ends meet. They tend to try to use substandard material and provide shoddy workmanship.

Appendix A

Hong Kong Housing Authority is downsizing, and use of short term employment is devastating for staff morale. Contract staff does not know what would happen next day, and all work is being done not for any long-term goal. To fill the vacancies, temps are employed. It is necessary to justify the post every few months. Time is spent on non-productive matters.

Restructure of Estates Management Team did not serve the purpose of "One Stop Service", as there are too much disciplines involved. It is postulated that reversion back to divisions based on discipline would reoccur later.

Staff is loaded with paper work, after adoption of ISO9000.

<u>**Appendix B**</u>

Newspaper Cuttings 1

Piling scandals spur industry to move (Chugani, 1999)

HONG KONG'S rich and powerful construction industry has been rocked by malpractice scandals and has hired well-connected lobbyists to clean up its public image through major reforms.

Top players in the industry have accepted the idea of a central policing authority with legal powers to set standards and slap fines. The new authority will make sure that building contractors are properly licensed and that only qualified workers are allowed on construction sites.

Construction bosses have hired former executive councillor and legislator Allen Lee Peng-fei - a China adviser and past chairman of the Liberal Party who now runs a lobbying firm to get the industry back into the government's good books.

Relations between the industry and the government soured considerably following a string of recent scandals involving faulty piling work at Housing Authority projects. As punishment, the government has temporarily banned several of Hong Kong's top construction firms responsible for faulty work from bidding for lucrative Housing Authority contracts.

Several industry leaders who spoke to the Hong Kong Standard on condition of anonymity said some of the scandals had been overblown and they blamed the government for not making this clear.

Mr. Lee and his partner, former legislator Steven Poon Kwok-lim, are preparing a proposal for the government, which will include a statutory body to ensure quality control within the construction industry. The two well-connected lobbyists will act as middlemen, arranging meetings between government policymakers and construction industry leaders. They will also sell the plan that needs Legislative Council approval to lawmakers.

Appendix B

"Right now there is very little control over contractors," said one source familiar with the plan. He was referring to the current practice under which contractors employed to construct buildings will hire sub-contractors who in turn will further sub-contract parts of the work to others. Often, sub-contractors down the line are unfamiliar to the main contractor, increasing the risk of poor quality. Similarly, unqualified construction workers, many of them migrants from the mainland are hired to perform skilled tasks.

The Hong Kong Housing Authority has its own list of approved contractors but has less control over sub-contractors. The government also has a training authority that issues certificates to construction workers who complete a course, but contractors are free to hire unskilled labour.

The proposal being prepared by the industry's lobbyists calls for one central body to handle licensing as well as training. "The plan is to do everything in a more organised way," said a source familiar with the proposal.

Appendix B

Newspaper Cuttings 2

Siu Lam site one of 15 investigated by department Engineer and contractor charged over materials (Wong and Poon, 1999)

The Buildings Department has charged a structural engineer and a contractor with using non-approved material, non-compliance on site supervision and misrepresentation of material facts.

The charges were lodged following an investigation, a government spokesman revealed. He said the engineer and the contractor breached conditions "imposed to provide qualified site supervision in respect of bored piling works at a Siu Lam construction site".

The site was one of 15 investigated by the Buildings Department last year after receiving allegations of malpractices in large bored piling works. Investigations also covered the Tung Chung station of the Airport Railway, two sites in Tuen Mun, two on Tsing Yi, one in Yuen Long, two in Kowloon, one on Hong Kong Island and the Northwest concourse extension to the Chek Lap Kok Passenger Terminal Building.

The registered structural engineer, Lee Ping-kwan, and the registered contractor, B+B Construction Co Ltd., both responsible for the piling works, were charged with contravention of a condition imposed by the Building Authority under Section 17 of the Buildings Ordinance, Director of Buildings, Leung Chin-man said. Mr. Leung said the case was being looked into to see if it warranted disciplinary action against the responsible parties. He said that summonses had also been served on B+B Construction with respect to bored piling works at four other construction sites. The four sites are No 5 to 7 Blue Pool Road, Happy Valley, Airport Railway Hong Kong Station Northern Site, Airport Railway Kowloon Station Development Site A and Airport Railway Olympic Station Development Site B, Phase 1.

Mr. Leung said the procedures for controlling this type of foundation works had been tightened up since the findings. "These measures include requiring closer supervision by authorised persons, registered structural engineers and registered specialist contractors for carrying out bored pile works. The Buildings Department also plans to further strengthen its monitoring role over the proof tests of bored piles and the handling and interpretation of the core test samples retrieved," Mr. Leung said.

Substandard foundation works were first detected at Airport Railway stations. In that incident, it was alleged that false documents were produced on concrete consumption together with false engineering reports on the length of bored piles. A total of 17 people working for different contractors, including an employee of B+B Construction, were arrested for suspected corruption.

Appendix B

Newspaper Cuttings 3

Lowest tender process slammed (Moy and Tse, 1999)

CONTRACTORS are tempted to cut corners and offer low prices to win public tender contracts, a seminar was told yesterday. The view was expressed by Cheng Yan-kee, chairman of the Corruption Prevention Advisory Committee of the Independent Commission Against Corruption (ICAC) and Martin Tam Tin-fong, a spokesman for the Real Estate Developers Association of Hong Kong. They accused the Housing Authority and some private developers of maximising their own interests at the expense of their business partners - the contractors.

Speaking at the Construction 2000 seminar, ICAC Commissioner Alan Lai Nin said he had been alarmed by a spate of recent housing scandals involving sub-standard building quality. Mr. Lai warned that inspection work at construction projects could easily induce corruption.

Mr. Cheng said the "unrealistic client expectations in relation to time, cost and quality outcomes" and the "harsh contract and sub-contract conditions that impose one-sided obligations and punitive damages" could drive bidders to cut costs by lowering their service quality. He warned that supervision of construction work could be affected if contractors became "too close" to their consultants.

Mr. Tam said some contractors had "over-estimated" their strength by offering very low construction costs in a bid to secure contracts. He accused some developers of depriving contractors of reasonable profits through the bidding system. Mr. Tam said such a business attitude could inevitably lead to poor building quality. "I hope the customers (developers) could understand that you receive what you pay for. Before putting in their bids, contractors should consider carefully their financial strength and the demands of their customers" he said.

Meanwhile in the Legislative Council, the Hong Kong Institute of Architects (HKIA) and the Hong Kong Institute of Surveyors (HKIS) criticised the awarding of building contracts based the lowest bids or short-term contracts, and hit out at inadequate supervision of projects.

At a meeting of the Legco housing panel, HKIA president Barry Will said the present practice of awarding tenders on the basis of the lowest bids would induce contractors to cut costs or take unnecessary risks in order to complete projects on time. This could lead to higher risks with cheaper piling systems being introduced.

But unionist legislator Lee Cheuk-yan argued that raising bidding amounts would not improve the quality of construction because the money would only be taken by sub-contractors.

Former HKIS president Lau Ping Cheung said a healthy sub-contracting system was essential for improving construction quality. The HKIA also urged the Housing Authority to lengthen the time of tendering and period of construction for building projects, saying that inadequate tendering and construction time would prevent contractors from using new construction technology.

Appendix B

Newspaper Cuttings 4

Cutting corners no way forward (Hong Kong Standard Editorial, 1999)

If the Housing Authority's new-found diligence in monitoring its construction projects is indeed a wake-up call for the industry as it has just been described by one contractor involved in the series of construction scandals this year, it is incredible that such a call should be issued only now. For it is not as though the authority or the Housing Department are novices at the game, or that they have not had ample evidence in the past of the willingness of some sections of the industry to, using the kindest interpretation, cut a few corners when no one is looking.

The words in the interim result statement from Hsing Chong Construction are instructive. Lamenting the removal of a subsidiary from the department's list of approved foundations contractors because of "irregularities" in jobs at Yau Tong and Tung Chung, the company says the authority has recently, "avowed to raise construction standards on its projects and adopted a "minimal defect policy". This, it says, "must serve as a wake-up call to the entire industry" which must now "ensure that it consistently delivers the high standards of construction that the people of Hong Kong demand, expect and deserve".

Stirring words. But if the authority and the industry do now form a "strategic partnership" to raise standards, welcome as this will be, they will be doing no more than they should have been doing for the past 40 years.

On the threshold of the 21st century, in a city that in many ways is one of the world's most modern, this failure to foster a culture of excellence, or even of compliance, in crucial programs that consume billions of dollars in public money every year, is an indictment on all concerned. As shown by a Hong Kong Standard investigation into the "leaning towers of Tin Shui Wai" - the other major site where defects were found this year - the government cannot escape its share of the blame. At the very least, the Housing Authority and Department stand accused of applying different standards to public housing projects than were demanded in the private sector. If it took an elevator company to notice that some of the blocks at Tin Shui Wai were not standing up straight it is also obvious that monitoring procedures have also been seriously deficient.

An inquiry is under way and when it is over the government must make all the details public. Anything less will smack of a cover-up, and will certainly not be acceptable to those Hong Kong people who rightly "demand, expect and deserve" high standards from those charged with providing one of the most basic human needs.

Appendix B

Newspaper Cuttings 5

Piling Scam (Mingpao Editorial, 2000)

THE piling scam at the Home Ownership Scheme developments in Sha Tin's Yuen Chau Kok is one of the most serious to be recorded in the territory. The investigation revealed that not only Housing Department staff was to blame, but there were also serious problems in the monitoring system.

These events show the shortcomings of the Director of Housing and the chairman of the Housing Authority and they should accept responsibility and offer to resign.

Two major loopholes in the monitoring system were highlighted:

Unqualified and inexperienced people were put in charge; and:

Instead of making on-site tests, the management relied on reports submitted.

This made it possible for the contractors to submit reports, which did not reflect the true state of the materials, used or work done.

The scandal at the two Home Ownership Schemes have resulted in heavy losses in taxpayers' money and damaged people's confidence in public housing. If nothing is done to show the accountability of the heads of the department and the authority, the public will be concerned that these matters are not being taken seriously and they will occur again in future.

Appendix B

Newspaper Cuttings 6

Culture of laxness puts housing officials on shaky ground (Hong Kong Standard Editorial, 2000)

OUR text for today comes from the Gospel according to the Housing Department. A wise man built his house upon a rock. And the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell not. A foolish man subcontracted his house to a Hong Kong company, which used substandard pilings. And the rain descended, and the floods came, and the winds blew, and beat upon that house; and it fell: and great was the fall of it.

This slightly edited version of a 2 000-year-old parable has literal significance in Hong Kong today, as the scandal of substandard housing developments spreads. Yesterday, the story acquired a new metaphorical meaning as well. The carefully constructed careers of a number of civil servants could totter and fall. And great will be the fall of them. Or will they?

The role of officials in the scandal came under the spotlight as Chief Executive Tung Chee-hwa ordered Secretary for Housing Dominic Wong to see where blame should be assigned. This follows the issuing of an initial report yesterday, by John Strickland, former chairman of HSBC, and two top civil engineers. The study, of the problems beneath Yue Tsui Court, a residential tower in Sha Tin, was impressive and thorough.

Want to hear a horror story? Listen to this and weep.

A Company called Zen Pacific Contractors had the correct qualifications to win the contract for building piles (structural foundation pillars that cut through the ground to the underlying bedrock), But it gave the actual work to a firm called Hui Hon Contractors, pocketing HK$3.2 million as "administration fees" although its staff didn't really oversee the subcontractors. Hui Hon Contractors in turn paid a firm called Chi Shing Drilling Engineering to drill holes. Chi Shing Drilling agreed to do this, but it was not on the "approved drillers" list. So it in turn made a deal with a firm called Tysan Foundations. Chi Shing would use Tysan's name, and pay them HK$1,330 per hole for doing nothing.

See how the money spreads? The bad news is that the experience and the commitment to do a good job did not filter around the site like the cash did. And nobody from the department checked that the work was being done as well as it should have been not until it was too late, anyway. The result was half-built towers on foundations that did not reach the bedrock and which will have to be demolished at the taxpayer's expense.

A lot of fingers were pointed yesterday - the report is admirably unstinting about naming names. Many of the lower-level department staff was seriously slapped around for lax monitoring of the building process. But there remains a feeling that people higher up the ladder were being let off lightly. A close reading of the report issued yesterday makes something very clear. Yes, it identifies the little people who failed to monitor the piling firms, but they are not the main cause of the problem.

The trouble stems from the culture of that particular operation, the researchers clearly concluded. At the department, "paper is treated as more important than substance", they said. Furthermore, "Staff directly responsible for construction quality spends most of their time at a desk in Housing Department headquarters".

The report said that the first thing that needs to be changed is the management and motivation of site-inspection staff. It also says that the emphasis at the department is on technical processes, rather than managing the operations. A lack of clear accountability in the management structure was a key defect.

In short, it is easy to blame supervisors in mud-spattered boots when something goes wrong at the works they are supposed to be supervising. But the buck shouldn't stop there. If the culture of a company is at fault, the people who are ultimately responsible for that culture should take the responsibility. And those are the people at the top. It's a parable that works for all organisations, big and small.

Here ends our lesson for today.

Appendix B

Speech by elected Member Dr. Raymond Ho Chung-tai on 23 Feb. 2000 to the Legislative Council, Hong Kong

THE SYSTEM OF LONG - TERM EMPLOYMENT FOR CONSTRUCTION WORKERS (Ho, 2000)

Madam President,

The sub-contracting system in the construction industry of Hong Kong has been in use for a very long time. Its advantage lies in giving a certain degree of flexibility to the operation of the construction industry. With the rapid development of the construction industry, the system can help us meet the needs of the industry. Under this arrangement, the employment of workers on a long-term basis is not the mainstream practice. There can be no denying that the employment of workers on a long-term basis would increase the sense of belonging among workers and give some of them greater security. But if we are to implement this system in Hong Kong, we have to give serious thoughts to it.

Free market economy is practised in Hong Kong. Any terms of employment should be determined by both the employer and the employee. It is undesirable that there should be any form of restriction or intervention from the Government on the industry. From the perspective of the construction industry, employment on a long-term basis would have some impact on the costs and manpower needs. For workers with a higher level of skills, the long-term employment system would not necessarily be most advantageous to them. As there may be other factors that we may need to consider, the implementation of the long-term employment system may not necessarily improve the safety and quality of the construction industry.

If the Government is set to implement such a system in the construction industry, it should encourage the industry to adopt the system at its own initiative, rather than making it mandatory. The authorities concerned can consider making joint efforts with the industry to create a more favourable environment and better conditions so as to make the system work more smoothly in the industry.

Appendix B

Looking at the present situation of the local construction industry, we do not think that it is a suitable time to implement the system of employment on a long-term basis across the industry. It is because the industry does not have a full grasp of the number of workers of different trades of the industry and the level of their skills. As a matter of fact, the construction industry is actively working to set up a registration system for construction workers. To implement such a system, it is necessary to set up trade tests and a system of registration for workers. Only by setting up these systems can the number of workers, their level of skills and the mobility of workers in different trades of the industry be accurately ascertained.

On the other hand, the Government should promote the training of skilled personnel in the construction industry so that more suitable workers can be employed on a long-term basis. For the contractors, they may consider hiring workers for some basic trades on a long-term basis as a start. Or the contractors may consider signing employment contracts with workers of certain trades commensurate with the contractual period of the projects.

In addition, the Government should set aside sufficient resources to promote research and development in the local construction industry and to enhance research and development in those building materials and methods, which are more environmentally friendly and efficient. These include prefabricated parts and comprehensive structural designs, which can reduce construction wastes and raise project quality. Workers can then also work in a safer and cleaner environment. It follows that there should be enough skilled workers as a support. So there must be training organised by the Government in this respect. This move will help raise the levels of skills and professionalism in the construction industry and enable it to catch up with those of the advanced countries. That will certainly help to attract more young people to join the industry.

Madam President, I so submit. Thank you.

Appendix C – Survey to study business risks for public housing construction Hong Kong

Main Survey

(Covering Letter)

December 2000

Dear

My name is K.W. Lee, a Candidate in a Doctor of Business Administration program with Curtin University, Perth, Australia and Lingnan University, Hong Kong. We are doing a survey among contractors about business risks associated with their public housing estates construction business, and risk management methods adopted by contractors in this sector of the local construction industry.

More than 2 million Hong Kong residents live in public housing estates, and expenditure spent by the Hong Kong Housing Authority (HKHA) is substantial. As more housing estates are being built, the quality of these newly constructed buildings has always been of interest to the general public.

We would like to include your opinions so as to identify issues that might have resulted in problems in the industry, and ultimately improve the quality of the public housing estates. Your personal assistance to spend about **twenty minutes** to complete the questionnaire will be appreciated. All your answers will be reported back in summary form only, and you will not be identified in any way. Any personal details and company information will be confidential and will not be disclosed unless with your prior written permission.

A copy of the reports of the findings will be sent for your reference.

Please return the questionnaire through the addressed, stamped envelope. If you require further information, you may contact me or the Supervisor of the study, Dr. Clement Chow at Lingnan University.

Mr. K. W. Lee Flat D7, Knight Court 38 Shing Tai Road Chai Wan Hong Kong. Tel: 28361801, pager 73071000 Fax: 28937849 Email: leekw@ln.edu.hk,	Dr. Clement K. W. Chow Associate Professor, Dept. of Marketing & International Business, Lingnan University, Tuen Mun, New Territories, Hong Kong. Tel: 26168373 Fax: 25724171

Appendix C – Survey to study business risks for public housing construction Hong Kong

A Study of Business Risks of
Public Housing Construction in Hong Kong
And Risks Management Methods Adopted by Contractors

Curtin University of Technology, Perth, Australia

And

Lingnan University, Hong Kong

This questionnaire should preferably be completed by the addressee named on the envelope. Your help is much appreciated.

Some of the questions may NOT apply to your company, but please consider its relative criticality or effectiveness on the operation of your company, if you were to introduce these measures to your company.

A scale of 1-5 is adopted. Please indicate the relative criticality / effectiveness of each of the factors and management measures: (1) for not critical / not effective, (2) for slightly critical / slightly effective, (3) for critical / effective, (4) for very critical / very effective and (5) for extremely critical / extremely effective.

(This questionnaire starts with sections A to F, from page 2 to 10. The whole survey consists of 10 pages printed on 5 sheets of paper).

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section A CLIENT FACTORS

For Questions A1 to A10, please circle on the Five Point Scale the relative criticality of the Client Factors on the operation of your Company.

		Not Critical	Slightly Critical	Critical	Very Critical	Extremely Critical
A1.	Provision of only basic tender drawings and tender specification at tender invitation, with details to be developed by contractors.	1	2	3	4	5
A2.	Bureaucracy of Client staff in making any technical or non-technical decisions.	1	2	3	4	5
A3.	Client staff not accepting responsibility for design errors and design changes.	1	2	3	4	5
A4.	Client staff subjective interpretation of contractual requirements on workmanship.	1	2	3	4	5
A5.	Over $100,000 per day as liquidated damages for any alleged delay to completion.	1	2	3	4	5
A6.	Inequitable contract terms and contract period.	1	2	3	4	5
A7.	Client policy to use Performance Assessment System to give objective assessment of contractors' performance, and paperwork created.	1	2	3	4	5
A8.	Client quality management policy as defined by ISO9000 and associated paperwork created.	1	2	3	4	5
A9.	Client previous policy to award contracts based on price alone, resulting in cut-throat bidding.	1	2	3	4	5
A10.	Corruption (solicited by Client staff, or offered to Client staff by subcontractors and suppliers, unknown to your company.)	1	2	3	4	5

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section B STATUTORY REQUIREMENTS

For Questions B1 to B5, please circle on the Five Point Scale the relative criticality of statutory requirements on the operation of your Company.

		Not Critical	Slightly Critical	Critical	Very Critical	Extremely Critical
B1.	Restriction to working hours for noisy site operations by Noise Control Ordinance.	1	2	3	4	5
B2.	Restriction on the employment of construction workers from overseas.	1	2	3	4	5
B3.	Contractors liable to criminal prosecution for illegal immigrants found employed by their subcontractors on their sites.	1	2	3	4	5
B4.	Contractors' obligation to provide a safe working site as stipulated by the Factories and Industrial Undertaking Safety Regulations for their workers as well as other subcontractors' workers.	1	2	3	4	5
B5.	Regular and unexpected safety checks by Inspectors of the Labour Department for compliance with the Factories and Industrial Undertaking Safety Regulations.	1	2	3	4	5

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section C FINES and PENALTY

Failure to comply with Statutory Requirement would usually result in pecuniary fines by Law Courts, as well as other reprimand by the HKHA or other Works Department of the HKSAR Government. Poor performance may also result in suspension from tendering. For questions C1 to C2, please tick ☑the most appropriate item.

C1. **In your opinion, what should be** the amount of pecuniary fines in one single Court case for non-compliance of statutory requirements such as Safety regulations, Immigration Ordinance that might result in no future conviction.

(a) Below $100,000 ________
(b) From $100,000 to $500,000 ________
(c) From $500,000 to $1,000,000 ________
(d) Above $1,000,000 ________
(e) Pecuniary fine is NOT effective as that is treated as part of operating expenses ________

C2. **In your opinion,** what is the period of suspension from tendering that might act as a deterrent to induce future improvement in performance.

(a) Below 3 months ________
(b) From 3 to 12 months ________
(c) Above 12 months ________
(d) Permanent removal from list of HA registered contractors ________
(e) Suspension from tendering on other public sector works funded by the Government, in addition to suspension from tendering on HKHA works. ________

For C3 to C4, please circle on the Five Point Scale, in terms of their criticality to the operation of your Company.

	Not Critical	Slightly Critical	Critical	Very Critical	Extremely Critical
C3. Poor reputation in the industry for conviction.	1	2	3	4	5
C4. Loss of tendering opportunity in the private sector, due to poor reputation in the public sector.	1	2	3	4	5

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section D PROCUREMENT and STAFFING

For Questions D1 to D10, please circle on the Five Point Scale the relative criticality of risks likely to occur in procurement for a project, and staffing problem on the operation of your Company

		Not Critical	Slightly Critical	Critical	Very Critical	Extremely Critical
D1.	Suppliers and subcontractors' bid is more than 5% higher than original cost estimate.	1	2	3	4	5
D2.	Incompetence of suppliers.	1	2	3	4	5
D3.	Poor performance of subcontractors.	1	2	3	4	5
D4.	Theft, fire and natural disasters caused losses and damage to material, or completed installation, or work-in-progress, but not yet handed over.	1	2	3	4	5
D5.	Limited number of specialist suppliers approved by HK Housing Authority from whom quotations are sought, resulting in possible collusion by these suppliers.	1	2	3	4	5
D6.	Delay by Utilities approval and final connection.	1	2	3	4	5
D7.	Turnover rate (over 10% per annum) of monthly paid staff.	1	2	3	4	5
D8.	Turnover rate (over 10% per annum) of monthly paid artisans.	1	2	3	4	5
D9.	Turnover rate (below 10% per annum) of monthly paid staff.	1	2	3	4	5
D10.	Turnover rate (below 10% per annum) of monthly paid artisans.	1	2	3	4	5

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section E RISK MANAGEMENT

For Questions E1 to E11, please circle on the Five Point Scale the relative effectiveness of management measures to problems stated in Sections A to D that are likely to occur in public housing projects contracted by your Company.

Questions E1 to E4 look at procurement of material and subcontractors. Question E5 looks at paper work caused by ISO9000 with its effectiveness for the construction industry being in doubt. Questions E6 to E11 look at staff management in your company to tackle suppliers' problem and to inspire on quality amongst staff.

		Not Effective	Slightly Effective	Effective	Very Effective	Extremely Effective
E1.	Have regular subcontractors with proven performance as business partners to tender for part of the Housing Authority building contract.	1	2	3	4	5
E2.	Increase number of subcontractors by open tendering each time to select best offers.	1	2	3	4	5
E3.	Sign up long term supply contracts (despite uncertainty in workload) with approved suppliers for major material.	1	2	3	4	5
E4.	Set up subsidiary trading companies to secure regular and reliable source of material.	1	2	3	4	5
E5.	Record management to deal with paperwork from ISO9000 and performance assessment.	1	2	3	4	5
E6.	Maintain a team of directly employed artisans for installation works in specialised areas or as backup in case of default by subcontractors.	1	2	3	4	5
E7.	Arrange regular training for directly employed artisans to upgrade their skills and safety awareness.	1	2	3	4	5
E8.	Arrange regular training for staff on technical matters and ethical standards.	1	2	3	4	5

Section E RISK MANAGEMENT

	Not Effective	Slightly Effective	Effective	Very Effective	Extremely Effective
E9. Have clear Company policy for career advancement to retain good staff.	1	2	3	4	5
E10. Have clear Company policy on Quality and Safety to inspire staff to provide quality installation.	1	2	3	4	5
E11. Have Vision and Mission statements to inspire on staff Company goal and objectives.	1	2	3	4	5

Questions E12 to E18 look at proposals that might improve the quality of the public housing as means to resolve problems in Sections A to C. Please circle on the Five Point Scale your views on the relative effectiveness of each proposal.

E12. Contractors associations to lobby for more equitable terms in HKHA contracts, more reasonable construction period and use arbitration to resolve contractual disputes.	1	2	3	4	5
E13. Contractors associations to lobby against cut-throat bidding and for HKHA to award contract to good performers only.	1	2	3	4	5
E14. Set up registration system for construction workers after trade tests.	1	2	3	4	5
E15. Strengthen supervision of your subcontractors.	1	2	3	4	5
E16. Disallow uncontrolled subcontracting and allow only subcontractors registered with HKHA, and directly employ registered contract workers.	1	2	3	4	5
E17. Set up Statutory Council comprising of representatives from the industry, government, professional institutions (such as HK Institute Of Engineers) to regulate the industry, set up standards and impose sanctions for violations, similar to other professions such as lawyers & doctors.	1	2	3	4	5

E18. Strengthen site supervision by HKHA, with additional resident Clerk of Works and resident Engineer and Architect on each site.	1	2	3	4	5

Appendix C – Survey to study business risks for public housing construction Hong Kong

Section F: General information about your Company - operation, structure, size, turnover.

Your Position : ____________________

Your name : ____________________

Name of Company : ____________________

Years worked in Company : ____________________

Your contact telephone number : ____________________

For Questions F1 to F6 (Please tick ✓ the most appropriate.)

F1. Main Area of Contracting Business of your Company:

(i) Air Conditioning and Mechanical Ventilation ____________
(ii) Building (substructure and superstructure) ____________
(iii) Electrical Services ____________
(iv) Fire Services ____________
(v) Landscaping ____________
(vi) Lifts ____________
(vii) Plumbing and Drainage ____________
(viii) Others ____________

F2. Latest Annual Turn Over (1998/1999) of your Company:

(i) Below \$100M (M = million) ____________
(ii) From \$100M to \$200M ____________
(iii) From \$200M to \$300M ____________
(iv) From \$300M to \$400M ____________
(v) More than \$400M ____________

F3. Number of full-time, directly employed monthly paid staff of your Company:

(i) Below 25 ____________
(ii) From 25 to 50 ____________
(iii) From 50 to 75 ____________
(iv) From 75 to 100 ____________
(v) More than 100 ____________

Appendix C – Survey to study business risks for public housing construction Hong Kong

F4. Number of full-time directly employed monthly paid artisans of your Company:

(i) Below 10 ______________
(ii) From 10 to 20 ______________
(iii) From 20 to 30 ______________
(iv) Over 30 ______________
(v) Does not employ full time artisans ______________

F5. Approximate Area of Workshop of your company:

(i) Below 250 sq.m ______________
(ii) From 250 to 500 sq.m ______________
(iii) From 500 to 750 sq.m ______________
(iv) Over 750 sq.m ______________
(v) Does not have any workshop ______________

F6. Approximate Value of fixed plant, tools, vehicles and equipment owned by your company:

(i) Below HK$ 2.5 M (M = million) ______________
(ii) From HK$ 2.5 M to HK$ 5.0 M ______________
(iii) From HK$ 5.0 M to HK$ 7.5 M ______________
(iv) From HK$ 7.5 M to HK$ 10 M ______________
(v) Over $10M ______________

Please add any additional views that you would like to include:

____

____

____

____

____

- END -

Please return questionnaire in the return envelope.

THANKYOU

APPENDIX D

Supplementary Survey (For subcontractors NOT involved with public housing construction) with Chinese Translation

December 2000

Dear

My name is K.W. Lee, a Candidate in a Doctor of Business Administration program with Curtin University, Perth, Australia and Lingnan University, Hong Kong. We are doing a survey among contractors about business risks associated with subcontracting in the local construction industry.

The construction industry in Hong Kong contributes significantly to the Gross Domestic Product in Hong Kong. In the past, quality of the buildings (particularly public buildings such as public housing estates and government buildings), has always been considered as poor by the public. One of the reasons put forward for poor quality is due to the proliferation of multi-layer subcontracting in the local construction industry.

We would like to include your opinions so as to identify issues that might have resulted in problems within the industry, and ultimately improve the quality of the industry. Your personal assistance in spending about **TEN minutes** to complete the questionnaire will be appreciated. All your answers will be reported back in summary form only, and you will not be identified in any way. Any personal details and company information will be confidential and will not be disclosed unless with your prior written permission.

A copy of the reports of the findings will be sent for your reference.

Please return the questionnaire through the addressed, stamped envelope. If you require further information, you may contact me or the Supervisor of the study, Dr. Clement Chow at Lingnan University.

Mr. K. W. Lee Flat D7, VTC Staff Quarters 38 Shing Tai Road Chai Wan Hong Kong. Tel: 28361801, pager 73282890 Fax: 28937849 Email: leekw@ln.edu.hk,	Dr. Clement K. W. Chow Associate Professor, Dept. of Marketing & International Business, Lingnan University, Tuen Mun, New Territories, Hong Kong. Tel: 26168373 Fax: 25724171

Appendix D – Survey to study subcontracting in construction industry Hong Kong

A Study of Subcontracting in

Construction Industry in Hong Kong

Curtin University of Technology, Perth, Australia

And

Lingnan University, Hong Kong

This questionnaire should preferably be completed by the addressee named on the envelope. Your help is much appreciated.

A scale of 1-5 is adopted. Please indicate the relative criticality / relevance / effectiveness of each of the factors and management measures: (1) for not critical / not relevant / not effective, (2) for slightly critical / slightly relevant / slightly effective, (3) for critical / relevant / effective, (4) for very critical / very relevant / very effective and (5) for extremely critical / extremely relevant / extremely effective.

(This questionnaire starts with sections A to D, from page 2 to 6. The whole survey consists of 6 pages printed on 3 sheets of paper).

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Appendix D – Survey to study subcontracting in construction industry Hong Kong

Section A MAIN CONTRACTOR BUSINESS PRACTICE

Main Contractor business practice affects the bidding strategy of your Company as a Subcontractor. There are factors affecting your bidding strategy. In other words, if a factor is considered as extremely critical, a higher level of contingency might be built into the bid. For Questions A1 to A7, please circle on the Five Point Scale the relative criticality of each factor.

		Not Critical	Slightly Critical	Critical	Very Critical	Extremel Critical
A1.	The non-existence of a formal written subcontract document with equitable terms fair to both sides.	1	2	3	4	5
A2.	Main contractor adopts flow-on tactic, i.e. all terms, conditions and liability of Contract between Main Contractor and client are passed onto Subcontractor entirely.	1	2	3	4	5
A3.	Subcontractor is paid only after the Main Contractor is being paid by the client.	1	2	3	4	5
A4.	To get all the payment for a completed job, Subcontractor has to continue work for and paid later by the same Main contractor in a new job.	1	2	3	4	5
A5.	Main Contractor does not have staff to run the project, but relies entirely on the Subcontractor to deal with the client on all matters, technical or non-technical.	1	2	3	4	5
A6.	Miscellaneous running expenses have to be borne by Subcontractor solely and will not be reimbursed by Main Contractor (e.g., commission, entertainment and kickbacks.	1	2	3	4	5
A7.	Main contractor adopts bid shopping. (It means that a main contractor approaches its subcontractors after it has been awarded a construction contract, and tells the subcontractors to lower their prices or lose their subcontracts.)	1	2	3	4	5

Appendix D – Survey to study subcontracting in construction industry Hong Kong

Section B YOUR BUSINESS PRACTICE

For Questions B1 to B6, reasons are suggested for further subcontracting from a subcontractor who subcontracts works from a Main Contractor. Please circle on the Five Point Scale the relative relevance of the reasons suggested for further subcontracting to other subcontractors, when operation of your company is considered.

		Not Relevant	Slightly Relevant	Relevant	Very Relevant	Extremely Relevant
B1.	We, as a Subcontractor to a Main Contractor, would subcontract works to another subcontractor because there are works which we do not have the expertise.	1	2	3	4	5
B2.	We, as a Subcontractor to a Main Contractor, would subcontract works to another subcontractor because of heavy workload.	1	2	3	4	5
B3.	We, as a Subcontractor to a Main Contractor, would subcontract works to another subcontractor so as to reduce risk of over expansion at time of low business.	1	2	3	4	5
B4.	We subcontract works to subcontractors, and they run the contracts themselves. We deduct a % from every payment received, and we could maintain a minimum overhead.	1	2	3	4	5
B5.	We would subcontract works to any subcontractors based on price only, as the bid-shopping norm adopted by main contractors.	1	2	3	4	5
B6.	We submit quotations to every main contractor that approaches us and there is no regular business partner. Likewise we do not have regular subcontractors as business partners.	1	2	3	4	5

B7. In a new building project, the rough % of work, on average, that we further subcontract to other subcontractors is: (Please pick one.)

(a) below 20% (b) 20 – 40% (c) 41 – 60% (d) 61 - 80% (e) over 80%

Appendix D – Survey to study subcontracting in construction industry Hong Kong

Section C QUALITY IMPROVEMENT

Questions C1 to C8 look at some of the possibilities that might improve the quality of the new building construction. Please circle on the Five Point Scale your views on the relative effectiveness of each proposal.

	Not Effective	Slightly Effective	Effective	Very Effective	Extremel Effective
C1. Set up registration system for construction workers after trade tests.	1	2	3	4	5
C2. Strengthen supervision of our workers.	1	2	3	4	5
C3. Strengthen site supervision by clients, with additional resident Clerk of Works and resident Engineer and Architect on each site.	1	2	3	4	5
C4. Disallow subcontracting and impose contractual requirement that a portion of workers shall be employed directly by main contractors.	1	2	3	4	5
C5. Set up of a registration system of contractors by Government of limited tenure and only registered firms can subcontract works from main contractors. Deregistration will result if justifiable complaints are received from clients.	1	2	3	4	5
C6. Award contracts by clients to main contractors based on past performance and not just price alone.	1	2	3	4	5
C7. Main contractors should treat their subcontractors as business partners to work hand in hand to deliver a project desired by their clients.	1	2	3	4	5
C8. Contractor associations and Government should prepare standard subcontract documents with equitable terms for both main contractors and subcontractors.	1	2	3	4	5

Appendix D – Survey to study subcontracting in construction industry Hong Kong

Section D: General information about your Company - operation, structure and turnover.

Your Position and your Name : ____________________

Name of Company : ____________________

Years worked in Company : ____________________

Your contact telephone number : ____________________

For Questions D1 and D2, please strike out the one NOT applicable to your Company.

D1. Our Company is / is NOT* an approved contractor on Housing Authority List of Contractors.

D2. Our Company is / is NOT* an approved contractor on Works Bureau List of Contractor.

For Questions D3 to D8 (Please tick ✓ the most appropriate.)

D3. Main Area of Contracting Business of your Company:

(i)	Air Conditioning and Mechanical Ventilation	______
(ii)	Building (substructure and superstructure)	______
(iii)	Electrical Services	______
(iv)	Fire Services	______
(v)	Landscaping	______
(vi)	Lifts	______
(vii)	Plumbing and Drainage	______
(viii)	Others	______

D4. Latest Annual Turn Over (1998/1999) of your Company:

(iii)	Below $10M (M = million)	______
(iv)	From $10M to $20M	______
(iii)	From $20M to $30M	______
(iv)	From $30M to $40M	______
(v)	More than $40M	______

Appendix D – Survey to study subcontracting in construction industry Hong Kong

D5. Number of directly employed staff of your Company:

(iii) Below 25 ______
(iv) From 25 to 50 ______
(iii) From 50 to 75 ______
(iv) From 75 to 100 ______
(v) More than 100 ______

D6. Number of directly employed artisans of your Company:

(iii) Below 10 ______
(iv) From 10 to 20 ______
(iii) From 20 to 30 ______
(iv) Over 30 ______
(v) Does not employ full time artisans ______

D7. Approximate Area of Workshop of your company:

(iii) Below 250 sq.m ______
(iv) From 250 to 500 sq.m ______
(iii) From 500 to 750 sq.m ______
(iv) Over 750 sq.m ______
(v) Does not have any workshop ______

D8. Approximate Value of fixed plant, tools, vehicles and equipment owned by your company:

(iii) Below HK$ 2.5 M (M = million) ______
(iv) From HK$ 2.5 M to HK$ 5.0 M ______
(iii) From HK$ 5.0 M to HK$ 7.5 M ______
(iv) From HK$ 7.5 M to HK$ 10 M ______
(v) Over $10M ______

Please add any additional views that you would like to include:

______
______
______
______

- END -

Please return questionnaire in the return envelope.

THANKYOU

Appendix D – Survey to study subcontracting in construction industry Hong Kong

December 2000

本人李健宏，現正修讀由澳洲柏斯科廷科技大學(Curtin University of Technology)及香港嶺南大學合辦的工商管理博士課程。我們正進行一項研究，關於香港建造業分包合同和商業風險的聯繫 。

建造業佔香港本地生產總值一個相當比重，以往香港建築物的質量，特別是公共建築物，諸如公屋和政府建築，總是被社會各界視爲品質差劣。造成這個問題的原因之一，是多層的分包合同在本地建造業非常普遍。

我們希望搜集你的意見，以找出問題的根由，最終改善這行業的質量。請你幫忙，用大約十分鐘時間塡妥這份問卷。你全部的答案將以摘要的形式表達，別人在任何情況下均不會知道你的身份。所有個人和公司資料將會保密，除非獲得你事先的書面許可，否則不會披露 。

我們會把這項研究報告的副本送一份給貴公司參考。

內有一個已貼上郵票的回郵信封，請把塡妥的問卷寄回。

假如你需要進一步資料，請與本人或這項研究的導師嶺南大學鄒港永博士聯絡。

Mr. K. W. Lee Flat D7, Knight Court, 38 Shing Tai Road Chai Wan Hong Kong. Tel: 28361801, pager 73282890 Fax: 28937849 Email: leekw@ln.edu.hk,	Dr. Clement K. W. Chow Associate Professor, Dept. of Marketing & International Business, Lingnan University, Tuen Mun, New Territories, Hong Kong. Tel: 26168373 Fax: 25724171

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澳洲柏斯科廷科技大學 (Curtin University of Technology)
香港嶺南大學

香港建造業分包合同的研究

這份問卷最好由收信人塡寫，多謝合作。

問卷採用五點分級表。請指出每一因素的相對重要性/關連/效用:

(1)	不重要	沒有關連	無效
(2)	略爲重要	略有關連	略爲有效
(3)	重要	有關連	有效
(4)	很重要	很有關連	很有效
(5)	非常重要	極有關連	非常有效

這份問卷由 A 至 D 部分組成，從第 2 頁到第 6 頁。
整份問卷有 6 頁，印在 3 張紙上。

Appendix D – Survey to study subcontracting in construction industry Hong Kong

A部分　　主承建商的經營手法

主承建商的經營手法會影響貴公司作爲分包商投標的出價。下文列出影響貴公司投標策略的各項因素。換句話說，假如某一因素被視爲非常重要，你便會因應其風險定出較高的標價。在回答問題 A1 到 A7 時，請在這五點分級表，按每項因素相對的重要性圈出相應的數字。

	不重要	略爲重要	重要	很重要	非常重要
A1. 主承建商和分包商之間沒有正式訂立一份條款對雙方都公平的書面分包合約。	1	2	3	4	5
A2. 主承建商將他和委託人之間的合約的全部條款和應負責任完全地轉嫁到分包商身上。	1	2	3	4	5
A3. 主承建商收到委託人付款之後，才支付給分包商。分包商間接支持主承建商的業務。	1	2	3	4	5
A4. 爲了在完成一項工程後得到全部付款，分包商必須繼續爲同一主承建商進行另一項工程，方能於稍後收到款項。	1	2	3	4	5
A5. 主承建商並無職員管理該項工程，而是完全依賴分包商處理和委託人有關的技術或非技術性事務 。	1	2	3	4	5
A6. 佣金，款待費等雜項業務費用全部由分包商支付，主承建商不會發還。	1	2	3	4	5
A7. 主承建商採用壓價策略(意指主承建商在投得新工程後會接觸分包商，要求他們降低價格，否則分包合約將會判給其它分包商。)	1	2	3	4	5

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B 部分　　貴公司的的經營手法

分包商從主承建商承包合同後，會把合同再分判給其他分包商，理由可能如下文問題 B1 到 B6 所述。就貴公司的運作而言，請在這五點分級表，按每個理由的相對關連圈出相應的數字。

	沒有關連	略有關連	有關連	很有關連	極有關連
B1. 作爲主承建商的分包商，我們會把部分合同再分判給另一分包商，因爲我們並不具備某方面的專門技術 。	1	2	3	4	5
B2. 作爲主承建商的分包商，我們會把合同再分判給另一分包商，因爲工作量沉重。	1	2	3	4	5
B3. 作爲主承建商的分包商，我們會把合同再分判給另一分包商，避免在業務低迷時過度擴充，以減低風險 。	1	2	3	4	5
B4. 我們把合同再分判給另一分包商，並由他們自行負責完成工程。我們從收到的每筆款項扣除某一百份比，以儘量減低基本開支。	1	2	3	4	5
B5. 我們把合同再分判給另一分包商時，價格是唯一的考慮，一如主承建商採用壓價策略。	1	2	3	4	5
B6. 對於每個接觸我們的主承建商，我們都會開出報價單，並無固定的商業夥伴可言；同樣地，我們也沒有固定的分包商作爲商業夥伴 。	1	2	3	4	5

B7. 就一項新的建築工程而言，按粗略的詁計，我們把部份合同再分判給另一分包商的百份比是：(請選一個)

(a) 20%以下　　(b) 20-40%　　(c) 41-60%　　(d) 61-80%　　(e) 超過 80%

Appendix D – Survey to study subcontracting in construction industry Hong Kong

C 部分　　品質改善

問題 C1 到 C8 探討一些可改善新建築工程質量的構想。 請在這五點分級表，按每個建議的相對效用圈出相應的數字。

	無效	略爲有效	有效	很有效	非常有效
C1. 爲建造業工人進行技能測試後，設立登記制度 。	1	2	3	4	5
C2. 我們加強對工人的監管。	1	2	3	4	5
C3. 由委託人加強工地監管，增加每個工地的工程監督、駐工地工程師和建築師 。	1	2	3	4	5
C4. 不允許分包合同，並在合同上列明一部份工人應由主承建商直接聘用 。	1	2	3	4	5
C5. 由政府爲承建商設立有限期的登記制度，祇有經註冊的公司才可以從主承建商承包合同。假如當局收到委託人合理的投訴，便會撤銷承建商的登記。	1	2	3	4	5
C6. 委託人向主承建商批出新的工程合約時，是依據承建商過去的表現，而非祇看價格。	1	2	3	4	5
C7. 主承建商將分包商視爲業務顆伴，共同完成令委託人滿意的項目。	1	2	3	4	5
C8. 承建商協會和政府將準備標準的分包合同文件，爲主承建商和分包商訂下公平的合約條款。	1	2	3	4	5

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D 部分　　關於貴公司運作、架構及營業額一般資料

你的職位：　________________________

你的姓名：　________________________

貴公司的名稱：　________________________

你在貴公司工作年資：　________________________

聯絡電話號碼：　________________________

*在回答問題 D1 及 D2 時，請刪去不適用者。

D1. 本公司是/ 不是*香港房屋委員會認可承建商。

D2. 本公司是/ 不是*香港特區政府工務局認可承建商。

問題 D3 到 D8，請選取最適合的答案，加上✓號。

D3. 貴公司承包主要的業務是：

(i) 空氣調節和機械通風 ______________
(ii) 建築(地基結構與上層建築) ______________
(iii) 電氣設備 ______________
(iv) 防火設備 ______________
(v) 環境綠化 ______________
(vi) 升降機 ______________
(vii) 水管和排水工程 ______________
(viii) 其它 ______________

D4. 貴公司最近年度(1998/1999)的營業額：

(i) 港幣 10,000,000 以下 ______________
(ii) 港幣 10,000,000 至 20,000,000 ______________
(iii) 港幣 20,000,000 至 30,000,000 ______________
(iv) 港幣 30,000,000 至 40,000,000 ______________
(v) 超過港幣 40,000,000 ______________

D5. 貴公司直接聘用的職員數字：

(i) 25 人以下 ______________
(ii) 25 至 50 人 ______________
(iii) 50 至 75 人 ______________
(iv) 75 至 100 人 ______________
(v) 超過 100 人 ______________

D6. 貴公司直接聘用工匠的數字：

(i) 10 人以下 ______________
(ii) 10 至 20 人 ______________
(iii) 20 至 30 人 ______________
(iv) 超過 30 人 ______________
(v) 並無聘用全職工匠 ______________

D7. 貴公司工場大約的面積：

(i) 250 平方公尺以下 ______________
(ii) 250 至 500 平方公尺 ______________
(iii) 500 至 750 平方公尺 ______________
(iv) 超過 750 平方公尺 ______________
(v) 沒有任何工場 ______________

D8. 由貴公司所擁有固定廠房、工具、車輛及設備的大約價值：

(i) 港幣 2,500,000 以下 ______________
(ii) 港幣 2,500,000 至 5,000,000 ______________
(iii) 港幣 5,000,000 至 7,500,000 ______________
(iv) 港幣 7,500,000 至 10,000,000 ______________
(v) 超過港幣 10,000,000 ______________

如有其它意見，請作補充：

____
____
____
____

結束
請將問卷寄回

多謝

Appendix E1 – Performance of Stocks of Hong Kong BETA

(Note: In some of the categories, there are no listed companies operating in Hong Kong and hence the columns in Appendix E1 are blank. Total listed non-construction companies processed were 581. There were 27 listed construction companies in Table E1c.)

Case Processing Summary (Listed non-construction companies)

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
BETA1996 * Company Category	581	82.6%	122	17.4%	703	100.0%
BETA1997 * Company Category	581	82.6%	122	17.4%	703	100.0%
BETA1998 * Company Category	581	82.6%	122	17.4%	703	100.0%
BETA1999 * Company Category	581	82.6%	122	17.4%	703	100.0%
BETA2000 * Company Category	581	82.6%	122	17.4%	703	100.0%

Table E1a-Beta of all non-construction companies

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
AEROSPACE	Mean	1.225	1.225	1.225	1.225	1.225
	Minimum	1.225	1.225	1.225	1.225	1.225
	Maximum	1.225	1.225	1.225	1.225	1.225
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	1.225	1.225	1.225	1.225	1.225
	Grouped Median	1.225	1.225	1.225	1.225	1.225
	Number of Firms	1	1	1	1	1
AIRLINES & AIRPORTS	Mean	0.753	0.753	0.753	0.753	0.753
	Minimum	0.575	0.575	0.575	0.575	0.575
	Maximum	0.986	0.986	0.986	0.986	0.986
	Std. Deviation	0.154	0.154	0.154	0.154	0.154
	Variance	0.024	0.024	0.024	0.024	0.024
	Median	0.752	0.752	0.752	0.752	0.752
	Grouped Median	0.752	0.752	0.752	0.752	0.752
	Number of Firms	6	6	6	6	6
ASSET MANAGERS	Mean	0.681	0.681	0.681	0.681	0.681
	Minimum	0.350	0.350	0.350	0.350	0.350
	Maximum	1.042	1.042	1.042	1.042	1.042
	Std. Deviation	0.292	0.292	0.292	0.292	0.292
	Variance	0.085	0.085	0.085	0.085	0.085
	Median	0.716	0.716	0.716	0.716	0.716
	Grouped Median	0.716	0.716	0.716	0.716	0.716
	Number of Firms	5	5	5	5	5
AUTOPARTS	Mean	0.757	0.757	0.757	0.757	0.757
	Minimum	0.757	0.757	0.757	0.757	0.757
	Maximum	0.757	0.757	0.757	0.757	0.757
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.757	0.757	0.757	0.757	0.757
	Grouped Median	0.757	0.757	0.757	0.757	0.757
	Number of Firms	1	1	1	1	1

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
AUTOMOBILE	Mean	0.875	0.875	0.875	0.875	0.875
	Minimum	0.875	0.875	0.875	0.875	0.875
	Maximum	0.875	0.875	0.875	0.875	0.875
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.875	0.875	0.875	0.875	0.875
	Grouped Median	0.875	0.875	0.875	0.875	0.875
	Number of Firms	1	1	1	1	1
BANKS	Mean	1.105	1.105	1.105	1.105	1.105
	Minimum	0.763	0.763	0.763	0.763	0.763
	Maximum	1.431	1.431	1.431	1.431	1.431
	Std. Deviation	0.199	0.199	0.199	0.199	0.199
	Variance	0.040	0.040	0.040	0.040	0.040
	Median	1.143	1.143	1.143	1.143	1.143
	Grouped Median	1.143	1.143	1.143	1.143	1.143
	Number of Firms	14	14	14	14	14
BUILDING MATERIALS	Mean	0.750	0.750	0.750	0.750	0.750
	Minimum	0.324	0.324	0.324	0.324	0.324
	Maximum	1.084	1.084	1.084	1.084	1.084
	Std. Deviation	0.247	0.247	0.247	0.247	0.247
	Variance	0.061	0.061	0.061	0.061	0.061
	Median	0.718	0.718	0.718	0.718	0.718
	Grouped Median	0.718	0.718	0.718	0.718	0.718
	Number of Firms	15	15	15	15	15
BROADCASTING	Mean	0.754	0.754	0.754	0.754	0.754
	Minimum	0.520	0.520	0.520	0.520	0.520
	Maximum	0.983	0.983	0.983	0.983	0.983
	Std. Deviation	0.231	0.231	0.231	0.231	0.231
	Variance	0.053	0.053	0.053	0.053	0.053
	Median	0.757	0.757	0.757	0.757	0.757
	Grouped Median	0.757	0.757	0.757	0.757	0.757
	Number of Firms	4	4	4	4	4
BREWER	Mean	0.697	0.697	0.697	0.697	0.697
	Minimum	0.540	0.540	0.540	0.540	0.540
	Maximum	0.901	0.901	0.901	0.901	0.901
	Std. Deviation	0.185	0.185	0.185	0.185	0.185
	Variance	0.034	0.034	0.034	0.034	0.034
	Median	0.650	0.650	0.650	0.650	0.650
	Grouped Median	0.650	0.650	0.650	0.650	0.650
	Number of Firms	3	3	3	3	3
CHEMICALS, COMMODITY	Mean	0.720	0.720	0.720	0.720	0.720
	Minimum	0.491	0.491	0.491	0.491	0.491
	Maximum	0.945	0.945	0.945	0.945	0.945
	Std. Deviation	0.137	0.137	0.137	0.137	0.137
	Variance	0.019	0.019	0.019	0.019	0.019
	Median	0.731	0.731	0.731	0.731	0.731
	Grouped Median	0.731	0.731	0.731	0.731	0.731
	Number of Firms	8	8	8	8	8

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
CHEMS.ADVANCED MATS.	Mean	0.607	0.607	0.607	0.607	0.607
	Minimum	0.391	0.391	0.391	0.391	0.391
	Maximum	0.925	0.925	0.925	0.925	0.925
	Std. Deviation	0.191	0.191	0.191	0.191	0.191
	Variance	0.036	0.036	0.036	0.036	0.036
	Median	0.639	0.639	0.639	0.639	0.639
	Grouped Median	0.639	0.639	0.639	0.639	0.639
	Number of Firms	7	7	7	7	7
CLOTHING + FOOTWEAR	Mean	0.674	0.674	0.674	0.674	0.674
	Minimum	0.255	0.255	0.255	0.255	0.255
	Maximum	1.038	1.038	1.038	1.038	1.038
	Std. Deviation	0.185	0.185	0.185	0.185	0.185
	Variance	0.034	0.034	0.034	0.034	0.034
	Median	0.703	0.703	0.703	0.703	0.703
	Grouped Median	0.703	0.703	0.703	0.703	0.703
	Number of Firms	28	28	28	28	28
COMPUTER SERVICES	Mean	0.647	0.647	0.647	0.647	0.647
	Minimum	0.576	0.576	0.576	0.576	0.576
	Maximum	0.717	0.717	0.717	0.717	0.717
	Std. Deviation	0.071	0.071	0.071	0.071	0.071
	Variance	0.005	0.005	0.005	0.005	0.005
	Median	0.647	0.647	0.647	0.647	0.647
	Grouped Median	0.647	0.647	0.647	0.647	0.647
	Number of Firms	3.000	3.000	3.000	3.000	3.000
CONSUMER FINANCE	Mean	0.996	0.996	0.996	0.996	0.996
	Minimum	0.873	0.873	0.873	0.873	0.873
	Maximum	1.119	1.119	1.119	1.119	1.119
	Std. Deviation	0.174	0.174	0.174	0.174	0.174
	Variance	0.030	0.030	0.030	0.030	0.030
	Median	0.996	0.996	0.996	0.996	0.996
	Grouped Median	0.996	0.996	0.996	0.996	0.996
	Number of Firms	2	2	2	2	2
COMMERCIAL VEHICLES						
COMPUTER HARDWARE	Mean	0.801	0.801	0.801	0.801	0.801
	Minimum	0.392	0.392	0.392	0.392	0.392
	Maximum	1.054	1.054	1.054	1.054	1.054
	Std. Deviation	0.275	0.275	0.275	0.275	0.275
	Variance	0.076	0.076	0.076	0.076	0.076
	Median	0.925	0.925	0.925	0.925	0.925
	Grouped Median	0.925	0.925	0.925	0.925	0.925
	Number of Firms	5	5	5	5	5

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
DISTRIB. IND. COMPS.	Mean	0.658	0.658	0.658	0.658	0.658
	Minimum	0.403	0.403	0.403	0.403	0.403
	Maximum	0.847	0.847	0.847	0.847	0.847
	Std. Deviation	0.189	0.189	0.189	0.189	0.189
	Variance	0.036	0.036	0.036	0.036	0.036
	Median	0.692	0.692	0.692	0.692	0.692
	Grouped Median	0.692	0.692	0.692	0.692	0.692
	Number of Firms	4	4	4	4	4
DISTILLERS + VINTNERS	Mean	1.032	1.032	1.032	1.032	1.032
	Minimum	1.032	1.032	1.032	1.032	1.032
	Maximum	1.032	1.032	1.032	1.032	1.032
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	1.032	1.032	1.032	1.032	1.032
	Grouped Median	1.032	1.032	1.032	1.032	1.032
	Number of Firms	1	1	1	1	1
DIVERSIFIED INDUSTRY	Mean	0.959	0.959	0.959	0.959	0.959
	Minimum	0.212	0.212	0.212	0.212	0.212
	Maximum	1.351	1.351	1.351	1.351	1.351
	Std. Deviation	0.272	0.272	0.272	0.272	0.272
	Variance	0.074	0.074	0.074	0.074	0.074
	Median	0.988	0.988	0.988	0.988	0.988
	Grouped Median	0.988	0.988	0.988	0.988	0.988
	Number of Firms	21	21	21	21	21
OTHER DISTRIBUTORS	Mean	0.727	0.727	0.727	0.727	0.727
	Minimum	0.385	0.385	0.385	0.385	0.385
	Maximum	0.962	0.962	0.962	0.962	0.962
	Std. Deviation	0.214	0.214	0.214	0.214	0.214
	Variance	0.046	0.046	0.046	0.046	0.046
	Median	0.784	0.784	0.784	0.784	0.784
	Grouped Median	0.784	0.784	0.784	0.784	0.784
	Number of Firms	10	10	10	10	10
VEHICLE DISTRIBUTION	Mean	0.813	0.813	0.813	0.813	0.813
	Minimum	0.766	0.766	0.766	0.766	0.766
	Maximum	0.859	0.859	0.859	0.859	0.859
	Std. Deviation	0.066	0.066	0.066	0.066	0.066
	Variance	0.004	0.004	0.004	0.004	0.004
	Median	0.813	0.813	0.813	0.813	0.813
	Grouped Median	0.813	0.813	0.813	0.813	0.813
	Number of Firms	2	2	2	2	2
EDUCATION + TRAINING	Mean	0.412	0.412	0.412	0.412	0.412
	Minimum	0.412	0.412	0.412	0.412	0.412
	Maximum	0.412	0.412	0.412	0.412	0.412
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.412	0.412	0.412	0.412	0.412
	Grouped Median	0.412	0.412	0.412	0.412	0.412
	Number of Firms	1	1	1	1	1

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
ELECTRICITY	Mean	0.501	0.501	0.501	0.501	0.501
	Minimum	0.246	0.246	0.246	0.246	0.246
	Maximum	0.809	0.809	0.809	0.809	0.809
	Std. Deviation	0.285	0.285	0.285	0.285	0.285
	Variance	0.081	0.081	0.081	0.081	0.081
	Median	0.449	0.449	0.449	0.449	0.449
	Grouped Median	0.449	0.449	0.449	0.449	0.449
	Number of Firms	3	3	3	3	3
ELECTRICAL EQUIPMENT	Mean	0.702	0.702	0.702	0.702	0.702
	Minimum	0.269	0.269	0.269	0.269	0.269
	Maximum	1.041	1.041	1.041	1.041	1.041
	Std. Deviation	0.234	0.234	0.234	0.234	0.234
	Variance	0.055	0.055	0.055	0.055	0.055
	Median	0.732	0.732	0.732	0.732	0.732
	Grouped Median	0.732	0.732	0.732	0.732	0.732
	Number of Firms	12	12	12	12	12
ELECTRONIC EQUIPMENT	Mean	0.719	0.719	0.719	0.719	0.719
	Minimum	0.223	0.223	0.223	0.223	0.223
	Maximum	1.105	1.105	1.105	1.105	1.105
	Std. Deviation	0.195	0.195	0.195	0.195	0.195
	Variance	0.038	0.038	0.038	0.038	0.038
	Median	0.729	0.729	0.729	0.729	0.729
	Grouped Median	0.729	0.729	0.729	0.729	0.729
	Number of Firms	50	50	50	50	50
ENG. CONTRACTORS	Mean	0.832	0.832	0.832	0.832	0.832
	Minimum	0.625	0.625	0.625	0.625	0.625
	Maximum	1.006	1.006	1.006	1.006	1.006
	Std. Deviation	0.186	0.186	0.186	0.186	0.186
	Variance	0.035	0.035	0.035	0.035	0.035
	Median	0.938	0.938	0.938	0.938	0.938
	Grouped Median	0.938	0.938	0.938	0.938	0.938
	Number of Firms	5	5	5	5	5
ENGINEERING, GENERAL	Mean	0.646	0.646	0.646	0.646	0.646
	Minimum	0.337	0.337	0.337	0.337	0.337
	Maximum	0.886	0.886	0.886	0.886	0.886
	Std. Deviation	0.175	0.175	0.175	0.175	0.175
	Variance	0.031	0.031	0.031	0.031	0.031
	Median	0.643	0.643	0.643	0.643	0.643
	Grouped Median	0.643	0.643	0.643	0.643	0.643
	Number of Firms	9	9	9	9	9
RETAILERS E-COMMERCE	Mean	0.789	0.789	0.789	0.789	0.789
	Minimum	0.789	0.789	0.789	0.789	0.789
	Maximum	0.789	0.789	0.789	0.789	0.789
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.789	0.789	0.789	0.789	0.789
	Grouped Median	0.789	0.789	0.789	0.789	0.789
	Number of Firms	1	1	1	1	1

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
FOOD PROCESSORS	Mean	0.564	0.564	0.564	0.564	0.564
	Minimum	0.250	0.250	0.250	0.250	0.250
	Maximum	1.028	1.028	1.028	1.028	1.028
	Std. Deviation	0.278	0.278	0.278	0.278	0.278
	Variance	0.077	0.077	0.077	0.077	0.077
	Median	0.506	0.506	0.506	0.506	0.506
	Grouped Median	0.506	0.506	0.506	0.506	0.506
	Number of Firms	12	12	12	12	12
FOOD + DRUG RETAILERS	Mean	0.310	0.310	0.310	0.310	0.310
	Minimum	0.085	0.085	0.085	0.085	0.085
	Maximum	0.439	0.439	0.439	0.439	0.439
	Std. Deviation	0.196	0.196	0.196	0.196	0.196
	Variance	0.038	0.038	0.038	0.038	0.038
	Median	0.407	0.407	0.407	0.407	0.407
	Grouped Median	0.407	0.407	0.407	0.407	0.407
	Number of Firms	3	3	3	3	3
FARMING AND FISHING	Mean	0.902	0.902	0.902	0.902	0.902
	Minimum	0.827	0.827	0.827	0.827	0.827
	Maximum	0.976	0.976	0.976	0.976	0.976
	Std. Deviation	0.105	0.105	0.105	0.105	0.105
	Variance	0.011	0.011	0.011	0.011	0.011
	Median	0.902	0.902	0.902	0.902	0.902
	Grouped Median	0.902	0.902	0.902	0.902	0.902
	Number of Firms	2	2	2	2	2
FORESTRY	Mean	0.866	0.866	0.866	0.866	0.866
	Minimum	0.866	0.866	0.866	0.866	0.866
	Maximum	0.866	0.866	0.866	0.866	0.866
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.866	0.866	0.866	0.866	0.866
	Grouped Median	0.866	0.866	0.866	0.866	0.866
	Number of Firms	1	1	1	1	1
FURN. + FLOORCOVERING	Mean	0.721	0.721	0.721	0.721	0.721
	Minimum	0.253	0.253	0.253	0.253	0.253
	Maximum	1.124	1.124	1.124	1.124	1.124
	Std. Deviation	0.303	0.303	0.303	0.303	0.303
	Variance	0.092	0.092	0.092	0.092	0.092
	Median	0.713	0.713	0.713	0.713	0.713
	Grouped Median	0.713	0.713	0.713	0.713	0.713
	Number of Firms	6	6	6	6	6
GAS DISTRIBUTION	Mean	0.568	0.568	0.568	0.568	0.568
	Minimum	0.568	0.568	0.568	0.568	0.568
	Maximum	0.568	0.568	0.568	0.568	0.568
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.568	0.568	0.568	0.568	0.568
	Grouped Median	0.568	0.568	0.568	0.568	0.568
	Number of Firms	1	1	1	1	1

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
HSEHOLD APPS+HSEWARES	Mean	0.696	0.696	0.696	0.696	0.696
	Minimum	0.369	0.369	0.369	0.369	0.369
	Maximum	0.994	0.994	0.994	0.994	0.994
	Std. Deviation	0.207	0.207	0.207	0.207	0.207
	Variance	0.043	0.043	0.043	0.043	0.043
	Median	0.707	0.707	0.707	0.707	0.707
	Grouped Median	0.707	0.707	0.707	0.707	0.707
	Number of Firms	17	17	17	17	17
RETAIL, HARDLINES	Mean	0.678	0.678	0.678	0.678	0.678
	Minimum	0.242	0.242	0.242	0.242	0.242
	Maximum	0.933	0.933	0.933	0.933	0.933
	Std. Deviation	0.206	0.206	0.206	0.206	0.206
	Variance	0.042	0.042	0.042	0.042	0.042
	Median	0.743	0.743	0.743	0.743	0.743
	Grouped Median	0.743	0.743	0.743	0.743	0.743
	Number of Firms	19	19	19	19	19
HOME ENTERTAINMENT						
HOTELS	Mean	0.730	0.730	0.730	0.730	0.730
	Minimum	0.183	0.183	0.183	0.183	0.183
	Maximum	1.105	1.105	1.105	1.105	1.105
	Std. Deviation	0.237	0.237	0.237	0.237	0.237
	Variance	0.056	0.056	0.056	0.056	0.056
	Median	0.729	0.729	0.729	0.729	0.729
	Grouped Median	0.749	0.749	0.749	0.749	0.749
	Number of Firms	16	16	16	16	16
INSURANCE BROKERS	Mean	1.010	1.010	1.010	1.010	1.010
	Minimum	1.010	1.010	1.010	1.010	1.010
	Maximum	1.010	1.010	1.010	1.010	1.010
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	1.010	1.010	1.010	1.010	1.010
	Grouped Median	1.010	1.010	1.010	1.010	1.010
	Number of Firms	1	1	1	1	1
INTERNET	Mean	0.605	0.605	0.605	0.605	0.605
	Minimum	0.357	0.357	0.357	0.357	0.357
	Maximum	0.759	0.759	0.759	0.759	0.759
	Std. Deviation	0.183	0.183	0.183	0.183	0.183
	Variance	0.033	0.033	0.033	0.033	0.033
	Median	0.652	0.652	0.652	0.652	0.652
	Grouped Median	0.652	0.652	0.652	0.652	0.652
	Number of Firms	4	4	4	4	4

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
INVESTMENT BANKS	Mean	0.788	0.788	0.788	0.788	0.788
	Minimum	0.726	0.726	0.726	0.726	0.726
	Maximum	0.849	0.849	0.849	0.849	0.849
	Std. Deviation	0.087	0.087	0.087	0.087	0.087
	Variance	0.008	0.008	0.008	0.008	0.008
	Median	0.788	0.788	0.788	0.788	0.788
	Grouped Median	0.788	0.788	0.788	0.788	0.788
	Number of Firms	2	2	2	2	2
INVESTMENT HOUSE	Mean	0.651	0.651	0.651	0.651	0.651
	Minimum	0.117	0.117	0.117	0.117	0.117
	Maximum	1.079	1.079	1.079	1.079	1.079
	Std. Deviation	0.287	0.287	0.287	0.287	0.287
	Variance	0.082	0.082	0.082	0.082	0.082
	Median	0.598	0.598	0.598	0.598	0.598
	Grouped Median	0.598	0.598	0.598	0.598	0.598
	Number of Firms	16	16	16	16	16
LEISURE FACILITIES	Mean	0.670	0.670	0.670	0.670	0.670
	Minimum	0.379	0.379	0.379	0.379	0.379
	Maximum	0.901	0.901	0.901	0.901	0.901
	Std. Deviation	0.193	0.193	0.193	0.193	0.193
	Variance	0.037	0.037	0.037	0.037	0.037
	Median	0.719	0.719	0.719	0.719	0.719
	Grouped Median	0.719	0.719	0.719	0.719	0.719
	Number of Firms	7	7	7	7	7
LEISURE EQUIPMENT	Mean	0.667	0.667	0.667	0.667	0.667
	Minimum	0.527	0.527	0.527	0.527	0.527
	Maximum	0.782	0.782	0.782	0.782	0.782
	Std. Deviation	0.097	0.097	0.097	0.097	0.097
	Variance	0.009	0.009	0.009	0.009	0.009
	Median	0.665	0.665	0.665	0.665	0.665
	Grouped Median	0.665	0.665	0.665	0.665	0.665
	Number of Firms	6	6	6	6	6
MEDIA AGENCIES	Mean	0.670	0.670	0.670	0.670	0.670
	Minimum	0.670	0.670	0.670	0.670	0.670
	Maximum	0.670	0.670	0.670	0.670	0.670
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.670	0.670	0.670	0.670	0.670
	Grouped Median	0.670	0.670	0.670	0.670	0.670
	Number of Firms	1	1	1	1	1
MEDICAL EQUIP + SUPPLIES	Mean	0.490	0.490	0.490	0.490	0.490
	Minimum	0.335	0.335	0.335	0.335	0.335
	Maximum	0.793	0.793	0.793	0.793	0.793
	Std. Deviation	0.262	0.262	0.262	0.262	0.262
	Variance	0.069	0.069	0.069	0.069	0.069
	Median	0.343	0.343	0.343	0.343	0.343
	Grouped Median	0.343	0.343	0.343	0.343	0.343
	Number of Firms	3	3	3	3	3

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
OTHER MINING						
OTHER FINANCIAL	Mean	0.862	0.862	0.862	0.862	0.862
	Minimum	0.808	0.808	0.808	0.808	0.808
	Maximum	0.915	0.915	0.915	0.915	0.915
	Std. Deviation	0.076	0.076	0.076	0.076	0.076
	Variance	0.006	0.006	0.006	0.006	0.006
	Median	0.862	0.862	0.862	0.862	0.862
	Grouped Median	0.862	0.862	0.862	0.862	0.862
	Number of Firms	2	2	2	2	2
MORTGAGE FINANCE	Mean	0.791	0.791	0.791	0.791	0.791
	Minimum	0.791	0.791	0.791	0.791	0.791
	Maximum	0.791	0.791	0.791	0.791	0.791
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.791	0.791	0.791	0.791	0.791
	Grouped Median	0.791	0.791	0.791	0.791	0.791
	Number of Firms	1	1	1	1	1
RETAILERS, MULTI DEPT	Mean	0.794	0.794	0.794	0.794	0.794
	Minimum	0.640	0.640	0.640	0.640	0.640
	Maximum	1.078	1.078	1.078	1.078	1.078
	Std. Deviation	0.165	0.165	0.165	0.165	0.165
	Variance	0.027	0.027	0.027	0.027	0.027
	Median	0.778	0.778	0.778	0.778	0.778
	Grouped Median	0.778	0.778	0.778	0.778	0.778
	Number of Firms	6	6	6	6	6
NON-FERROUS METALS	Mean	0.748	0.748	0.748	0.748	0.748
	Minimum	0.554	0.554	0.554	0.554	0.554
	Maximum	0.886	0.886	0.886	0.886	0.886
	Std. Deviation	0.151	0.151	0.151	0.151	0.151
	Variance	0.023	0.023	0.023	0.023	0.023
	Median	0.805	0.805	0.805	0.805	0.805
	Grouped Median	0.805	0.805	0.805	0.805	0.805
	Number of Firms	6	6	6	6	6
OIL + GAS EXPL/PROD.	Mean	0.751	0.751	0.751	0.751	0.751
	Minimum	0.603	0.603	0.603	0.603	0.603
	Maximum	0.899	0.899	0.899	0.899	0.899
	Std. Deviation	0.209	0.209	0.209	0.209	0.209
	Variance	0.044	0.044	0.044	0.044	0.044
	Median	0.751	0.751	0.751	0.751	0.751
	Grouped Median	0.751	0.751	0.751	0.751	0.751
	Number of Firms	2	2	2	2	2

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
OIL INTEGRATED	Mean	0.678	0.678	0.678	0.678	0.678
	Minimum	0.678	0.678	0.678	0.678	0.678
	Maximum	0.678	0.678	0.678	0.678	0.678
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.678	0.678	0.678	0.678	0.678
	Grouped Median	0.678	0.678	0.678	0.678	0.678
OTHER HEALTH CARE	Mean	0.567	0.567	0.567	0.567	0.567
	Minimum	0.567	0.567	0.567	0.567	0.567
	Maximum	0.567	0.567	0.567	0.567	0.567
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.567	0.567	0.567	0.567	0.567
	Grouped Median	0.567	0.567	0.567	0.567	0.567
	Number of Firms	1	1	1	1	1
OTHER INSURANCE						
PAPER	Mean	0.525	0.525	0.525	0.525	0.525
	Minimum	0.246	0.246	0.246	0.246	0.246
	Maximum	0.688	0.688	0.688	0.688	0.688
	Std. Deviation	0.243	0.243	0.243	0.243	0.243
	Variance	0.059	0.059	0.059	0.059	0.059
	Median	0.640	0.640	0.640	0.640	0.640
	Grouped Median	0.640	0.640	0.640	0.640	0.640
	Number of Firms	3	3	3	3	3
PACKAGING	Mean	0.404	0.404	0.404	0.404	0.404
	Minimum	0.132	0.132	0.132	0.132	0.132
	Maximum	0.675	0.675	0.675	0.675	0.675
	Std. Deviation	0.384	0.384	0.384	0.384	0.384
	Variance	0.147	0.147	0.147	0.147	0.147
	Median	0.404	0.404	0.404	0.404	0.404
	Grouped Median	0.404	0.404	0.404	0.404	0.404
	Number of Firms	2	2	2	2	2

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
PHARMACEUTICALS	Mean	0.695	0.695	0.695	0.695	0.695
	Minimum	0.264	0.264	0.264	0.264	0.264
	Maximum	0.945	0.945	0.945	0.945	0.945
	Std. Deviation	0.299	0.299	0.299	0.299	0.299
	Variance	0.089	0.089	0.089	0.089	0.089
	Median	0.785	0.785	0.785	0.785	0.785
	Grouped Median	0.785	0.785	0.785	0.785	0.785
	Number of Firms	4	4	4	4	4
PHOTOGRAPHY	Mean	0.739	0.739	0.739	0.739	0.739
	Minimum	0.739	0.739	0.739	0.739	0.739
	Maximum	0.739	0.739	0.739	0.739	0.739
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.739	0.739	0.739	0.739	0.739
	Grouped Median	0.739	0.739	0.739	0.739	0.739
	Number of Firms	1	1	1	1	1
PERSONAL PRODUCTS						
PROPERTY AGENCIES	Mean	1.205	1.205	1.205	1.205	1.205
	Minimum	1.205	1.205	1.205	1.205	1.205
	Maximum	1.205	1.205	1.205	1.205	1.205
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	1.205	1.205	1.205	1.205	1.205
	Grouped Median	1.205	1.205	1.205	1.205	1.205
	Number of Firms	1	1	1	1	1
PUBLISHING + PRINTING	Mean	0.675	0.675	0.675	0.675	0.675
	Minimum	0.437	0.437	0.437	0.437	0.437
	Maximum	0.920	0.920	0.920	0.920	0.920
	Std. Deviation	0.158	0.158	0.158	0.158	0.158
	Variance	0.025	0.025	0.025	0.025	0.025
	Median	0.682	0.682	0.682	0.682	0.682
	Grouped Median	0.682	0.682	0.682	0.682	0.682
	Number of Firms	14	14	14	14	14
REINSURANCE						

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
RESTAURANTS AND PUBS	Mean	0.575	0.575	0.575	0.575	0.575
	Minimum	0.343	0.343	0.343	0.343	0.343
	Maximum	0.776	0.776	0.776	0.776	0.776
	Std. Deviation	0.172	0.172	0.172	0.172	0.172
	Variance	0.030	0.030	0.030	0.030	0.030
	Median	0.581	0.581	0.581	0.581	0.581
	Grouped Median	0.581	0.581	0.581	0.581	0.581
	Number of Firms	7	7	7	7	7
REAL ESTATE DEV.	Mean	0.777	0.777	0.777	0.777	0.777
	Minimum	0.138	0.138	0.138	0.138	0.138
	Maximum	1.405	1.405	1.405	1.405	1.405
	Std. Deviation	0.307	0.307	0.307	0.307	0.307
	Variance	0.095	0.095	0.095	0.095	0.095
	Median	0.834	0.834	0.834	0.834	0.834
	Grouped Median	0.834	0.834	0.834	0.834	0.834
	Number of Firms	108	108	108	108	108
RAIL, ROAD, FREIGHT	Mean	0.668	0.668	0.668	0.668	0.668
	Minimum	0.225	0.225	0.225	0.225	0.225
	Maximum	1.019	1.019	1.019	1.019	1.019
	Std. Deviation	0.225	0.225	0.225	0.225	0.225
	Variance	0.050	0.050	0.050	0.050	0.050
	Median	0.701	0.701	0.701	0.701	0.701
	Grouped Median	0.701	0.701	0.701	0.701	0.701
	Number of Firms	12	12	12	12	12
SEMICONDUCTORS	Mean	0.927	0.927	0.927	0.927	0.927
	Minimum	0.927	0.927	0.927	0.927	0.927
	Maximum	0.927	0.927	0.927	0.927	0.927
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.927	0.927	0.927	0.927	0.927
	Grouped Median	0.927	0.927	0.927	0.927	0.927
	Number of Firms	1	1	1	1	1
SHIPPING AND PORTS	Mean	0.800	0.800	0.800	0.800	0.800
	Minimum	0.285	0.285	0.285	0.285	0.285
	Maximum	1.211	1.211	1.211	1.211	1.211
	Std. Deviation	0.328	0.328	0.328	0.328	0.328
	Variance	0.107	0.107	0.107	0.107	0.107
	Median	0.886	0.886	0.886	0.886	0.886
	Grouped Median	0.886	0.886	0.886	0.886	0.886
	Number of Firms	11	11	11	11	11
SOFT DRINKS	Mean	0.853	0.853	0.853	0.853	0.853
	Minimum	0.853	0.853	0.853	0.853	0.853
	Maximum	0.853	0.853	0.853	0.853	0.853
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	0.853	0.853	0.853	0.853	0.853
	Grouped Median	0.853	0.853	0.853	0.853	0.853
	Number of Firms	1	1	1	1	1

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
RETAILERS, SOFT GOODS						
SOFTWARE	Mean	1.135	1.135	1.135	1.135	1.135
	Minimum	1.029	1.029	1.029	1.029	1.029
	Maximum	1.240	1.240	1.240	1.240	1.240
	Std. Deviation	0.106	0.106	0.106	0.106	0.106
	Variance	0.011	0.011	0.011	0.011	0.011
	Median	1.137	1.137	1.137	1.137	1.137
	Grouped Median	1.137	1.137	1.137	1.137	1.137
	Number of Firms	3	3	3	3	3
STEEL	Mean	0.898	0.898	0.898	0.898	0.898
	Minimum	0.463	0.463	0.463	0.463	0.463
	Maximum	1.129	1.129	1.129	1.129	1.129
	Std. Deviation	0.234	0.234	0.234	0.234	0.234
	Variance	0.055	0.055	0.055	0.055	0.055
	Median	0.962	0.962	0.962	0.962	0.962
	Grouped Median	0.962	0.962	0.962	0.962	0.962
	Number of Firms	6	6	6	6	6
TELECOM EQUIPMENT	Mean	0.790	0.790	0.790	0.790	0.790
	Minimum	0.443	0.443	0.443	0.443	0.443
	Maximum	1.149	1.149	1.149	1.149	1.149
	Std. Deviation	0.250	0.250	0.250	0.250	0.250
	Variance	0.062	0.062	0.062	0.062	0.062
	Median	0.836	0.836	0.836	0.836	0.836
	Grouped Median	0.836	0.836	0.836	0.836	0.836
	Number of Firms	13	13	13	13	13
TELECOM FIXLINE	Mean	0.814	0.814	0.814	0.814	0.814
	Minimum	0.591	0.591	0.591	0.591	0.591
	Maximum	1.036	1.036	1.036	1.036	1.036
	Std. Deviation	0.315	0.315	0.315	0.315	0.315
	Variance	0.099	0.099	0.099	0.099	0.099
	Median	0.814	0.814	0.814	0.814	0.814
	Grouped Median	0.814	0.814	0.814	0.814	0.814
	Number of Firms	2	2	2	2	2
TELECOM WIRELESS	Mean	0.824	0.824	0.824	0.824	0.824
	Minimum	0.584	0.584	0.584	0.584	0.584
	Maximum	1.175	1.175	1.175	1.175	1.175
	Std. Deviation	0.209	0.209	0.209	0.209	0.209
	Variance	0.044	0.044	0.044	0.044	0.044
	Median	0.832	0.832	0.832	0.832	0.832
	Grouped Median	0.832	0.832	0.832	0.832	0.832
	Number of Firms	6	6	6	6	6

Appendix E1 – Performance of Stocks of Hong Kong BETA

Company Category		BETA 1996	BETA 1997	BETA 1998	BETA 1999	BETA 2000
TEXTILES+LEATHER GDS	Mean	0.601	0.601	0.601	0.601	0.601
	Minimum	0.101	0.101	0.101	0.101	0.101
	Maximum	0.983	0.983	0.983	0.983	0.983
	Std. Deviation	0.264	0.264	0.264	0.264	0.264
	Variance	0.070	0.070	0.070	0.070	0.070
	Median	0.652	0.652	0.652	0.652	0.652
	Grouped Median	0.652	0.652	0.652	0.652	0.652
	Number of Firms	28	28	28	28	28
WATER						

Table E1b-Mean Beta of non-construction companies

Company Category		**BETA 1996**	**BETA 1997**	**BETA 1998**	**BETA 1999**	**BETA 2000**
Total	**Mean**	**0.735**	**0.735**	**0.735**	**0.735**	**0.735**
	Minimum	**0.085**	**0.085**	**0.085**	**0.085**	**0.085**
	Maximum	**1.431**	**1.431**	**1.431**	**1.431**	**1.431**
	Std. Deviation	**0.258**	**0.258**	**0.258**	**0.258**	**0.258**
	Variance	**0.067**	**0.067**	**0.067**	**0.067**	**0.067**
	Median	**0.755**	**0.755**	**0.755**	**0.755**	**0.755**
	Grouped Median	**0.754**	**0.754**	**0.754**	**0.754**	**0.754**
	Number of Firms	**581**	**581**	**581**	**581**	**581**

Table E1c-Mean Beta of construction companies

Company Category		**BETA 1996**	**BETA 1997**	**BETA 1998**	**BETA 1999**	**BETA 2000**
CONSTRUCTION	**Mean**	**0.740**	**0.740**	**0.740**	**0.740**	**0.740**
	Minimum	**0.309**	**0.309**	**0.309**	**0.309**	**0.309**
	Maximum	**1.355**	**1.355**	**1.355**	**1.355**	**1.355**
	Std. Deviation	**0.220**	**0.220**	**0.220**	**0.220**	**0.220**
	Variance	**0.048**	**0.048**	**0.048**	**0.048**	**0.048**
	Median	**0.717**	**0.717**	**0.717**	**0.717**	**0.717**
	Grouped Median	**0.717**	**0.717**	**0.717**	**0.717**	**0.717**
	Number of Firms	**27**	**27**	**27**	**27**	**27**

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

(Note: In some of the categories, there are no listed companies operating in Hong Kong and hence the columns in Appendix E2 are blank. Total listed non-construction companies processed were 444 at year 2000. There were data from 19 listed construction companies at year 1997 in Table E2c.)

Case Processing Summary (Listed non-construction companies)

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
P/E1996 * Company Category	373	53.1%	330	46.9%	703	100.0%
P/E1997 * Company Category	456	64.9%	247	35.1%	703	100.0%
P/E1998 * Company Category	391	55.6%	312	44.4%	703	100.0%
P/E1999 * Company Category	346	49.2%	357	50.8%	703	100.0%
P/E2000 * Company Category	444	63.2%	259	36.8%	703	100.0%

Table E2a-P/E of non-construction companies

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
AEROSPACE	Mean	13.100	14.700	5.500		
	Minimum	13.100	14.700	5.500		
	Maximum	13.100	14.700	5.500		
	Std. Deviation	.	.	.		
	Variance	.	.	.		
	Median	13.100	14.700	5.500		
	Grouped Median	13.100	14.700	5.500		
	Number of Firms	1	1	1		
AIRLINES & AIRPORTS	Mean	11.433	7.850	16.900	87.200	19.217
	Minimum	9.700	6.600	3.900	34.900	9.700
	Maximum	13.100	10.300	58.300	139.500	42.000
	Std. Deviation	1.701	1.662	23.218	73.963	11.927
	Variance	2.893	2.763	539.075	5470.580	142.262
	Median	11.500	7.250	7.000	87.200	15.200
	Grouped Median	11.500	7.250	7.000	87.200	15.200
	Number of Firms	3	4	5	2	6
ASSET MANAGERS	Mean	21.075	5.925	11.600	11.500	9.067
	Minimum	7.200	2.700	5.100	5.500	4.200
	Maximum	39.000	9.200	19.800	23.400	17.800
	Std. Deviation	13.319	2.654	7.496	10.306	7.580
	Variance	177.383	7.043	56.190	106.210	57.453
	Median	19.050	5.900	9.900	5.600	5.200
	Grouped Median	19.050	5.900	9.900	5.600	5.200
	Number of Firms	4	4	3	3	3
AUTOPARTS	Mean	7.200	6.100	5.600		12.200
	Minimum	7.200	6.100	5.600		12.200
	Maximum	7.200	6.100	5.600		12.200
	Std. Deviation	.	.	.		.
	Variance	.	.	.		.
	Median	7.200	6.100	5.600		12.200
	Grouped Median	7.200	6.100	5.600		12.200
	Number of Firms	1	1	1		1

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
AUTOMOBILE	Mean			10.300	38.000	13.150
	Minimum			8.300	8.700	7.900
	Maximum			12.300	67.300	18.400
	Std. Deviation			2.828	41.436	7.425
	Variance			8.000	1716.980	55.125
	Median			10.300	38.000	13.150
	Grouped Median			10.300	38.000	13.150
	Number of Firms			2	2	2
BANKS	Mean	12.450	9.214	9.986	20.100	16.040
	Minimum	7.200	3.800	4.600	5.500	7.300
	Maximum	20.000	16.000	16.300	33.700	40.400
	Std. Deviation	3.905	3.846	3.523	8.347	8.505
	Variance	15.252	14.795	12.414	69.666	72.338
	Median	11.750	8.200	9.350	23.000	15.100
	Grouped Median	11.750	8.200	9.350	23.000	15.100
	Number of Firms	14	14	14	11	15
BUILDING MATERIALS	Mean	21.938	12.190	8.722	7.957	10.520
	Minimum	6.700	1.900	2.000	3.300	1.200
	Maximum	88.700	40.400	33.900	18.600	60.900
	Std. Deviation	28.118	12.267	9.679	5.042	17.868
	Variance	790.594	150.479	93.677	25.426	319.248
	Median	9.950	7.100	6.200	6.500	4.950
	Grouped Median	9.950	7.100	6.200	6.500	4.950
	Number of Firms	8	10	9	7	10
BROADCASTING	Mean	39.367	21.300	16.900	45.700	114.175
	Minimum	27.400	1.700	14.600	45.700	10.700
	Maximum	59.400	36.000	19.200	45.700	400.000
	Std. Deviation	17.459	14.963	3.253	.	190.824
	Variance	304.803	223.887	10.580	.	36413.649
	Median	31.300	23.750	16.900	45.700	23.000
	Grouped Median	31.300	23.750	16.900	45.700	23.000
	Number of Firms	3	4	2	1	4
BREWER	Mean	18.200	27.667	23.950	16.067	19.267
	Minimum	8.600	7.900	5.000	7.900	7.100
	Maximum	27.800	60.600	42.900	31.300	42.200
	Std. Deviation	13.576	28.711	26.799	13.204	19.873
	Variance	184.320	824.343	718.205	174.343	394.943
	Median	18.200	14.500	23.950	9.000	8.500
	Grouped Median	18.200	14.500	23.950	9.000	8.500
	Number of Firms	2	3	2	3	3
CHEMICALS, COMMODITY	Mean	15.267	19.100	14.233	35.100	7.529
	Minimum	6.400	2.900	4.300	4.500	3.700
	Maximum	43.600	51.700	36.100	148.100	10.900
	Std. Deviation	14.121	19.680	11.792	44.016	2.405
	Variance	199.399	387.289	139.055	1937.440	5.782
	Median	9.650	10.700	10.200	20.900	7.600
	Grouped Median	9.650	10.700	10.200	20.900	7.600
	Number of Firms	6	8	6	9	7

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
CHEMS.ADVANCED MATS.	Mean	19.117	12.850	269.471	17.367	7.633
	Minimum	6.800	3.000	3.400	1.300	3.500
	Maximum	52.200	36.800	1789.700	44.800	13.400
	Std. Deviation	17.324	12.926	670.461	23.874	5.148
	Variance	300.130	167.071	449518.236	569.963	26.503
	Median	10.550	8.400	16.100	6.000	6.000
	Grouped Median	10.667	8.400	16.100	6.000	6.000
	Number of Firms	6	6	7	3	3
CLOTHING + FOOTWEAR	Mean	24.412	7.625	8.431	8.913	6.300
	Minimum	4.100	1.600	2.600	3.900	1.300
	Maximum	235.000	25.300	54.600	17.100	16.900
	Std. Deviation	54.640	6.610	12.670	4.534	4.389
	Variance	2985.542	43.686	160.525	20.553	19.263
	Median	9.500	4.850	4.450	8.100	5.000
	Grouped Median	9.500	4.850	4.450	8.100	5.000
	Number of Firms	17	20	16	15	19
COMPUTER SERVICES	Mean	6.900	3.800	2.050	11.000	5.800
	Minimum	6.900	3.800	0.400	11.000	5.800
	Maximum	6.900	3.800	3.700	11.000	5.800
	Std. Deviation	.	.	2.333	.	.
	Variance	.	.	5.445	.	.
	Median	6.900	3.800	2.050	11.000	5.800
	Grouped Median	6.900	3.800	2.050	11.000	5.800
	Number of Firms	1.000	1.000	2.000	1.000	1.000
CONSUMER FINANCE	Mean	14.150	6.250	4.550	10.650	5.850
	Minimum	13.800	5.700	4.300	7.500	5.000
	Maximum	14.500	6.800	4.800	13.800	6.700
	Std. Deviation	0.495	0.778	0.354	4.455	1.202
	Variance	0.245	0.605	0.125	19.845	1.445
	Median	14.150	6.250	4.550	10.650	5.850
	Grouped Median	14.150	6.250	4.550	10.650	5.850
	Number of Firms	2	2	2	2	2
COMMERCIAL VEHICLES	Mean	27.700	16.900	5.500	5.100	4.500
	Minimum	27.700	16.900	5.500	5.100	4.500
	Maximum	27.700	16.900	5.500	5.100	4.500
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	27.700	16.900	5.500	5.100	4.500
	Grouped Median	27.700	16.900	5.500	5.100	4.500
	Number of Firms	1	1	1	1	1
COMPUTER HARDWARE	Mean		5.750	6.020	106.020	19.729
	Minimum		2.600	2.100	5.500	1.700
	Maximum		8.900	13.800	393.400	57.600
	Std. Deviation		4.455	4.552	165.076	23.686
	Variance		19.845	20.717	27250.157	561.029
	Median		5.750	5.100	25.600	9.700
	Grouped Median		5.750	5.100	25.600	9.700
	Number of Firms		2	5	5	7

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
DISTRIB. IND. COMPS.	Mean	26.333	4.825	10.900	13.033	3.025
	Minimum	3.000	3.500	2.600	3.100	1.500
	Maximum	70.500	8.000	22.500	31.400	5.100
	Std. Deviation	38.270	2.139	9.739	15.924	1.773
	Variance	1464.583	4.576	94.847	253.563	3.143
	Median	5.500	3.900	9.250	4.600	2.750
	Grouped Median	5.500	3.900	9.250	4.600	2.750
	Number of Firms	3	4	4	3	4
DISTILLERS + VINTNERS	Mean			6.500	15.200	10.900
	Minimum			6.500	15.200	10.900
	Maximum			6.500	15.200	10.900
	Std. Deviation			.	.	.
	Variance			.	.	.
	Median			6.500	15.200	10.900
	Grouped Median			6.500	15.200	10.900
	Number of Firms			1	1	1
DIVERSIFIED INDUSTRY	Mean	21.769	23.544	18.820	52.246	20.931
	Minimum	6.300	5.100	2.100	10.100	0.900
	Maximum	58.400	154.300	100.000	365.600	94.500
	Std. Deviation	14.445	35.288	23.383	94.996	23.802
	Variance	208.666	1245.221	546.767	9024.286	566.534
	Median	17.350	10.550	11.700	25.400	14.000
	Grouped Median	17.350	10.550	11.700	25.400	14.000
	Number of Firms	16	18	15	13	16
OTHER DISTRIBUTORS	Mean	18.175	8.175	11.800	20.100	18.650
	Minimum	9.200	0.100	0.600	5.300	3.700
	Maximum	24.000	20.400	24.900	50.500	54.800
	Std. Deviation	7.050	6.529	8.896	18.194	19.245
	Variance	49.696	42.622	79.140	331.028	370.363
	Median	19.750	6.200	13.850	11.300	11.300
	Grouped Median	19.750	6.200	13.850	11.300	11.300
	Number of Firms	4	8	6	6	6
VEHICLE DISTRIBUTION	Mean			3.100		
	Minimum			3.100		
	Maximum			3.100		
	Std. Deviation			.		
	Variance			.		
	Median			3.100		
	Grouped Median			3.100		
	Number of Firms			1		
EDUCATION + TRAINING	Mean	12.900	9.200	8.600	5.500	7.900
	Minimum	12.900	9.200	8.600	5.500	7.900
	Maximum	12.900	9.200	8.600	5.500	7.900
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	12.900	9.200	8.600	5.500	7.900
	Grouped Median	12.900	9.200	8.600	5.500	7.900
	Number of Firms	1	1	1	1	1

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
ELECTRICITY	Mean	11.533	12.900	9.320	7.167	9.467
	Minimum	7.100	6.300	5.300	3.800	5.100
	Maximum	14.200	17.100	11.800	13.700	13.600
	Std. Deviation	3.866	4.680	2.605	3.828	3.020
	Variance	14.943	21.900	6.787	14.651	9.123
	Median	13.300	14.100	10.500	5.650	9.850
	Grouped Median	13.300	14.100	10.500	5.650	9.850
	Number of Firms	3	4	5	6	6
ELECTRICAL EQUIPMENT	Mean	35.367	7.945	8.577	18.925	26.054
	Minimum	3.300	2.100	0.900	3.900	1.300
	Maximum	232.900	20.000	24.400	68.200	181.600
	Std. Deviation	74.390	5.097	7.012	20.861	48.988
	Variance	5533.873	25.975	49.167	435.169	2399.836
	Median	9.400	6.000	5.900	8.050	8.400
	Grouped Median	9.400	6.000	5.900	8.050	8.400
	Number of Firms	9	11	13	12	13
ELECTRONIC EQUIPMENT	Mean	29.783	9.892	5.174	13.628	10.233
	Minimum	2.700	1.100	0.700	1.000	1.000
	Maximum	330.000	57.300	17.000	45.900	52.600
	Std. Deviation	65.751	12.773	3.957	11.530	12.390
	Variance	4323.206	163.156	15.658	132.941	153.500
	Median	9.700	5.700	3.900	9.900	6.300
	Grouped Median	9.700	5.700	3.933	9.900	6.300
	Number of Firms	29	37	31	25	33
ENG. CONTRACTORS	Mean	7.167	51.900	9.067	7.867	3.667
	Minimum	5.900	2.400	4.200	6.000	3.200
	Maximum	8.100	243.900	18.700	9.600	4.600
	Std. Deviation	1.137	107.336	8.343	1.804	0.808
	Variance	1.293	11521.035	69.603	3.253	0.653
	Median	7.500	4.300	4.300	8.000	3.200
	Grouped Median	7.500	4.300	4.300	8.000	3.667
	Number of Firms	3	5	3	3	3
ENGINEERING, GENERAL	Mean	18.543	15.950	13.125	9.017	5.667
	Minimum	3.900	3.100	2.700	0.300	0.000
	Maximum	79.900	111.200	66.500	19.800	12.500
	Std. Deviation	27.310	33.507	21.706	6.654	4.185
	Variance	745.863	1122.712	471.151	44.270	17.511
	Median	9.700	5.700	5.300	8.450	5.800
	Grouped Median	9.700	5.700	5.300	8.450	5.800
	Number of Firms	7	10	8	6	6
RETAILERS E-COMMERCE	Mean	11.100	5.000		6.700	
	Minimum	11.100	5.000		6.700	
	Maximum	11.100	5.000		6.700	
	Std. Deviation	.	.		.	
	Variance	.	.		.	
	Median	11.100	5.000		6.700	
	Grouped Median	11.100	5.000		6.700	
	Number of Firms	1	1		1	

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
FOOD PROCESSORS	Mean	30.675	13.625	8.356	14.240	28.922
	Minimum	8.600	2.200	0.800	8.200	2.200
	Maximum	135.000	38.100	17.600	28.900	192.300
	Std. Deviation	42.761	10.854	4.944	8.374	61.720
	Variance	1828.474	117.808	24.445	70.128	3809.314
	Median	16.150	11.750	9.500	11.900	7.600
	Grouped Median	16.150	11.750	9.500	11.900	7.600
	Number of Firms	8	8	9	5	9
FOOD + DRUG RETAILERS	Mean	31.550	21.800	4.900	5.300	11.150
	Minimum	27.400	21.800	3.500	5.300	1.300
	Maximum	35.700	21.800	6.300	5.300	21.000
	Std. Deviation	5.869	.	1.980	.	13.930
	Variance	34.445	.	3.920	.	194.045
	Median	31.550	21.800	4.900	5.300	11.150
	Grouped Median	31.550	21.800	4.900	5.300	11.150
	Number of Firms	2	1	2	1	2
FARMING AND FISHING	Mean	20.700	19.400	2.200	1.400	3.000
	Minimum	20.700	19.400	2.200	1.400	3.000
	Maximum	20.700	19.400	2.200	1.400	3.000
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	20.700	19.400	2.200	1.400	3.000
	Grouped Median	20.700	19.400	2.200	1.400	3.000
	Number of Firms	1	1	1	1	1
FORESTRY	Mean			1.900		
	Minimum			1.900		
	Maximum			1.900		
	Std. Deviation			.		
	Variance			.		
	Median			1.900		
	Grouped Median			1.900		
	Number of Firms			1		
FURN. + FLOORCOVERING	Mean	7.600	4.233	4.300	11.720	5.980
	Minimum	3.300	3.300	3.600	4.000	3.100
	Maximum	11.900	5.000	5.300	25.000	11.800
	Std. Deviation	6.081	0.862	0.726	8.987	3.454
	Variance	36.980	0.743	0.527	80.772	11.927
	Median	7.600	4.400	4.150	6.800	4.900
	Grouped Median	7.600	4.400	4.150	6.800	4.900
	Number of Firms	2	3	4	5	5
GAS DISTRIBUTION	Mean	22.800	25.600	17.200	18.100	19.600
	Minimum	22.800	25.600	17.200	18.100	19.600
	Maximum	22.800	25.600	17.200	18.100	19.600
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	22.800	25.600	17.200	18.100	19.600
	Grouped Median	22.800	25.600	17.200	18.100	19.600
	Number of Firms	1	1	1	1	1

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
HSEHOLD APPS+HSEWARES	Mean	15.338	8.320	80.357	11.300	9.029
	Minimum	2.400	3.500	2.800	3.000	1.200
	Maximum	63.300	13.300	546.700	34.100	50.200
	Std. Deviation	15.735	3.408	190.826	9.747	14.301
	Variance	247.598	11.615	36414.443	95.000	204.530
	Median	9.200	8.400	5.550	8.200	4.600
	Grouped Median	9.200	8.400	5.550	7.767	4.467
	Number of Firms	13	15	14	11	17
RETAIL, HARDLINES	Mean	13.587	8.739	9.563	20.738	6.593
	Minimum	3.800	2.300	2.600	3.700	2.200
	Maximum	35.500	27.900	23.600	74.100	16.100
	Std. Deviation	7.508	7.931	7.536	21.235	4.648
	Variance	56.368	62.898	56.791	450.926	21.608
	Median	12.100	6.300	6.150	12.700	4.800
	Grouped Median	12.100	6.067	6.150	12.700	4.800
	Number of Firms	15	18	8	13	15
HOME ENTERTAINMENT					3.200	4.700
					3.200	1.300
					3.200	8.100
					.	4.808
					.	23.120
					3.200	4.700
					3.200	4.700
					1.000	2.000
HOTELS	Mean	22.208	24.292	76.080	20.078	19.833
	Minimum	8.800	5.400	1.700	7.900	7.400
	Maximum	98.300	171.400	465.000	42.600	37.500
	Std. Deviation	24.564	45.841	143.798	10.788	9.044
	Variance	603.384	2101.424	20677.786	116.384	81.801
	Median	16.150	8.100	15.850	17.400	19.600
	Grouped Median	16.150	8.100	15.850	17.400	19.600
	Number of Firms	12	13	10	9	12
INSURANCE BROKERS	Mean	41.900	3.700			10.500
	Minimum	41.900	3.700			10.500
	Maximum	41.900	3.700			10.500
	Std. Deviation	.	.			.
	Variance	.	.			.
	Median	41.900	3.700			10.500
	Grouped Median	41.900	3.700			10.500
	Number of Firms	1	1			1
INTERNET	Mean	13.800	11.800			
	Minimum	13.800	6.500			
	Maximum	13.800	17.100			
	Std. Deviation	.	7.495			
	Variance	.	56.180			
	Median	13.800	11.800			
	Grouped Median	13.800	11.800			
	Number of Firms	1	2			

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
INVESTMENT BANKS	Mean	6.800	4.000	246.600	6.900	5.750
	Minimum	6.800	3.600	13.200	6.900	3.000
	Maximum	6.800	4.400	480.000	6.900	8.500
	Std. Deviation	.	0.566	330.077	.	3.889
	Variance	.	0.320	108951.120	.	15.125
	Median	6.800	4.000	246.600	6.900	5.750
	Grouped Median	6.800	4.000	246.600	6.900	5.750
	Number of Firms	1	2	2	1	2
INVESTMENT HOUSE	Mean	63.083	15.200	4.229	30.167	15.246
	Minimum	3.900	1.300	2.100	5.000	1.800
	Maximum	476.500	72.700	12.200	69.600	84.800
	Std. Deviation	131.205	20.978	3.755	29.738	21.665
	Variance	17214.665	440.071	14.099	884.339	469.351
	Median	29.950	9.050	2.600	16.150	9.500
	Grouped Median	29.950	9.050	2.600	16.150	9.233
	Number of Firms	12	10	7	6	13
LEISURE FACILITIES	Mean	13.300	9.450	7.767	18.450	4.200
	Minimum	1.900	4.000	4.500	5.600	4.000
	Maximum	34.000	19.500	10.800	33.500	4.400
	Std. Deviation	13.273	7.045	3.156	11.477	0.283
	Variance	176.160	49.630	9.963	131.723	0.080
	Median	8.400	7.150	8.000	17.350	4.200
	Grouped Median	8.400	7.150	8.000	17.350	4.200
	Number of Firms	5	4	3	4	2
LEISURE EQUIPMENT	Mean	7.450	9.275	8.525	22.925	4.350
	Minimum	5.700	2.400	1.300	5.300	0.900
	Maximum	9.200	13.700	22.000	71.700	11.100
	Std. Deviation	2.475	4.881	9.207	32.562	4.683
	Variance	6.125	23.823	84.763	1060.309	21.930
	Median	7.450	10.500	5.400	7.350	2.700
	Grouped Median	7.450	10.500	5.400	7.350	2.700
	Number of Firms	2	4	4	4	4
MEDIA AGENCIES	Mean	13.600	10.300	6.500		4.900
	Minimum	13.600	10.300	6.500		4.900
	Maximum	13.600	10.300	6.500		4.900
	Std. Deviation	.	.	.		.
	Variance	.	.	.		.
	Median	13.600	10.300	6.500		4.900
	Grouped Median	13.600	10.300	6.500		4.900
	Number of Firms	1	1	1		1
MEDICAL EQUIP + SUPPLIES	Mean	12.700	9.100	10.600	33.833	11.667
	Minimum	12.700	9.100	9.100	3.300	2.400
	Maximum	12.700	9.100	12.100	89.600	25.000
	Std. Deviation	.	.	2.121	48.368	11.836
	Variance	.	.	4.500	2339.463	140.093
	Median	12.700	9.100	10.600	8.600	7.600
	Grouped Median	12.700	9.100	10.600	8.600	7.600
	Number of Firms	1	1	2	3	3

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
OTHER MINING				4.600	6.700	10.933
				3.000	6.700	6.900
				6.200	6.700	18.000
				2.263	.	6.140
				5.120	.	37.703
				4.600	6.700	7.900
				4.600	6.700	7.900
				2.000	1.000	3.000
OTHER FINANCIAL	Mean	53.300	2.950		20.900	9.667
	Minimum	6.600	2.100		11.000	3.100
	Maximum	100.000	3.800		30.800	21.600
	Std. Deviation	66.044	1.202		14.001	10.352
	Variance	4361.780	1.445		196.020	107.163
	Median	53.300	2.950		20.900	4.300
	Grouped Median	53.300	2.950		20.900	4.300
	Number of Firms	2	2		2	3
MORTGAGE FINANCE	Mean	7.400	5.700	5.000	5.600	
	Minimum	7.400	5.700	5.000	5.600	
	Maximum	7.400	5.700	5.000	5.600	
	Std. Deviation	.	.	.	.	
	Variance	.	.	.	.	
	Median	7.400	5.700	5.000	5.600	
	Grouped Median	7.400	5.700	5.000	5.600	
	Number of Firms	1	1	1	1	
RETAILERS, MULTI DEPT	Mean	114.500	5.900	29.600	14.950	3.500
	Minimum	7.900	4.300	6.400	6.100	3.500
	Maximum	550.000	8.800	52.800	23.800	3.500
	Std. Deviation	215.267	1.773	32.810	12.516	.
	Variance	46339.852	3.145	1076.480	156.645	.
	Median	17.950	5.100	29.600	14.950	3.500
	Grouped Median	17.950	5.100	29.600	14.950	3.500
	Number of Firms	6	5	2	2	1
NON-FERROUS METALS	Mean	9.967	12.825	9.950	2.167	12.267
	Minimum	1.400	3.000	1.900	1.500	2.200
	Maximum	21.600	32.900	14.400	3.300	28.600
	Std. Deviation	10.443	13.566	5.862	0.987	14.272
	Variance	109.063	184.049	34.363	0.973	203.693
	Median	6.900	7.700	11.750	1.700	6.000
	Grouped Median	6.900	7.700	11.750	1.700	6.000
	Number of Firms	3	4	4	3	3
OIL + GAS EXPL/PROD.	Mean	90.000	135.900	256.950	32.900	5.900
	Minimum	90.000	135.900	36.500	32.900	5.900
	Maximum	90.000	135.900	477.400	32.900	5.900
	Std. Deviation	.	.	311.763	.	.
	Variance	.	.	97196.405	.	.
	Median	90.000	135.900	256.950	32.900	5.900
	Grouped Median	90.000	135.900	256.950	32.900	5.900
	Number of Firms	1	1	2	1	1

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
OIL INTEGRATED	Mean	13.300	13.300	6.100	4.500	5.133
	Minimum	13.300	13.300	6.100	3.100	3.800
	Maximum	13.300	13.300	6.100	5.900	5.900
	Std. Deviation	.	.	.	1.980	1.159
	Variance	.	.	.	3.920	1.343
	Median	13.300	13.300	6.100	4.500	5.700
	Grouped Median	13.300	13.300	6.100	4.500	5.700
	Number of Firms	1	1	1	2	3
OTHER HEALTH CARE	Mean			2.900	12.900	
	Minimum			2.900	12.900	
	Maximum			2.900	12.900	
	Std. Deviation			.	.	
	Variance			.	.	
	Median			2.900	12.900	
	Grouped Median			2.900	12.900	
	Number of Firms			1	1	
OTHER INSURANCE					24.600	17.800
					24.600	17.800
					24.600	17.800
					.	.
					.	.
					24.600	17.800
					24.600	17.800
					1.000	1.000
PAPER	Mean	17.233	7.933	7.800	4.400	2.750
	Minimum	4.700	4.600	7.800	4.400	0.800
	Maximum	38.300	14.100	7.800	4.400	4.700
	Std. Deviation	18.354	5.346	.	.	2.758
	Variance	336.853	28.583	.	.	7.605
	Median	8.700	5.100	7.800	4.400	2.750
	Grouped Median	8.700	5.100	7.800	4.400	2.750
	Number of Firms	3	3	1	1	2
PACKAGING	Mean	16.600	7.400	5.200	4.200	7.600
	Minimum	16.600	7.400	5.200	3.100	3.600
	Maximum	16.600	7.400	5.200	5.300	11.600
	Std. Deviation	.	.	.	1.556	5.657
	Variance	.	.	.	2.420	32.000
	Median	16.600	7.400	5.200	4.200	7.600
	Grouped Median	16.600	7.400	5.200	4.200	7.600
	Number of Firms	1	1	1	2	2

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
PHARMACEUTICALS	Mean	16.600	7.700	11.750	6.780	11.838
	Minimum	8.000	3.800	4.000	5.800	2.700
	Maximum	25.200	11.700	28.400	8.300	28.700
	Std. Deviation	12.162	3.951	11.439	1.018	10.606
	Variance	147.920	15.610	130.857	1.037	112.494
	Median	16.600	7.600	7.300	6.400	6.350
	Grouped Median	16.600	7.600	7.300	6.400	6.350
	Number of Firms	2	3	4	5	8
PHOTOGRAPHY	Mean	11.600	9.100	4.800	6.300	6.000
	Minimum	11.600	9.100	4.800	6.300	6.000
	Maximum	11.600	9.100	4.800	6.300	6.000
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	11.600	9.100	4.800	6.300	6.000
	Grouped Median	11.600	9.100	4.800	6.300	6.000
	Number of Firms	1	1	1	1	1
PERSONAL PRODUCTS					6.300	6.400
					6.300	6.400
					6.300	6.400
					.	.
					.	.
					6.300	6.400
					6.300	6.400
					1.000	1.000
PROPERTY AGENCIES	Mean	9.700	1.700		10.500	7.700
	Minimum	9.700	1.700		10.500	7.700
	Maximum	9.700	1.700		10.500	7.700
	Std. Deviation	.	.		.	.
	Variance	.	.		.	.
	Median	9.700	1.700		10.500	7.700
	Grouped Median	9.700	1.700		10.500	7.700
	Number of Firms	1	1		1	1
PUBLISHING + PRINTING	Mean	9.140	32.727	7.700	50.138	11.233
	Minimum	5.700	2.200	2.500	2.400	2.300
	Maximum	14.300	295.800	16.700	297.200	46.600
	Std. Deviation	3.573	87.309	5.609	101.233	12.311
	Variance	12.763	7622.856	31.457	10248.163	151.557
	Median	9.700	6.300	5.800	6.800	6.400
	Grouped Median	9.700	6.300	5.800	6.800	6.400
	Number of Firms	5	11	8	8	12
REINSURANCE						7.800
						7.800
						7.800
						.
						.
						7.800
						7.800
						1.000

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
RESTAURANTS AND PUBS	Mean	32.025	5.325	6.150	7.200	9.000
	Minimum	6.300	4.000	4.300	5.400	3.800
	Maximum	103.000	6.600	8.000	9.000	15.500
	Std. Deviation	47.367	1.081	2.616	2.546	5.957
	Variance	2243.669	1.169	6.845	6.480	35.490
	Median	9.400	5.350	6.150	7.200	7.700
	Grouped Median	9.400	5.350	6.150	7.200	7.700
	Number of Firms	4	4	2	2	3
REAL ESTATE DEV.	Mean	27.906	10.210	22.597	19.596	17.491
	Minimum	2.700	1.100	0.800	2.700	0.200
	Maximum	208.300	71.700	811.500	184.600	113.700
	Std. Deviation	37.818	11.825	100.714	29.701	20.194
	Variance	1430.211	139.823	10143.270	882.129	407.803
	Median	15.100	6.100	6.100	11.050	11.700
	Grouped Median	15.267	6.133	6.133	10.967	11.700
	Number of Firms	77	87	64	50	67
RAIL, ROAD, FREIGHT	Mean	22.829	13.242	9.907	11.214	8.357
	Minimum	6.400	4.700	3.100	3.900	3.800
	Maximum	87.500	25.600	21.700	38.700	17.900
	Std. Deviation	29.545	6.960	5.546	8.657	4.536
	Variance	872.899	48.437	30.755	74.951	20.575
	Median	9.900	12.600	8.000	8.400	8.000
	Grouped Median	9.900	12.600	8.000	8.400	8.000
	Number of Firms	7	12	15	14	14
SEMICONDUCTORS	Mean	6.600	15.100	5.500	45.100	5.500
	Minimum	6.600	15.100	5.500	45.100	5.500
	Maximum	6.600	15.100	5.500	45.100	5.500
	Std. Deviation	.	.	.	.	.
	Variance	.	.	.	.	.
	Median	6.600	15.100	5.500	45.100	5.500
	Grouped Median	6.600	15.100	5.500	45.100	5.500
	Number of Firms	1	1	1	1	1
SHIPPING AND PORTS	Mean	16.400	31.778	53.950	19.767	19.613
	Minimum	2.700	6.100	2.400	5.900	2.600
	Maximum	30.600	144.200	343.300	57.600	56.000
	Std. Deviation	10.174	44.772	117.369	19.000	19.504
	Variance	103.514	2004.544	13775.431	361.015	380.393
	Median	13.350	15.100	9.550	14.100	11.950
	Grouped Median	13.350	15.100	9.550	14.100	11.950
	Number of Firms	8	9	8	6	8
SOFT DRINKS	Mean					
	Minimum					
	Maximum					
	Std. Deviation					
	Variance					
	Median					
	Grouped Median					
	Number of Firms					

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
RETAILERS, SOFT GOODS	Mean				9.100	5.800
	Minimum				9.100	5.800
	Maximum				9.100	5.800
	Std. Deviation				.	.
	Variance				.	.
	Median				9.100	5.800
	Grouped Median				9.100	5.800
	Number of Firms				1	1
SOFTWARE	Mean	9.000	10.533	13.900		11.650
	Minimum	9.000	1.000	13.900		9.400
	Maximum	9.000	22.900	13.900		13.900
	Std. Deviation	.	11.222	.		3.182
	Variance	.	125.923	.		10.125
	Median	9.000	7.700	13.900		11.650
	Grouped Median	9.000	7.700	13.900		11.650
	Number of Firms	1	3	1		2
STEEL	Mean	76.480	27.560	13.720	28.675	7.480
	Minimum	9.400	2.800	2.100	7.400	1.000
	Maximum	302.200	94.900	44.500	80.000	18.800
	Std. Deviation	127.324	39.330	17.516	34.502	6.941
	Variance	16211.447	1546.883	306.812	1190.396	48.172
	Median	11.500	5.200	7.300	13.650	4.400
	Grouped Median	11.500	5.200	7.300	13.650	4.400
	Number of Firms	5	5	5	4	5
TELECOM EQUIPMENT	Mean	25.333	117.313	6.150	18.729	12.444
	Minimum	6.400	0.900	2.100	0.900	0.700
	Maximum	59.800	875.000	10.800	69.800	38.600
	Std. Deviation	22.618	306.217	3.625	23.078	11.544
	Variance	511.591	93768.644	13.139	532.589	133.268
	Median	15.650	8.350	5.900	12.200	9.800
	Grouped Median	15.650	8.350	5.900	12.200	9.800
	Number of Firms	6	8	6	7	9
TELECOM FIXLINE	Mean	17.900	46.250	5.600	111.000	15.500
	Minimum	17.900	4.300	5.600	111.000	3.600
	Maximum	17.900	88.200	5.600	111.000	27.400
	Std. Deviation	.	59.326	.	.	16.829
	Variance	.	3519.605	.	.	283.220
	Median	17.900	46.250	5.600	111.000	15.500
	Grouped Median	17.900	46.250	5.600	111.000	15.500
	Number of Firms	1	2	1	1	2
TELECOM WIRELESS	Mean	38.100	17.000	11.667	37.840	47.680
	Minimum	7.200	2.700	1.000	14.400	3.300
	Maximum	69.000	47.000	30.500	80.900	151.300
	Std. Deviation	43.699	20.235	10.475	25.475	63.091
	Variance	1909.620	409.447	109.719	648.973	3980.507
	Median	38.100	9.150	10.050	31.000	13.400
	Grouped Median	38.100	9.150	10.050	31.000	13.400
	Number of Firms	2	4	6	5	5

Appendix E2 – Performance of Stocks of Hong Kong (P/E)

Company Category		P/E1996	P/E1997	P/E1998	P/E1999	P/E2000
TEXTILES+LEATHER GDS	Mean	23.527	8.191	42.779	6.300	19.605
	Minimum	2.200	0.200	2.000	2.800	0.400
	Maximum	140.000	47.100	540.000	12.700	263.300
	Std. Deviation	39.357	10.676	124.593	3.165	58.066
	Variance	1549.002	113.968	15523.497	10.019	3371.709
	Median	10.100	4.700	6.100	5.400	4.000
	Grouped Median	10.100	4.700	6.100	5.400	4.000
	Number of Firms	11	22	19	15	20
WATER	Mean					11.000
	Minimum					11.000
	Maximum					11.000
	Std. Deviation					.
	Variance					.
	Median					11.000
	Grouped Median					11.000
	Number of Firms					1
Total	Mean	25.552	16.668	25.442	22.034	16.102
	Minimum	1.400	0.100	0.400	0.300	0.000
	Maximum	550.000	875.000	1789.700	580.800	400.000
	Std. Deviation	50.895	56.389	116.189	47.936	32.713
	Variance	2590.342	3179.752	13499.896	2297.819	1070.111
	Median	12.300	7.000	6.300	9.950	7.800
	Grouped Median	12.300	6.986	6.333	9.975	7.830
	Number of Firms	387	475	401	358	460

Table E2b-mean P/E of non-construction companies

Total	**Mean**	**26.158**	**15.179**	**25.525**	**20.440**	**14.689**
	Minimum	**1.400**	**0.100**	**0.400**	**0.300**	**0.000**
	Maximum	**550.000**	**875.000**	**1789.700**	**393.400**	**400.000**
	Std. Deviation	**51.740**	**47.554**	**117.428**	**38.141**	**29.304**
	Variance	**2677.048**	**2261.351**	**13789.298**	**1454.766**	**858.744**
	Median	**12.700**	**7.000**	**6.300**	**9.900**	**7.800**
	Grouped Median	**12.675**	**6.971**	**6.356**	**9.925**	**7.763**
	Number of Firms	**373**	**456**	**391**	**346**	**444**

Table E2c-mean P/E of construction companies

CONSTRUCTION	**Mean**	**9.421**	**52.400**	**22.220**	**68.008**	**55.319**
	Minimum	**4.400**	**2.600**	**1.300**	**2.700**	**1.200**
	Maximum	**19.800**	**695.800**	**162.500**	**580.800**	**220.000**
	Std. Deviation	**4.209**	**158.643**	**49.470**	**162.979**	**75.394**
	Variance	**17.719**	**25167.671**	**2447.277**	**26562.183**	**5684.275**
	Median	**8.150**	**7.100**	**5.250**	**11.100**	**12.800**
	Grouped Median	**8.150**	**7.100**	**5.250**	**11.100**	**12.800**
	Number of Firms	**14**	**19**	**10**	**12**	**16**

Appendix E3 – Performance of Construction Companies Stocks of Hong Kong

Independent Samples t -Test on Beta for all non-construction companies stocks and construction companies stocks

Mean beta of all the non-construction companies is 0.7352.
Mean beta of all the construction companies is 0.7397.

Group Statistics

	Construction or Others	N	Mean	Std. Deviation	Std. Error Mean
BETA2000	All Other Business	581	.7352	.2583	1.072E-02
	Construction Contractors	27	.7397	.2201	4.236E-02
BETA1999	All Other Business	581	.7352	.2583	1.072E-02
	Construction Contractors	27	.7397	.2201	4.236E-02
BETA1998	All Other Business	581	.7352	.2583	1.072E-02
	Construction Contractors	27	.7397	.2201	4.236E-02
BETA1997	All Other Business	581	.7352	.2583	1.072E-02
	Construction Contractors	27	.7397	.2201	4.236E-02
BETA1996	All Other Business	581	.7352	.2583	1.072E-02
	Construction Contractors	27	.7397	.2201	4.236E-02

Independent Samples t- Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
BETA2000	Equal variances	1.912	.167	-.089	606	.929	-.0045	.0506	-.1038	.0948
	Not Equal variances			-.103	29.429	.919	-.0045	.0437	-.0938	.0848
BETA1999	Equal variances	1.912	.167	-.089	606	.929	-.0045	.0506	-.1038	.0948
	Not Equal variances			-.103	29.429	.919	-.0045	.0437	-.0938	.0848
BETA1998	Equal variances	1.912	.167	-.089	606	.929	-.0045	.0506	-.1038	.0948
	Not Equal variances			-.103	29.429	.919	-.0045	.0437	-.0938	.0848
BETA1997	Equal variances	1.912	.167	-.089	606	.929	-.0045	.0506	-.1038	.0948
	Not Equal variances			-.103	29.429	.919	-.0045	.0437	-.0938	.0848
BETA1996	Equal variances	1.912	.167	-.089	606	.929	-.0045	.0506	-.1038	.0948
	Not Equal variances			-.103	29.429	.919	-.0045	.0437	-.0938	.0848

Appendix E3 – Performance of Construction Companies Stocks of Hong Kong

This is the test for Hypothesis H1. Using a level of significance of 0.05, the p value is 0.929 which is not significant. The null hypothesis is accepted, or the mean beta of the stocks of construction contractors is NOT significantly different from the mean beta of the stocks of non-construction business.

As the sample size of construction firms is only 27, non-parametric tests were also carried out to see if there is any difference when compared with using the independent samples t-tests. The same conclusion was got.

Ranks

	Construction or Others	N	Mean Rank	Sum of Ranks
BETA2000	Construction Contractors	27	300.09	8102.50
	All Other Business	581	304.70	177033.52
	Total	608		
BETA1999	Construction Contractors	27	300.09	8102.50
	All Other Business	581	304.70	177033.52
	Total	608		
BETA1998	Construction Contractors	27	300.09	8102.50
	All Other Business	581	304.70	177033.52
	Total	608		
BETA1997	Construction Contractors	27	300.09	8102.50
	All Other Business	581	304.70	177033.52
	Total	608		
BETA1996	Construction Contractors	27	300.09	8102.50
	All Other Business	581	304.70	177033.52
	Total	608		

Test Statistics[a]

	BETA2000	BETA1999	BETA1998	BETA1997	BETA1996
Mann-Whitney U	7724.500	7724.500	7724.500	7724.500	7724.500
Wilcoxon W	8102.500	8102.500	8102.500	8102.500	8102.500
Z	-.133	-.133	-.133	-.133	-.133
Asymp. Sig. (2-tailed)	.894	.894	.894	.894	.894

a. Grouping Variable: Construction or Others

Appendix E4a, E4b, E4c –

Performance of Construction Companies Stocks of Hong Kong

Appendix E4a Non-parametric test for mean BETA

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
BETA2000	27	.7397	.2201	.31	1.36
BETA1999	27	.7397	.2201	.31	1.36
BETA1998	27	.7397	.2201	.31	1.36
BETA1997	27	.7397	.2201	.31	1.36
BETA1996	27	.7397	.2201	.31	1.36

Mann-Whitney Test

Ranks

	Public Housing	N	Mean Rank	Sum of Ranks
BETA2000	Non-public Housing Contractors	18	14.25	256.50
	Public Housing Contractors	9	13.50	121.50
	Total	27		
BETA1999	Non-public Housing Contractors	18	14.25	256.50
	Public Housing Contractors	9	13.50	121.50
	Total	27		
BETA1998	Non-public Housing Contractors	18	14.25	256.50
	Public Housing Contractors	9	13.50	121.50
	Total	27		
BETA1997	Non-public Housing Contractors	18	14.25	256.50
	Public Housing Contractors	9	13.50	121.50
	Total	27		
BETA1996	Non-public Housing Contractors	18	14.25	256.50
	Public Housing Contractors	9	13.50	121.50
	Total	27		

Test Statistics[b]

	BETA2000	BETA1999	BETA1998	BETA1997	BETA1996
Mann-Whitney U	76.500	76.500	76.500	76.500	76.500
Wilcoxon W	121.500	121.500	121.500	121.500	121.500
Z	-.231	-.231	-.231	-.231	-.231
Asymp. Sig. (2-tailed)	.817	.817	.817	.817	.817
Exact Sig. [2*(1-tailed Sig.)]	.820[a]	.820[a]	.820[a]	.820[a]	.820[a]

a. Not corrected for ties.

b. Grouping Variable: Public Housing

Appendix E4a, E4b, E4c –

Performance of Construction Companies Stocks of Hong Kong

Appendix E4b Non-parametric test for mean P/E

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
PE2000	16	55.3188	75.3941	1.20	220.00
PE1999	12	68.0083	162.9791	2.70	580.80
PE1998	10	22.2200	49.4700	1.30	162.50
PE1997	19	52.4000	158.6432	2.60	695.80
PE1996	14	9.4214	4.2094	4.40	19.80

Mann-Whitney Test

Ranks

	Public Housing	N	Mean Rank	Sum of Ranks
PE2000	Non-public Housing Contractors	10	9.80	98.00
	Public Housing Contractors	6	6.33	38.00
	Total	16		
PE1999	Non-public Housing Contractors	9	7.78	70.00
	Public Housing Contractors	3	2.67	8.00
	Total	12		
PE1998	Non-public Housing Contractors	6	4.92	29.50
	Public Housing Contractors	4	6.38	25.50
	Total	10		
PE1997	Non-public Housing Contractors	11	12.00	132.00
	Public Housing Contractors	8	7.25	58.00
	Total	19		
PE1996	Non-public Housing Contractors	5	9.00	45.00
	Public Housing Contractors	9	6.67	60.00
	Total	14		

Test Statistics[b]

	PE2000	PE1999	PE1998	PE1997	PE1996
Mann-Whitney U	17.000	2.000	8.500	22.000	15.000
Wilcoxon W	38.000	8.000	29.500	58.000	60.000
Z	-1.410	-2.126	-.748	-1.817	-1.000
Asymp. Sig. (2-tailed)	.159	.033	.454	.069	.317
Exact Sig. [2*(1-tailed Sig.)]	.181[a]	.036[a]	.476[a]	.075[a]	.364[a]

a. Not corrected for ties.

b. Grouping Variable: Public Housing

Appendix E4a, E4b, E4c –

Performance of Construction Companies Stocks of Hong Kong

Appendix E4c Non-parametric test for mean Price

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
P2000	29	.8538	2.3353	.01	12.85
P1999	28	1.3432	2.8300	.09	15.00
P1998	28	1.1150	3.2362	.03	17.30
P1997	27	2.2615	4.2787	.06	21.90
P1996	24	2.4646	4.6531	.10	20.50

Mann-Whitney Test

Ranks

	Public Housing	N	Mean Rank	Sum of Ranks
P2000	Non-public Housing Contractors	20	14.82	296.50
	Public Housing Contractors	9	15.39	138.50
	Total	29		
P1999	Non-public Housing Contractors	19	14.29	271.50
	Public Housing Contractors	9	14.94	134.50
	Total	28		
P1998	Non-public Housing Contractors	19	13.16	250.00
	Public Housing Contractors	9	17.33	156.00
	Total	28		
P1997	Non-public Housing Contractors	18	12.61	227.00
	Public Housing Contractors	9	16.78	151.00
	Total	27		
P1996	Non-public Housing Contractors	15	10.60	159.00
	Public Housing Contractors	9	15.67	141.00
	Total	24		

Test Statistics[b]

	P2000	P1999	P1998	P1997	P1996
Mann-Whitney U	86.500	81.500	60.000	56.000	39.000
Wilcoxon W	296.500	271.500	250.000	227.000	159.000
Z	-.165	-.197	-1.255	-1.286	-1.700
Asymp. Sig. (2-tailed)	.869	.844	.209	.198	.089
Exact Sig. [2*(1-tailed Sig.)]	.871[a]	.847[a]	.223[a]	.212[a]	.096[a]

a. Not corrected for ties.

b. Grouping Variable: Public Housing

Appendix F – Response Rate of Main Survey

List of Public Housing Contractors for new housing estates

NW1	New Works Category 1	NW2	New Works Category 2
PP	Percussive Piling	LDBP	Large Diameter Bored Pile
DEMO	Demolition	LAND	Landscape
DECO	Decoration		
LESC	Lift & Escalator	ELEC	Electrical
FS&P	Fire Services & Pump	ACMV	Air Conditioning

Code	Total Companies on HA List	Total (less number of firms in over 1 category)	Number of Reply Company	Number of Reply Persons	Company Response Rate	Person Response Rate
NW1	25	25	4	4	16%	16%
NW2	27	27	15	19	56%	70%
Subtotal	***52***	***52***	***19***	***23***	***37%***	***44%***
PP	10	8	10	12	100%	120%
LDBP	7	1	0	0	0%	0%
Subtotal	***17***	***9***	***10***	***12***	***59%***	***71%***
DEMO	21	18	3	3	14%	14%
Subtotal	***21***	***18***	***3***	***3***	***14%***	***14%***
LAND	24	24	8	8	33%	33%
Subtotal	***24***	***24***	***8***	***8***	***33%***	***33%***
DECO	134	134	11	11	8%	8%
Subtotal	***134***	***134***	***11***	***11***	***8%***	***8%***
LESC	12	12	6	9	50%	75%
Subtotal	***12***	***12***	***6***	***9***	***50%***	***75%***
ELEC	33	33	14	20	42%	61%
FS&P	24	18	5	6	21%	25%
ACMV	21	10	5	5	24%	24%
Subtotal	***78***	***61***	***24***	***31***	***31%***	***40%***
Total	***338***	***310***	***81***	***97***	***24%***	***29%***

Notes

1. Response Rate is number of reply (companies or persons) over total no. of HA contractors (338).

2. There are 28 firms which are registered in more than one categories of work.

Appendix G – Response Rate of Supplementary Survey

Type of Work	Code	Total of Questionnaires Sent	Number of Reply Company	Company Response Rate
Building + Site Formation	MC, C	33	23	70%
General	1-88	88	46	52%
Miscellaneous	Z+KS	25	22	88%
Kitchen Equipment	KE	9	7	78%
Switchboard	SW	8	5	63%
Electrical	ELEC	79	29	37%
Fire Services	FS	48	9	19%
Air Conditioning	ACMV	19	5	26%
Sewage Equipment + Plumbing	SA+PD	17	7	41%
Burglar Alarm	BA	13	4	31%
	Total	***339***	***157***	***46%***

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

General Information of Respondent Companies

Frequencies

Statistics

		Rank / Post of Respondents	Number of Years Working in Firm
N	Valid	89	83
	Missing	8	14
Std. Deviation		1.34	2.59
Variance		1.78	6.69
Minimum		1	1
Maximum		5	10

Frequency Table

Rank / Post of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General Manager (GM), Director, Dir & GM, Executive Dir, CEO	41	42.3	46.1	46.1
	Deputy GM, AGM, Operations Director, Executive Manager	12	12.4	13.5	59.6
	Senior Manager, Project Manager, Contracts Manager	18	18.6	20.2	79.8
	Manager, Assistant Project Manager	12	12.4	13.5	93.3
	Engineer and Similar Rank	6	6.2	6.7	100.0
	Total	89	91.8	100.0	
Missing	System	8	8.2		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Number of Years Working in Firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 3 Years	13	13.4	15.7	15.7
	4 years to 6 years	15	15.5	18.1	33.7
	7 years to 9 years	11	11.3	13.3	47.0
	10 years to 12 years	12	12.4	14.5	61.4
	13 years to 15 years	6	6.2	7.2	68.7
	16 years to 18 years	7	7.2	8.4	77.1
	19 years to 21 years	12	12.4	14.5	91.6
	22 years to 24 years	1	1.0	1.2	92.8
	25 years to 27 years	1	1.0	1.2	94.0
	28 years and above	5	5.2	6.0	100.0
	Total	83	85.6	100.0	
Missing	System	14	14.4		
Total		97	100.0		

Frequencies

Statistics

		F1 - Main Area of Business	F2 - Latest Annual Turnover (1998/1999)	F3 - Number of full-time, directly employed staff	F4 - Number of full-time directly employed artisans	F5 - Approximate Area of Workshop	F6 - Approximate Value of fixed plants, tools etc.
N	Valid	97	95	96	96	96	96
	Missing	0	2	1	1	1	1
Std. Deviation			1.68	1.72	1.49	1.29	1.76
Variance			2.83	2.96	2.21	1.66	3.10
Minimum			1	1	1	1	1
Maximum			5	5	5	5	5

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequency Table

F1 - Main Area of Business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Air conditioning and mechanical ventilation	1	1.0	1.0	1.0
	Building (substructure and superstructure)	41	42.3	42.3	43.3
	Electrical Services	8	8.2	8.2	51.5
	Fire Services	2	2.1	2.1	53.6
	Landscaping	8	8.2	8.2	61.9
	Lifts	9	9.3	9.3	71.1
	More than one categories	28	28.9	28.9	100.0
	Total	97	100.0	100.0	

F2 - Latest Annual Turnover (1998/1999)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below $100M	20	20.6	21.1	21.1
	From $100M to $200M	14	14.4	14.7	35.8
	FRom $200M to $300M	7	7.2	7.4	43.2
	From $300M to $400M	7	7.2	7.4	50.5
	More than $400M	47	48.5	49.5	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

F3 - Number of full-time, directly employed staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 25	22	22.7	22.9	22.9
	From 25 to 50	15	15.5	15.6	38.5
	From 50 to 75	6	6.2	6.3	44.8
	From 75 to 100	5	5.2	5.2	50.0
	More than 100	48	49.5	50.0	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

F4 - Number of full-time directly employed artisans

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 10	29	29.9	30.2	30.2
	From 10 - 20	17	17.5	17.7	47.9
	From 20 - 30	3	3.1	3.1	51.0
	Over 30	36	37.1	37.5	88.5
	Does not employ full time artisans	11	11.3	11.5	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

F5 - Approximate Area of Workshop

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 250 sq.m	19	19.6	19.8	19.8
	From 250 to 500 sq.m	20	20.6	20.8	40.6
	From 500 to 750 sq.m	7	7.2	7.3	47.9
	Over 750 sq.m	46	47.4	47.9	95.8
	Does not have any workshop	4	4.1	4.2	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

F6 - Approximate Value of fixed plants, tools etc.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below HK$2.5M	36	37.1	37.5	37.5
	From HK$2.5M - HK$5.0M	18	18.6	18.8	56.3
	From HK$5.0M - HK$7.5M	7	7.2	7.3	63.5
	From HK$7.5M - HK$10M	1	1.0	1.0	64.6
	Over $10M	34	35.1	35.4	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Questionnaire Results

Frequencies

Statistics

		Client Factors a1 - Basic Info. in Tender	Client Factors a2 - Bureaucracy of Client Staff	Client Factors a3 - Not accept design errors	Client Factors a4 - Client staff subjective interpretation	Client Factors a5 - $100000 as LD
N	Valid	96	96	96	94	96
	Missing	1	1	1	3	1
Std. Deviation		1.00	.94	.77	.85	1.03
Variance		1.00	.88	.60	.72	1.07
Minimum		1	1	2	2	1
Maximum		5	5	5	5	5

Statistics

		Client Factors a6 - Inequitable Contract Terms	Client Factors a7 - Performance Assessment and Paperwork	Client Factors a8 - ISO and paperwork	Client Factors a9 - Award contract by price	Client Factors a10 - Corruption
N	Valid	96	96	96	96	96
	Missing	1	1	1	1	1
Std. Deviation		.88	.88	.96	1.02	1.32
Variance		.78	.78	.92	1.04	1.73
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

Frequency Tables

Client Factors a1 - Basic Info. in Tender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	5	5.2	5.2	5.2
	Slightly Critical	11	11.3	11.5	16.7
	Critical	38	39.2	39.6	56.3
	Very Critical	31	32.0	32.3	88.5
	Extremely Critical	11	11.3	11.5	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Client Factors a2 - Bureaucracy of Client Staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	2	2.1	2.1	2.1
	Slightly Critical	7	7.2	7.3	9.4
	Critical	20	20.6	20.8	30.2
	Very Critical	46	47.4	47.9	78.1
	Extremely Critical	21	21.6	21.9	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a3 - Not accept design errors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Critical	1	1.0	1.0	1.0
	Critical	18	18.6	18.8	19.8
	Very Critical	39	40.2	40.6	60.4
	Extremely Critical	38	39.2	39.6	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a4 - Client staff subjective interpretation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Critical	6	6.2	6.4	6.4
	Critical	20	20.6	21.3	27.7
	Very Critical	44	45.4	46.8	74.5
	Extremely Critical	24	24.7	25.5	100.0
	Total	94	96.9	100.0	
Missing	System	3	3.1		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Client Factors a5 - $100000 as LD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	2	2.1	2.1	2.1
	Slightly Critical	8	8.2	8.3	10.4
	Critical	22	22.7	22.9	33.3
	Very Critical	33	34.0	34.4	67.7
	Extremely Critical	31	32.0	32.3	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a6 - Inequitable Contract Terms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	1	1.0	1.0	1.0
	Slightly Critical	3	3.1	3.1	4.2
	Critical	16	16.5	16.7	20.8
	Very Critical	37	38.1	38.5	59.4
	Extremely Critical	39	40.2	40.6	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a7 - Performance Assessment and Paperwork

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	3	3.1	3.1	3.1
	Slightly Critical	20	20.6	20.8	24.0
	Critical	42	43.3	43.8	67.7
	Very Critical	27	27.8	28.1	95.8
	Extremely Critical	4	4.1	4.2	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Client Factors a8 - ISO and paperwork

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	13	13.4	13.5	13.5
	Slightly Critical	36	37.1	37.5	51.0
	Critical	30	30.9	31.3	82.3
	Very Critical	16	16.5	16.7	99.0
	Extremely Critical	1	1.0	1.0	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a9 - Award contract by price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	2	2.1	2.1	2.1
	Slightly Critical	6	6.2	6.3	8.3
	Critical	22	22.7	22.9	31.3
	Very Critical	31	32.0	32.3	63.5
	Extremely Critical	35	36.1	36.5	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Client Factors a10 - Corruption

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	8	8.2	8.3	8.3
	Slightly Critical	13	13.4	13.5	21.9
	Critical	21	21.6	21.9	43.8
	Very Critical	20	20.6	20.8	64.6
	Extremely Critical	34	35.1	35.4	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Statutory Requirements b1 - Noise Ordinance	Statutory Requirements b2 - Restriction on Employing overseas workers	Statutory Requirements b3 - Criminial prosecution to employ illegal workers	Statutory Requirements b4 - OH&S requirements	Statutory Requirements b5 - Unexpected safety checks
N	Valid	97	97	97	97	97
	Missing	0	0	0	0	0
Mean		3.02	2.21	2.81	2.91	2.61
Median		3.00	2.00	3.00	3.00	3.00
Std. Deviation		1.00	1.10	1.33	1.23	1.02
Variance		1.00	1.21	1.78	1.50	1.03
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

Frequency Tables

Statutory Requirements b1 - Noise Ordinance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	6	6.2	6.2	6.2
	Slightly Critical	23	23.7	23.7	29.9
	Critical	37	38.1	38.1	68.0
	Very Critical	25	25.8	25.8	93.8
	Extremely Critical	6	6.2	6.2	100.0
	Total	97	100.0	100.0	

Statutory Requirements b2 - Restriction on Employing overseas workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	34	35.1	35.1	35.1
	Slightly Critical	23	23.7	23.7	58.8
	Critical	28	28.9	28.9	87.6
	Very Critical	10	10.3	10.3	97.9
	Extremely Critical	2	2.1	2.1	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Statutory Requirements b3 - Criminial prosecution to employ illegal workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	20	20.6	20.6	20.6
	Slightly Critical	24	24.7	24.7	45.4
	Critical	19	19.6	19.6	64.9
	Very Critical	22	22.7	22.7	87.6
	Extremely Critical	12	12.4	12.4	100.0
	Total	97	100.0	100.0	

Statutory Requirements b4 - OH&S requirements

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	16	16.5	16.5	16.5
	Slightly Critical	19	19.6	19.6	36.1
	Critical	30	30.9	30.9	67.0
	Very Critical	22	22.7	22.7	89.7
	Extremely Critical	10	10.3	10.3	100.0
	Total	97	100.0	100.0	

Statutory Requirements b5 - Unexpected safety checks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	14	14.4	14.4	14.4
	Slightly Critical	31	32.0	32.0	46.4
	Critical	34	35.1	35.1	81.4
	Very Critical	15	15.5	15.5	96.9
	Extremely Critical	3	3.1	3.1	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Fines and Penalty c1 - Breaching statutory requirements	Fines and Penalty c2 - Period of suspension from tendering	Fines and Penalty c3 - Poor reputation	Fines and Penalty c4 - Loss of tendering opportunity in private sector
N	Valid	92	92	95	95
	Missing	5	5	2	2
Std. Deviation		1.35	1.03	1.07	1.14
Variance		1.82	1.06	1.14	1.31
Minimum		1	1	1	1
Maximum		5	5	5	5

Frequency Tables

Fines and Penalty c1 - Breaching statutory requirements

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below $100,000	58	59.8	63.0	63.0
	From $100,000 to $500,000	17	17.5	18.5	81.5
	From $500,000 to $1,000,000	4	4.1	4.3	85.9
	Above $1,000,000	2	2.1	2.2	88.0
	Pecuniary fines not effective	11	11.3	12.0	100.0
	Total	92	94.8	100.0	
Missing	System	5	5.2		
Total		97	100.0		

Fines and Penalty c2 - Period of suspension from tendering

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 3 Months	27	27.8	29.3	29.3
	From 3 to 12 Months	49	50.5	53.3	82.6
	Above 12 months	8	8.2	8.7	91.3
	Permanent removal	2	2.1	2.2	93.5
	Suspend from other Public Works tender and HA tenders	6	6.2	6.5	100.0
	Total	92	94.8	100.0	
Missing	System	5	5.2		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Fines and Penalty c3 - Poor reputation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	5	5.2	5.3	5.3
	Slightly Critical	7	7.2	7.4	12.6
	Critical	33	34.0	34.7	47.4
	Very Critical	30	30.9	31.6	78.9
	Extremely Critical	20	20.6	21.1	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Fines and Penalty c4 - Loss of tendering opportunity in private sector

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	5	5.2	5.3	5.3
	Slightly Critical	9	9.3	9.5	14.7
	Critical	18	18.6	18.9	33.7
	Very Critical	34	35.1	35.8	69.5
	Extremely Critical	29	29.9	30.5	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Procurement and Staffing d1 - Suppliers price above 5%	Procurement and Staffing d2 - Incompetence of suppliers	Procurement and Staffing d3 - Poor performance of subcontractors	Procurement and Staffing d4 - Fire, theft	Procurement and Staffing d5 - limited suppliers
N	Valid	96	97	96	97	96
	Missing	1	0	1	0	1
Std. Deviation		.93	.93	.84	1.05	1.11
Variance		.87	.87	.70	1.10	1.23
Minimum		1	1	2	1	1
Maximum		5	5	5	5	5

Statistics

		Procurement and Staffing d6 - Delay by utilities	Procurement and Staffing d7 - Staff turnover over 10%	Procurement and Staffing d8 - Artisan turnover above 10%	Procurement and Staffing d9 - Staff turnover below 10%	Procurement and Staffing d10 - Artisan turnover below 10%
N	Valid	97	97	95	96	95
	Missing	0	0	2	1	2
Std. Deviation		1.08	.91	.96	.93	.97
Variance		1.16	.83	.92	.86	.93
Minimum		1	1	1	1	1
Maximum		5	5	5	5	5

Frequency Tables

Procurement and Staffing d1 - Suppliers price above 5%

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	3	3.1	3.1	3.1
	Slightly Critical	11	11.3	11.5	14.6
	Critical	40	41.2	41.7	56.3
	Very Critical	32	33.0	33.3	89.6
	Extremely Critical	10	10.3	10.4	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Procurement and Staffing d2 - Incompetence of suppliers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	1	1.0	1.0	1.0
	Slightly Critical	8	8.2	8.2	9.3
	Critical	23	23.7	23.7	33.0
	Very Critical	42	43.3	43.3	76.3
	Extremely Critical	23	23.7	23.7	100.0
	Total	97	100.0	100.0	

Procurement and Staffing d3 - Poor performance of subcontractors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Critical	4	4.1	4.2	4.2
	Critical	15	15.5	15.6	19.8
	Very Critical	39	40.2	40.6	60.4
	Extremely Critical	38	39.2	39.6	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Procurement and Staffing d4 - Fire, theft

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	3	3.1	3.1	3.1
	Slightly Critical	16	16.5	16.5	19.6
	Critical	32	33.0	33.0	52.6
	Very Critical	30	30.9	30.9	83.5
	Extremely Critical	16	16.5	16.5	100.0
	Total	97	100.0	100.0	

Procurement and Staffing d5 - limited suppliers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	4	4.1	4.2	4.2
	Slightly Critical	10	10.3	10.4	14.6
	Critical	24	24.7	25.0	39.6
	Very Critical	32	33.0	33.3	72.9
	Extremely Critical	26	26.8	27.1	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Procurement and Staffing d6 - Delay by utilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	6	6.2	6.2	6.2
	Slightly Critical	13	13.4	13.4	19.6
	Critical	34	35.1	35.1	54.6
	Very Critical	30	30.9	30.9	85.6
	Extremely Critical	14	14.4	14.4	100.0
	Total	97	100.0	100.0	

Procurement and Staffing d7 - Staff turnover over 10%

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	5	5.2	5.2	5.2
	Slightly Critical	19	19.6	19.6	24.7
	Critical	41	42.3	42.3	67.0
	Very Critical	29	29.9	29.9	96.9
	Extremely Critical	3	3.1	3.1	100.0
	Total	97	100.0	100.0	

Procurement and Staffing d8 - Artisan turnover above 10%

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	7	7.2	7.4	7.4
	Slightly Critical	24	24.7	25.3	32.6
	Critical	35	36.1	36.8	69.5
	Very Critical	27	27.8	28.4	97.9
	Extremely Critical	2	2.1	2.1	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Procurement and Staffing d9 - Staff turnover below 10%

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	13	13.4	13.5	13.5
	Slightly Critical	34	35.1	35.4	49.0
	Critical	35	36.1	36.5	85.4
	Very Critical	13	13.4	13.5	99.0
	Extremely Critical	1	1.0	1.0	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Procurement and Staffing d10 - Artisan turnover below 10%

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	14	14.4	14.7	14.7
	Slightly Critical	38	39.2	40.0	54.7
	Critical	31	32.0	32.6	87.4
	Very Critical	9	9.3	9.5	96.8
	Extremely Critical	3	3.1	3.2	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Risk Management e1 - Regular contractor as partner	Risk Management e2 - Increase no. of subcontractor	Risk Management e3 - Long term material supply contract	Risk Management e4 - Setup subsidiary trading company
N	Valid	96	95	96	96
	Missing	1	2	1	1
Std. Deviation		.81	1.11	1.05	1.08
Variance		.66	1.23	1.11	1.17
Minimum		1	0	0	0
Maximum		5	5	5	5

Statistics

		Risk Management e5 - Record Mgt to deal with ISO	Risk Management e6 - Employ direct labour	Risk Management e7 - Arrange regular training for artisans	Risk Management e8 - Arrange regular training for staff
N	Valid	96	96	96	95
	Missing	1	1	1	2
Std. Deviation		.86	1.08	.91	.74
Variance		.73	1.16	.83	.55
Minimum		1	1	1	2
Maximum		4	5	5	5

Statistics

		Risk Management e9 - Clear career prospect for staff	Risk Management e10 - Clear policy on quality and safety	Risk Management e11 - Have vision and mission
N	Valid	97	97	97
	Missing	0	0	0
Std. Deviation		.66	.82	.87
Variance		.44	.67	.75
Minimum		2	1	1
Maximum		5	5	5

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequency Tables

Risk Management e1 - Regular contractor as partner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	2	2.1	2.1	2.1
	Slightly Effective	6	6.2	6.3	8.3
	Effective	25	25.8	26.0	34.4
	Very Effective	55	56.7	57.3	91.7
	Extremely Effective	8	8.2	8.3	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Risk Management e2 - Increase no. of subcontractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NOT applicable	1	1.0	1.1	1.1
	Not Effective	12	12.4	12.6	13.7
	Slightly Effective	22	22.7	23.2	36.8
	Effective	32	33.0	33.7	70.5
	Very Effective	24	24.7	25.3	95.8
	Extremely Effective	4	4.1	4.2	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Risk Management e3 - Long term material supply contract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.0	1.0	1.0
	Not Effective	11	11.3	11.5	12.5
	Slightly Effective	38	39.2	39.6	52.1
	Effective	25	25.8	26.0	78.1
	Very Effective	18	18.6	18.8	96.9
	Extremely Effective	3	3.1	3.1	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Risk Management e4 - Setup subsidiary trading company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	1.0	1.0	1.0
	Not Effective	18	18.6	18.8	19.8
	Slightly Effective	35	36.1	36.5	56.3
	Effective	27	27.8	28.1	84.4
	Very Effective	11	11.3	11.5	95.8
	Extremely Effective	4	4.1	4.2	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Risk Management e5 - Record Mgt to deal with ISO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	12	12.4	12.5	12.5
	Slightly Effective	29	29.9	30.2	42.7
	Effective	44	45.4	45.8	88.5
	Very Effective	11	11.3	11.5	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Risk Management e6 - Employ direct labour

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	12	12.4	12.5	12.5
	Slightly Effective	21	21.6	21.9	34.4
	Effective	43	44.3	44.8	79.2
	Very Effective	12	12.4	12.5	91.7
	Extremely Effective	8	8.2	8.3	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Risk Management e7 - Arrange regular training for artisans

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	3	3.1	3.1	3.1
	Slightly Effective	17	17.5	17.7	20.8
	Effective	41	42.3	42.7	63.5
	Very Effective	29	29.9	30.2	93.8
	Extremely Effective	6	6.2	6.3	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Risk Management e8 - Arrange regular training for staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Effective	9	9.3	9.5	9.5
	Effective	39	40.2	41.1	50.5
	Very Effective	42	43.3	44.2	94.7
	Extremely Effective	5	5.2	5.3	100.0
	Total	95	97.9	100.0	
Missing	System	2	2.1		
Total		97	100.0		

Risk Management e9 - Clear career prospect for staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Effective	5	5.2	5.2	5.2
	Effective	40	41.2	41.2	46.4
	Very Effective	48	49.5	49.5	95.9
	Extremely Effective	4	4.1	4.1	100.0
	Total	97	100.0	100.0	

Risk Management e10 - Clear policy on quality and safety

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	2	2.1	2.1	2.1
	Slightly Effective	4	4.1	4.1	6.2
	Effective	41	42.3	42.3	48.5
	Very Effective	40	41.2	41.2	89.7
	Extremely Effective	10	10.3	10.3	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Risk Management e11 - Have vision and mission

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	2	2.1	2.1	2.1
	Slightly Effective	14	14.4	14.4	16.5
	Effective	41	42.3	42.3	58.8
	Very Effective	34	35.1	35.1	93.8
	Extremely Effective	6	6.2	6.2	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Quality Improvement Proposal e12 - Lobby equitable terms	Quality Improvement Proposal e13 - Lobby to award to good performers	Quality Improvement Proposal e14 - Registration of workers	Quality Improvement Proposal e15 - Strengthen supervision of subcontractors
N	Valid	97	96	97	96
	Missing	0	1	0	1
Std. Deviation		.96	1.19	1.05	.64
Variance		.93	1.41	1.10	.41
Minimum		1	1	1	2
Maximum		5	5	5	5

Statistics

		Quality Improvement Proposal e16 - Disallow uncontrolled subcontracting	Quality Improvement Proposal e17 - Setup statutory Council	Quality Improvement Proposal e18 - HA strengthen supervision
N	Valid	97	97	97
	Missing	0	0	0
Std. Deviation		1.11	1.11	1.03
Variance		1.23	1.24	1.05
Minimum		1	1	1
Maximum		5	5	5

Frequency Tables

Quality Improvement Proposal e12 - Lobby equitable terms

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	1	1.0	1.0	1.0
	Slightly Effective	10	10.3	10.3	11.3
	Effective	34	35.1	35.1	46.4
	Very Effective	32	33.0	33.0	79.4
	Extremely Effective	20	20.6	20.6	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Quality Improvement Proposal e13 - Lobby to award to good performers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	6	6.2	6.3	6.3
	Slightly Effective	15	15.5	15.6	21.9
	Effective	24	24.7	25.0	46.9
	Very Effective	29	29.9	30.2	77.1
	Extremely Effective	22	22.7	22.9	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Quality Improvement Proposal e14 - Registration of workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	4	4.1	4.1	4.1
	Slightly Effective	23	23.7	23.7	27.8
	Effective	34	35.1	35.1	62.9
	Very Effective	25	25.8	25.8	88.7
	Extremely Effective	11	11.3	11.3	100.0
	Total	97	100.0	100.0	

Quality Improvement Proposal e15 - Strengthen supervision of subcontractors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly Effective	2	2.1	2.1	2.1
	Effective	33	34.0	34.4	36.5
	Very Effective	54	55.7	56.3	92.7
	Extremely Effective	7	7.2	7.3	100.0
	Total	96	99.0	100.0	
Missing	System	1	1.0		
Total		97	100.0		

Quality Improvement Proposal e16 - Disallow uncontrolled subcontracting

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	9	9.3	9.3	9.3
	Slightly Effective	14	14.4	14.4	23.7
	Effective	32	33.0	33.0	56.7
	Very Effective	32	33.0	33.0	89.7
	Extremely Effective	10	10.3	10.3	100.0
	Total	97	100.0	100.0	

Appendix H1 – Main Survey Statistical Results

Descriptive Statistics

Quality Improvement Proposal e17 - Setup statutory Council

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	11	11.3	11.3	11.3
	Slightly Effective	19	19.6	19.6	30.9
	Effective	35	36.1	36.1	67.0
	Very Effective	24	24.7	24.7	91.8
	Extremely Effective	8	8.2	8.2	100.0
	Total	97	100.0	100.0	

Quality Improvement Proposal e18 - HA strengthen supervision

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	9	9.3	9.3	9.3
	Slightly Effective	19	19.6	19.6	28.9
	Effective	41	42.3	42.3	71.1
	Very Effective	22	22.7	22.7	93.8
	Extremely Effective	6	6.2	6.2	100.0
	Total	97	100.0	100.0	

Appendix H2a – Main Survey Statistical Results

Reliability Tests

1. Reliability for a1 to a10 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	a1	3.3085	.9949	94.0
2.	a2	3.8298	.9233	94.0
3.	a3	4.1915	.7659	94.0
4.	a4	3.9149	.8508	94.0
5.	a5	3.8936	1.0209	94.0
6.	a6	4.1489	.8794	94.0
7.	a7	3.0851	.8879	94.0
8.	a8	2.5213	.9586	94.0
9.	a9	3.9574	1.0256	94.0
10.	a10	3.6170	1.3125	94.0

No. of Cases = 94.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	36.4681	21.0474	4.5877	10

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	3.6468	2.5213	4.1915	1.6702	1.6624	.2788

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Variances	.9450	.5866	1.7227	1.1361	2.9368	.0965

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
a1	33.1596	18.2216	.2162	.1008	.6027
a2	32.6383	17.4162	.3606	.2848	.5696
a3	32.2766	18.4388	.3074	.3043	.5842
a4	32.5532	17.4326	.4069	.3223	.5619
a5	32.5745	17.8600	.2486	.1817	.5954
a6	32.3191	17.9186	.3164	.2114	.5802
a7	33.3830	18.9700	.1666	.2614	.6113
a8	33.9468	17.3197	.3520	.3017	.5708
a9	32.5106	17.5429	.2855	.1830	.5864
a10	32.8511	16.7088	.2438	.1399	.6047

Appendix H2a – Main Survey Statistical Results

Reliability Tests

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

Reliability Coefficients   10 items

Alpha = .6122   Standardised item alpha = .6249

Appendix H2a – Main Survey Statistical Results

Reliability Tests

2. Reliability for b1 to b5 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	b1	3.0206	.9998	97.0
2.	b2	2.2062	1.0987	97.0
3.	b3	2.8144	1.3333	97.0
4.	b4	2.9072	1.2254	97.0
5.	b5	2.6082	1.0161	97.0

No. of Cases = 97.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	13.5567	17.1244	4.1382	5

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	2.7113	2.2062	3.0206	.8144	1.3692	.1026

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	1.3037	.9996	1.7777	.7781	1.7785	.1098

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
b1	10.5361	12.9180	.4462	.2383	.7637
b2	11.3505	12.5217	.4367	.2114	.7678
b3	10.7423	10.5683	.5512	.3288	.7352
b4	10.6495	10.3967	.6613	.5781	.6900
b5	10.9485	11.4869	.6686	.5636	.6965

Reliability Coefficients 5 items

Alpha = .7742 Standardised item alpha = .7766

Reliability Tests

3. Reliability for c1 to c4 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	c1	1.8152	1.3500	92.0
2.	c2	2.0326	1.0319	92.0
3.	c3	3.5652	1.0824	92.0
4.	c4	3.7826	1.1562	92.0

No. of Cases = 92.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	11.1957	7.4338	2.7265	4

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	2.7989	1.8152	3.7826	1.9674	2.0838	1.0366

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	1.3490	1.0649	1.8226	.7578	1.7116	.1122

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
c1	9.3804	5.4910	.0190	.0454	.5239
c2	9.1630	5.5665	.1648	.0276	.3329
c3	7.6304	4.9608	.2699	.3424	.2227
c4	7.4130	4.2451	.3887	.3348	.0658

Reliability Coefficients 4 items

Alpha = .3655 Standardised item alpha = .3894

Appendix H2a – Main Survey Statistical Results

Reliability Tests

4. Reliability c3 to c4 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	c3	3.5579	1.0691	95.0
2.	c4	3.7684	1.1435	95.0

No. of Cases = 95.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	7.3263	3.8392	1.9594	2

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	3.6632	3.5579	3.7684	.2105	1.0592	.0222
Item Variances	1.2252	1.1429	1.3075	.1646	1.1440	.0135

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
c3	3.7684	1.3075	.5681	.3227	.
c4	3.5579	1.1429	.5681	.3227	.

Reliability Coefficients 2 items

Alpha = .7235 Standardised item alpha = .7245

Appendix H2a – Main Survey Statistical Results

Reliability Tests

5. Reliability d1 to d10 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	d1	3.3587	.9327	92.0
2.	d2	3.8043	.9520	92.0
3.	d3	4.1848	.8245	92.0
4.	d4	3.4130	1.0603	92.0
5.	d5	3.7500	1.0652	92.0
6.	d6	3.3370	1.0922	92.0
7.	d7	3.0652	.9353	92.0
8.	d8	2.9348	.9699	92.0
9.	d9	2.5326	.9429	92.0
10.	d10	2.4674	.9772	92.0

No. of Cases = 92.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	32.8478	30.5700	5.5290	10

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.2848	2.4674	4.1848	1.7174	1.6960	.3028

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.9567	.6798	1.1929	.5131	1.7549	.0238

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
d1	29.4891	27.1317	.2643	.2836	.7644
d2	29.0435	26.3058	.3438	.5738	.7546
d3	28.6630	26.1819	.4395	.5504	.7431
d4	29.4348	25.3034	.3883	.2082	.7496
d5	29.0978	24.1991	.4997	.4189	.7330
d6	29.5109	24.1427	.4877	.3508	.7348
d7	29.7826	25.4467	.4502	.5673	.7407
d8	29.9130	24.8275	.4968	.5752	.7341
d9	30.3152	24.8336	.5158	.6829	.7319
d10	30.3804	25.7548	.3892	.6846	.7488

Appendix H2a – Main Survey Statistical Results

Reliability Tests

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

Reliability Coefficients   10 items

Alpha = .7634   Standardised item alpha = .7636

Appendix H2a – Main Survey Statistical Results

Reliability Tests

6. Reliability e1 to e11 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	e1	3.6383	.8145	94.0
2.	e2	2.8298	1.1133	94.0
3.	e3	2.6170	1.0484	94.0
4.	e4	2.4362	1.0931	94.0
5.	e5	2.5638	.8621	94.0
6.	e6	2.8191	1.0773	94.0
7.	e7	3.1809	.8916	94.0
8.	e8	3.4362	.7267	94.0
9.	e9	3.5213	.6346	94.0
10.	e10	3.5319	.7992	94.0
11.	e11	3.2766	.8476	94.0

No. of Cases = 94.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	33.8511	31.5045	5.6129	11

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.0774	2.4362	3.6383	1.2021	1.4934	.1912

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.8349	.4028	1.2395	.8368	3.0775	.0841

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
e1	30.2128	26.6424	.4993	.3658	.7558
e2	31.0213	26.7952	.3010	.3572	.7817
e3	31.2340	26.2887	.3829	.4183	.7694
e4	31.4149	25.3852	.4471	.3297	.7614
e5	31.2872	25.3037	.6293	.4971	.7405
e6	31.0319	27.3216	.2684	.3893	.7848
e7	30.6702	26.0944	.5067	.6600	.7539
e8	30.4149	26.9335	.5360	.6307	.7540
e9	30.3298	28.6965	.3537	.3566	.7711
e10	30.3191	26.5637	.5222	.5218	.7537
e11	30.5745	26.6987	.4667	.4029	.7588

Appendix H2a – Main Survey Statistical Results

Reliability Tests

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

Reliability Coefficients   11 items

Alpha = .7794   Standardised item alpha = .7953

7. Reliability e12 to e18 (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	e12	3.6000	.9609	95.0
2.	e13	3.4632	1.1833	95.0
3.	e14	3.1368	1.0377	95.0
4.	e15	3.6842	.6402	95.0
5.	e16	3.2000	1.1166	95.0
6.	e17	2.9579	1.1004	95.0
7.	e18	2.9579	1.0306	95.0

No. of Cases = 95.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	23.0000	20.8085	4.5616	7

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.2857	2.9579	3.6842	.7263	1.2456	.0889

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	1.0472	.4099	1.4002	.9904	3.4164	.1023

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
e12	19.4000	16.0511	.4979	.4343	.7210
e13	19.5368	15.3789	.4342	.4460	.7373
e14	19.8632	15.7577	.4824	.2853	.7238
e15	19.3158	18.4099	.3620	.1824	.7489
e16	19.8000	14.5660	.5861	.4157	.6988
e17	20.0421	15.2535	.5054	.3676	.7186
e18	20.0421	15.9557	.4604	.2343	.7286

Reliability Coefficients 7 items

Alpha = .7557 Standardised item alpha = .7568

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

8. Reliability a1-a9 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	a1	3.3085	.9949	94.0
2.	a2	3.8298	.9233	94.0
3.	a3	4.1915	.7659	94.0
4.	a4	3.9149	.8508	94.0
5.	a5	3.8936	1.0209	94.0
6.	a6	4.1489	.8794	94.0
7.	a7	3.0851	.8879	94.0
8.	a8	2.5213	.9586	94.0
9.	a9	3.9574	1.0256	94.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	32.8511	16.7088	4.0876	9

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
a1	29.5426	14.4444	.1685	.0740	.6098
a2	29.0213	13.5479	.3396	.2805	.5629
a3	28.6596	14.6140	.2575	.2894	.5844
a4	28.9362	13.3507	.4237	.3206	.5433
a5	28.9574	13.6756	.2637	.1814	.5842
a6	28.7021	13.7598	.3335	.2111	.5653
a7	29.7660	14.3962	.2262	.2453	.5920
a8	30.3298	13.2987	.3563	.2931	.5577
a9	28.8936	13.6015	.2717	.1801	.5819

Reliability Coefficients 9 items

Alpha = .6047 Standardized item alpha = .6104

Reliability Tests (after factor analysis)

9. Reliability b1-b5 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	b1	3.0206	.9998	97.0
2.	b2	2.2062	1.0987	97.0
3.	b3	2.8144	1.3333	97.0
4.	b4	2.9072	1.2254	97.0
5.	b5	2.6082	1.0161	97.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	13.5567	17.1244	4.1382	5

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
b1	10.5361	12.9180	.4462	.2383	.7637
b2	11.3505	12.5217	.4367	.2114	.7678
b3	10.7423	10.5683	.5512	.3288	.7352
b4	10.6495	10.3967	.6613	.5781	.6900
b5	10.9485	11.4869	.6686	.5636	.6965

Reliability Coefficients   5 items

Alpha = .7742   Standardized item alpha = .7766

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

10. Reliability c3-c4 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	c3	3.5579	1.0691	95.0
2.	c4	3.7684	1.1435	95.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	7.3263	3.8392	1.9594	2

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
c3	3.7684	1.3075	.5681	.3227	.
c4	3.5579	1.1429	.5681	.3227	.

Reliability Coefficients   2 items

Alpha = .7235   Standardized item alpha = .7245

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

11. Reliability d1, d2, d3, d5 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	d1	3.3511	.9241	94.0
2.	d2	3.8085	.9422	94.0
3.	d3	4.1809	.8160	94.0
4.	d5	3.7021	1.1055	94.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	15.0426	7.2670	2.6957	4

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
d1	11.6915	5.0113	.3388	.1827	.6692
d2	11.2340	4.3962	.5019	.5156	.5645
d3	10.8617	4.6796	.5443	.5114	.5500
d5	11.3404	4.0764	.4409	.2279	.6141

Reliability Coefficients   4 items

Alpha = .6674   Standardized item alpha = .6766

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

12. Reliability e1, e3, e4 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

RELIABILITY ANALYSIS - SCALE (ALPHA)

		Mean	Std Dev	Cases
1.	e1	3.6354	.8094	96.0
2.	e3	2.5938	1.0521	96.0
3.	e4	2.4271	1.0833	96.0

Statistics for	Mean	Variance	Std Dev	No of Variables
Scale	8.6563	5.2385	2.2888	3

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
e1	5.0208	3.3680	.4091	.1686	.6458
e3	6.0625	2.4171	.5241	.2764	.4868
e4	6.2292	2.3890	.5004	.2572	.5249

RELIABILITY ANALYSIS - SCALE (ALPHA)

Reliability Coefficients 3 items

Alpha = .6594 Standardized item alpha = .6607

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

13. Reliability d7, d8, d9, d10 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	d7	3.0638	.9253	94.0
2.	d8	2.9255	.9643	94.0
3.	d9	2.5319	.9356	94.0
4.	d10	2.4681	.9694	94.0

Statistics for	Mean	Variance	Std Dev	No of Variables
Scale	10.9894	8.8493	2.9748	4

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
d7	7.9255	5.8976	.4663	.4842	.8018
d8	8.0638	5.0496	.6622	.5395	.7065
d9	8.4574	5.0681	.6899	.6713	.6932
d10	8.5213	5.2845	.5889	.6750	.7446

Reliability Coefficients   4 items

Alpha = .7908   Standardized item alpha = .7903

Appendix H2b – Main Survey Statistical Results

Reliability Tests (after factor analysis)

14. Reliability e1 to e11 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	e5	2.5684	.8587	95.0
2.	e6	2.8316	1.0783	95.0
3.	e7	3.2000	.9062	95.0
4.	e8	3.4526	.7404	95.0
5.	e9	3.5263	.6332	95.0
6.	e10	3.5368	.7964	95.0
7.	e11	3.2842	.8463	95.0

Statistics for	Mean	Variance	Std Dev	No of Variables
Scale	22.4000	15.2851	3.9096	7

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
e5	19.8316	11.3543	.5519	.3536	.7473
e6	19.5684	11.6522	.3355	.3121	.8027
e7	19.2000	10.6936	.6361	.6441	.7287
e8	18.9474	11.6461	.6116	.5967	.7391
e9	18.8737	12.7498	.4720	.3321	.7652
e10	18.8632	11.3321	.6189	.4959	.7355
e11	19.1158	12.0184	.4347	.2887	.7702

Reliability Coefficients   7 items

Alpha = .7834   Standardized item alpha = .7969

Reliability Tests (after factor analysis)

15. Reliability e12 to e18 (after factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	e12	3.6146	.9665	96.0
2.	e13	3.4792	1.1875	96.0
3.	e14	3.1563	1.0496	96.0
4.	e16	3.1979	1.1109	96.0
5.	e17	2.9792	1.1143	96.0
6.	e18	2.9583	1.0251	96.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	19.3854	18.6815	4.3222	6

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
e12	15.7708	14.0311	.5133	.4389	.7121
e13	15.9062	13.2648	.4632	.4431	.7258
e14	16.2292	13.9259	.4664	.2517	.7230
e16	16.1875	12.9539	.5619	.3840	.6963
e17	16.4062	13.3174	.5069	.3686	.7121
e18	16.4271	14.2052	.4433	.2242	.7289

Reliability Coefficients   6 items

Alpha = .7521   Standardized item alpha = .7534

Appendix H3 – Main Survey Statistical Results

Factor Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N	Missing N
a1	3.33	1.00	96	1
a2	3.80	.94	96	1
a3	4.19	.77	96	1
a4	3.91	.85	94	3
a5	3.86	1.03	96	1
a6	4.15	.88	96	1
a7	3.09	.88	96	1
a8	2.54	.96	96	1
a9	3.95	1.02	96	1
a10	3.61	1.32	96	1
b1	3.02	1.00	97	0
b2	2.21	1.10	97	0
b3	2.81	1.33	97	0
b4	2.91	1.23	97	0
b5	2.61	1.02	97	0
c1	1.82	1.35	92	5
c2	2.03	1.03	92	5
c3	3.56	1.07	95	2
c4	3.77	1.14	95	2
d1	3.36	.93	96	1
d2	3.80	.93	97	0
d3	4.16	.84	96	1
d4	3.41	1.05	97	0
d5	3.69	1.11	96	1
d6	3.34	1.08	97	0
d7	3.06	.91	97	0
d8	2.93	.96	95	2
d9	2.53	.93	96	1
d10	2.46	.97	95	2
e1	3.64	.81	96	1
e2	2.82	1.11	95	2
e3	2.59	1.05	96	1
e4	2.43	1.08	96	1
e5	2.56	.86	96	1
e6	2.82	1.08	96	1
e7	3.19	.91	96	1
e8	3.45	.74	95	2
e9	3.53	.66	97	0
e10	3.54	.82	97	0
e11	3.29	.87	97	0
e12	3.62	.96	97	0
e13	3.48	1.19	96	1
e14	3.16	1.05	97	0
e15	3.69	.64	96	1
e16	3.21	1.11	97	0
e17	2.99	1.11	97	0
e18	2.97	1.03	97	0

Appendix H3 – Main Survey Statistical Results

Factor Analysis

Communalities

	Raw		Rescaled	
	Initial	Extraction	Initial	Extraction
a1 - Basic Info. in Tender	.935	.620	1.000	.663
a2 - Bureaucracy of Client Staff	.768	.367	1.000	.477
a3 - Not accept design errors	.569	.254	1.000	.447
a4 - Client staff subjective interpretation	.731	.383	1.000	.524
a5 - $100000 as LD	1.037	.691	1.000	.666
a6 - Inequitable Contract Terms	.628	.321	1.000	.511
a7 - Performance Assessment and Paperwork	.776	.567	1.000	.730
a8 - ISO and paperwork	.842	.607	1.000	.720
a9 - Award contract by price	.988	.744	1.000	.753
a10 - Corruption	1.709	1.426	1.000	.834
b1 - Noise Ordinance	.987	.624	1.000	.633
b2 - Restriction on Employing overseas workers	1.164	.838	1.000	.720
b3 - Criminial prosecution to employ illegal workers	1.803	1.624	1.000	.900
b4 - OH&S requirements	1.549	1.312	1.000	.847
b5 - Unexpected safety checks	1.039	.806	1.000	.775
c1 - Breaching statutory requirements	1.946	1.874	1.000	.963
c2 - Period of suspension from tendering	1.037	.665	1.000	.642
c3 - Poor reputation	1.184	.867	1.000	.732
c4 - Loss of tendering opportunity in private sector	1.401	1.217	1.000	.869
d1 - Suppliers price above 5%	.833	.501	1.000	.602
d2 - Incompetence of suppliers	.932	.688	1.000	.739
d3 - Poor performance of subcontractors	.687	.479	1.000	.697
d4 - Fire, theft	1.050	.791	1.000	.754
d5 - limited suppliers	1.123	.829	1.000	.738
d6 - Delay by utilities	1.252	1.018	1.000	.813
d7 - Staff turnover over 10%	.943	.757	1.000	.803
d8 - Artisan turnover above 10%	1.010	.779	1.000	.771
d9 - Staff turnover below 10%	.920	.798	1.000	.867
d10 - Artisan turnover below 10%	.964	.810	1.000	.841
e1 - Regular contractor as partner	.545	.335	1.000	.616
e2 - Increase no. of subcontractor	1.196	.937	1.000	.783
e3 - Long term material supply contract	1.132	.909	1.000	.803
e4 - Setup subsidiary trading company	1.262	.940	1.000	.745
e5 - Record Mgt to deal with ISO	.722	.540	1.000	.748
e6 - Employ direct labour	1.242	1.022	1.000	.823
e7 - Arrange regular training for artisans	.851	.641	1.000	.753
e8 - Arrange regular training for staff	.547	.347	1.000	.635
e9 - Clear career prospect for staff	.376	.202	1.000	.538
e10 - Clear policy on quality and safety	.697	.454	1.000	.651
e11 - Have vision and mission	.736	.443	1.000	.602
e12 - Lobby equitable terms	.852	.716	1.000	.840
e13 - Lobby to award to good performers	1.363	1.212	1.000	.889
e14 - Registration of workers	1.049	.696	1.000	.663
e15 - Strengthen supervision of subcontractors	.417	.210	1.000	.504
e16 - Disallow uncontrolled subcontracting	1.295	1.101	1.000	.850
e17 - Setup statutory Council	1.247	1.039	1.000	.833
e18 - HA strengthen supervision	1.099	.748	1.000	.681

Extraction Method: Principal Component Analysis.

Appendix H3 – Main Survey Statistical Results

Factor Analysis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.529
Bartlett's Test of Sphericity	Approx. Chi-Square	2049.315
	df	1081
	Sig.	.000

Appendix H3 – Main Survey Statistical Results

Factor Analysis

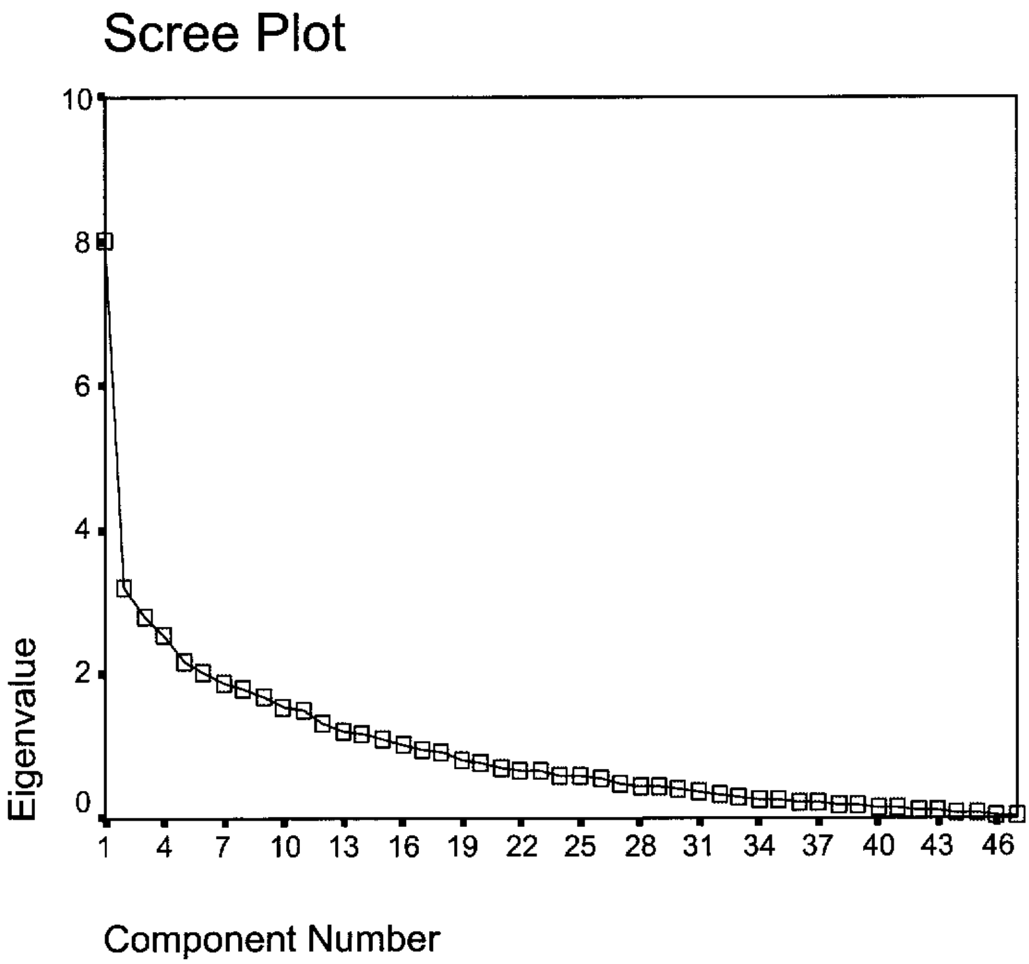
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.998	17.02	17.02	7.998	17.02	17.02	3.169	6.743	6.743
2	3.182	6.771	23.79	3.182	6.771	23.79	2.896	6.162	12.91
3	2.800	5.957	29.74	2.800	5.957	29.74	2.775	5.905	18.81
4	2.555	5.435	35.18	2.555	5.435	35.18	2.516	5.353	24.16
5	2.172	4.622	39.80	2.172	4.622	39.80	2.424	5.156	29.32
6	2.019	4.296	44.10	2.019	4.296	44.10	2.353	5.006	34.32
7	1.864	3.967	48.06	1.864	3.967	48.06	2.161	4.599	38.92
8	1.790	3.808	51.87	1.790	3.808	51.87	2.090	4.447	43.37
9	1.694	3.604	55.48	1.694	3.604	55.48	2.057	4.376	47.75
10	1.540	3.276	58.75	1.540	3.276	58.75	2.045	4.350	52.10
11	1.517	3.227	61.98	1.517	3.227	61.98	2.008	4.273	56.37
12	1.323	2.816	64.79	1.323	2.816	64.79	1.875	3.989	60.36
13	1.208	2.571	67.36	1.208	2.571	67.36	1.826	3.885	64.24
14	1.164	2.476	69.84	1.164	2.476	69.84	1.707	3.632	67.88
15	1.106	2.354	72.20	1.106	2.354	72.20	1.554	3.306	71.18
16	1.038	2.209	74.40	1.038	2.209	74.40	1.515	3.223	74.40
17	.959	2.040	76.44						
18	.935	1.989	78.43						
19	.814	1.732	80.17						
20	.757	1.611	81.78						
21	.701	1.491	83.27						
22	.669	1.424	84.69						
23	.654	1.391	86.08						
24	.591	1.258	87.34						
25	.575	1.224	88.56						
26	.537	1.142	89.71						
27	.490	1.043	90.75						
28	.453	.964	91.71						
29	.423	.900	92.61						
30	.402	.855	93.47						
31	.354	.754	94.22						
32	.334	.710	94.93						
33	.299	.637	95.57						
34	.268	.571	96.14						
35	.252	.536	96.68						
36	.227	.484	97.16						
37	.214	.455	97.61						
38	.186	.395	98.01						
39	.167	.355	98.36						
40	.153	.325	98.69						
41	.136	.290	98.98						
42	.125	.266	99.24						
43	.101	.215	99.46						
44	.092	.195	99.65						
45	.060	.127	99.78						
46	.053	.113	99.90						
47	.049	.105	100.0						

Extraction Method: Principal Component Analysis.

Appendix H3 – Main Survey Statistical Results

Factor Analysis



Appendix H3 – Main Survey Statistical Results

Factor Analysis

Component Matrix[a]

	Component															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
a1																
a2		.571														
a3		.517														
a4																
a5						.513										
a6																
a7																
a8																
a9																
a10																
b1																
b2																
b3																
b4																
b5	.535															
c1																
c2																
c3																
c4																
d1																
d2		.506														
d3		.554														
d4																
d5																
d6	.541															
d7																
d8																
d9				-.57												
d10				-.53												
e1																
e2																
e3																
e4																
e5	.575															
e6																
e7	.609															
e8	.559															
e9																
e10	.573															
e11																
e12			-.58													
e13																
e14	.571															
e15																
e16																
e17																
e18																

Extraction Method: Principal Component Analysis.

a. 16 components extracted.

Appendix H3 – Main Survey Statistical Results

Factor Analysis

Rotated Component Matrix[a]

	Component															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
a1															.841	
a2												.713				
a3													.527			
a4								.782								
a5								.501								
a6								.550								
a7														.700		
a8														.651		
a9												.640				
a10																
b1	.625															
b2	.538															
b3	.688															
b4	.758															
b5	.761															
c1													-.68			
c2																.789
c3									.745							
c4									.773							
d1											.671					
d2						.829										
d3						.746										
d4													.614			
d5											.769					
d6																
d7		.731														
d8		.814														
d9		.757														
d10		.675														
e1							.760									
e2																
e3							.711									
e4					.503		.574									
e5			.633													
e6				.543												
e7				.783												
e8				.759												
e9			.681													
e10			.808													
e11			.698													
e12										.629						
e13										.829						
e14					.502											
e15																
e16					.566											
e17					.791											
e18					.507											

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 31 iterations. Factors smaller than 0.5 discarded.

Appendix H4 – Main Survey Statistical Results

Compare of Means

Table A Test of Normality

Tests of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
F2 - Latest Annual Turnover (1998/1999)	.306	94	.000
F3 - Number of full-time, directly employed staff	.318	94	.000
F4 - Number of full-time directly employed artisans	.275	94	.000
F5 - Approximate Area of Workshop	.311	94	.000
F6 - Approximate Value of fixed plants, tools etc.	.254	94	.000

a. Lilliefors Significance Correction

Appendix H4 – Main Survey Statistical Results

Compare of Means

Tests of Normality

	Kolmogorov-Smirnov [a]		
	Statistic	df	Sig.
Client Factors a1 - Basic Info. in Tender	.213	82	.000
Client Factors a2 - Bureaucracy of Client Staff	.286	82	.000
Client Factors a3 - Not accept design errors	.252	82	.000
Client Factors a4 - Client staff subjective interpretation	.277	82	.000
Client Factors a5 - $100000 as LD	.238	82	.000
Client Factors a6 - Inequitable Contract Terms	.235	82	.000
Client Factors a7 - Performance Assessment and Paperwork	.227	82	.000
Client Factors a8 - ISO and paperwork	.242	82	.000
Client Factors a9 - Award contract by price	.233	82	.000
Client Factors a10 - Corruption	.201	82	.000
Statutory Requirements b1 - Noise Ordinance	.198	82	.000
Statutory Requirements b2 - Restriction on Employing overseas workers	.234	82	.000
Statutory Requirements b3 - Criminial prosecution to employ illegal workers	.183	82	.000
Statutory Requirements b4 - OH&S requirements	.164	82	.000
Statutory Requirements b5 - Unexpected safety checks	.203	82	.000
Fines and Penalty c1 - Breaching statutory requirements	.370	82	.000
Fines and Penalty c2 - Period of suspension from tendering	.341	82	.000
Fines and Penalty c3 - Poor reputation	.185	82	.000
Fines and Penalty c4 - Loss of tendering opportunity in private sector	.252	82	.000
Procurement and Staffing d1 - Suppliers price above 5%	.211	82	.000
Procurement and Staffing d2 - Incompetence of suppliers	.256	82	.000
Procurement and Staffing d3 - Poor performance of subcontractors	.244	82	.000
Procurement and Staffing d4 - Fire, theft	.195	82	.000
Procurement and Staffing d5 - limited suppliers	.219	82	.000
Procurement and Staffing d6 - Delay by utilities	.184	82	.000
Procurement and Staffing d7 - Staff turnover over 10%	.205	82	.000
Procurement and Staffing d8 - Artisan turnover above 10%	.193	82	.000
Procurement and Staffing d9 - Staff turnover below 10%	.207	82	.000
Procurement and Staffing d10 - Artisan turnover below 10%	.241	82	.000
Risk Management e1 - Regular contractor as partner	.343	82	.000
Risk Management e2 - Increase no. of subcontractor	.205	82	.000
Risk Management e3 - Long term material supply contract	.237	82	.000
Risk Management e4 - Setup subsidiary trading company	.213	82	.000
Risk Management e5 - Record Mgt to deal with ISO	.275	82	.000
Risk Management e6 - Employ direct labour	.210	82	.000
Risk Management e7 - Arrange regular training for artisans	.215	82	.000
Risk Management e8 - Arrange regular training for staff	.271	82	.000
Risk Management e9 - Clear career prospect for staff	.311	82	.000
Risk Management e10 - Clear policy on quality and safety	.242	82	.000
Risk Management e11 - Have vision and mission	.239	82	.000
Quality Improvement Proposal e12 - Lobby equitable terms	.215	82	.000
Quality Improvement Proposal e13 - Lobby to award to good performers	.214	82	.000
Quality Improvement Proposal e14 - Registration of workers	.208	82	.000
Quality Improvement Proposal e15 - Strengthen supervision of subcontractors	.298	82	.000
Quality Improvement Proposal e16 - Disallow uncontrolled subcontracting	.199	82	.000
Quality Improvement Proposal e17 - Setup statutory Council	.187	82	.000
Quality Improvement Proposal e18 - HA strengthen supervision	.200	82	.000

a. Lilliefors Significance Correction

Appendix H4 – Main Survey Statistical Results

Compare of Means

t-Tests

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
F2 - Latest Annual Turnover (1998/1999)	95	3.49	1.68	.17
F3 - Number of full-time, directly employed staff	96	3.44	1.72	.18
F4 - Number of full-time directly employed artisans	96	2.82	1.49	.15
F5 - Approximate Area of Workshop	96	2.96	1.29	.13
F6 - Approximate Value of fixed plants, tools etc.	96	2.78	1.76	.18
Client Factors a1 - Basic Info. in Tender	96	3.33	1.00	.10
Client Factors a2 - Bureaucracy of Client Staff	96	3.80	.94	9.55E-02
Client Factors a3 - Not accept design errors	96	4.19	.77	7.88E-02
Client Factors a4 - Client staff subjective interpretation	94	3.91	.85	8.78E-02
Client Factors a5 - $100000 as LD	96	3.86	1.03	.11
Client Factors a6 - Inequitable Contract Terms	96	4.15	.88	9.01E-02
Client Factors a7 - Performance Assessment and Paperwork	96	3.09	.88	9.02E-02
Client Factors a8 - ISO and paperwork	96	2.54	.96	9.81E-02
Client Factors a9 - Award contract by price	96	3.95	1.02	.10
Client Factors a10 - Corruption	96	3.61	1.32	.13

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
F2 - Latest Annual Turnover (1998/1999)	2.868	94	.005	.49	.15	.84
F3 - Number of full-time, directly employed staff	2.490	95	.015	.44	8.86E-02	.79
F4 - Number of full-time directly employed artisans	-1.167	95	.246	-.18	-.48	.12
F5 - Approximate Area of Workshop	-.317	95	.752	-4.17E-02	-.30	.22
F6 - Approximate Value of fixed plants, tools etc.	-1.218	95	.226	-.22	-.58	.14
Client Factors a1 - Basic Info. in Tender	3.260	95	.002	.33	.13	.54
Client Factors a2 - Bureaucracy of Client Staff	8.396	95	.000	.80	.61	.99
Client Factors a3 - Not accept design errors	15.070	95	.000	1.19	1.03	1.34
Client Factors a4 - Client staff subjective interpretation	10.426	93	.000	.91	.74	1.09
Client Factors a5 - $100000 as LD	8.206	95	.000	.86	.66	1.07
Client Factors a6 - Inequitable Contract Terms	12.724	95	.000	1.15	.97	1.32
Client Factors a7 - Performance Assessment and Paperwork	1.040	95	.301	9.38E-02	-8.53E-02	.27
Client Factors a8 - ISO and paperwork	-4.670	95	.000	-.46	-.65	-.26
Client Factors a9 - Award contract by price	9.110	95	.000	.95	.74	1.15
Client Factors a10 - Corruption	4.573	95	.000	.61	.35	.88

Note: The test for mean is a 1-sided test with significance level $\propto$ of 0.05, or $t \geq 1.645$. p-value indicated in this page is for a 2-sided test and should not be used.

Appendix H4 – Main Survey Statistical Results

Compare of Means

t-Tests

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Statutory Requirements b1 - Noise Ordinance	97	3.02	1.00	.10
Statutory Requirements b2 - Restriction on Employing overseas workers	97	2.21	1.10	.11
Statutory Requirements b3 - Criminial prosecution to employ illegal workers	97	2.81	1.33	.14
Statutory Requirements b4 - OH&S requirements	97	2.91	1.23	.12
Statutory Requirements b5 - Unexpected safety checks	97	2.61	1.02	.10
Fines and Penalty c1 - Breaching statutory requirements	92	1.82	1.35	.14
Fines and Penalty c2 - Period of suspension from tendering	92	2.03	1.03	.11
Fines and Penalty c3 - Poor reputation	95	3.56	1.07	.11
Fines and Penalty c4 - Loss of tendering opportunity in private sector	95	3.77	1.14	.12
Procurement and Staffing d1 - Suppliers price above 5%	96	3.36	.93	9.50E-02
Procurement and Staffing d2 - Incompetence of suppliers	97	3.80	.93	9.46E-02
Procurement and Staffing d3 - Poor performance of subcontractors	96	4.16	.84	8.55E-02
Procurement and Staffing d4 - Fire, theft	97	3.41	1.05	.11
Procurement and Staffing d5 - limited suppliers	96	3.69	1.11	.11
Procurement and Staffing d6 - Delay by utilities	97	3.34	1.08	.11
Procurement and Staffing d7 - Staff turnover over 10%	97	3.06	.91	9.25E-02
Procurement and Staffing d8 - Artisan turnover above 10%	95	2.93	.96	9.84E-02
Procurement and Staffing d9 - Staff turnover below 10%	96	2.53	.93	9.48E-02
Procurement and Staffing d10 - Artisan turnover below 10%	95	2.46	.97	9.91E-02

Appendix H4 – Main Survey Statistical Results

Compare of Means

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Statutory Requirements b1 - Noise Ordinance	.203	96	.839	2.06E-02	-.18	.22
Statutory Requirements b2 - Restriction on Employing overseas workers	-7.116	96	.000	-.79	-1.02	-.57
Statutory Requirements b3 - Criminial prosecution employ illegal workers	-1.371	96	.174	-.19	-.45	8.32E-02
Statutory Requirements b4 - OH&S requirements	-.746	96	.458	-9.28E-02	-.34	.15
Statutory Requirements b5 - Unexpected safety checks	-3.797	96	.000	-.39	-.60	-.19
Fines and Penalty c1 - Breaching statutory requirements	-8.418	91	.000	-1.18	-1.46	-.91
Fines and Penalty c2 - Period of suspension from tendering	-8.992	91	.000	-.97	-1.18	-.75
Fines and Penalty c3 - Poor reputation	5.086	94	.000	.56	.34	.78
Fines and Penalty c4 - Loss of tendering opportun in private sector	6.550	94	.000	.77	.54	1.00
Procurement and Staffing d1 - Suppliers price abo 5%	3.839	95	.000	.36	.18	.55
Procurement and Staffing d2 - Incompetence of suppliers	8.503	96	.000	.80	.62	.99
Procurement and Staffing d3 - Poor performance c subcontractors	13.525	95	.000	1.16	.99	1.33
Procurement and Staffing d4 - Fire, theft	3.874	96	.000	.41	.20	.62
Procurement and Staffing d5 - limited suppliers	6.080	95	.000	.69	.46	.91
Procurement and Staffing d6 - Delay by utilities	3.105	96	.002	.34	.12	.56
Procurement and Staffing d7 - Staff turnover over 10%	.669	96	.505	6.19E-02	-.12	.25
Procurement and Staffing d8 - Artisan turnover ab 10%	-.749	94	.456	-7.37E-02	-.27	.12
Procurement and Staffing d9 - Staff turnover belov 10%	-4.946	95	.000	-.47	-.66	-.28
Procurement and Staffing d10 - Artisan turnover below 10%	-5.420	94	.000	-.54	-.73	-.34

Note: The test for mean is a 1-sided test with significance level $\propto$ of 0.05, or t $\geq$ 1.645. p-value indicated in this page is for a 2-sided test and should not be used.

Appendix H4 – Main Survey Statistical Results

Compare of Means

t-Tests

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Risk Management e1 - Regular contractor as partner	96	3.64	.81	8.26E-02
Risk Management e2 - Increase no. of subcontractor	95	2.82	1.11	.11
Risk Management e3 - Long term material supply contract	96	2.59	1.05	.11
Risk Management e4 - Setup subsidiary trading company	96	2.43	1.08	.11
Risk Management e5 - Record Mgt to deal with ISO	96	2.56	.86	8.74E-02
Risk Management e6 - Employ direct labour	96	2.82	1.08	.11
Risk Management e7 - Arrange regular training for artisans	96	3.19	.91	9.29E-02
Risk Management e8 - Arrange regular training for staff	95	3.45	.74	7.60E-02
Risk Management e9 - Clear career prospect for staff	97	3.53	.66	6.73E-02
Risk Management e10 - Clear policy on quality and safety	97	3.54	.82	8.30E-02
Risk Management e11 - Have vision and mission	97	3.29	.87	8.79E-02
Quality Improvement Proposal e12 - Lobby equitable terms	97	3.62	.96	9.77E-02
Quality Improvement Proposal e13 - Lobby to award to good performers	96	3.48	1.19	.12
Quality Improvement Proposal e14 - Registration of workers	97	3.16	1.05	.11
Quality Improvement Proposal e15 - Strengthen supervision of subcontractors	96	3.69	.64	6.51E-02
Quality Improvement Proposal e16 - Disallow uncontrolled subcontracting	97	3.21	1.11	.11
Quality Improvement Proposal e17 - Setup statutory Council	97	2.99	1.11	.11
Quality Improvement Proposal e18 - HA strengthen supervision	97	2.97	1.03	.10

Appendix H4 – Main Survey Statistical Results

Compare of Means

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Risk Management e1 - Regular contractor as partn	7.692	95	.000	.64	.47	.80
Risk Management e2 - Increase no. of subcontract	-1.570	94	.120	-.18	-.41	4.73E-02
Risk Management e3 - Long term material supply contract	-3.783	95	.000	-.41	-.62	-.19
Risk Management e4 - Setup subsidiary trading company	-5.182	95	.000	-.57	-.79	-.35
Risk Management e5 - Record Mgt to deal with ISC	-5.007	95	.000	-.44	-.61	-.26
Risk Management e6 - Employ direct labour	-1.612	95	.110	-.18	-.40	4.09E-02
Risk Management e7 - Arrange regular training for artisans	2.019	95	.046	.19	3.17E-03	.37
Risk Management e8 - Arrange regular training for staff	5.958	94	.000	.45	.30	.60
Risk Management e9 - Clear career prospect for st	7.812	96	.000	.53	.39	.66
Risk Management e10 - Clear policy on quality and safety	6.460	96	.000	.54	.37	.70
Risk Management e11 - Have vision and mission	3.285	96	.001	.29	.11	.46
Quality Improvement Proposal e12 - Lobby equitab terms	6.331	96	.000	.62	.42	.81
Quality Improvement Proposal e13 - Lobby to awar to good performers	3.954	95	.000	.48	.24	.72
Quality Improvement Proposal e14 - Registration o workers	1.551	96	.124	.16	-4.62E-02	.38
Quality Improvement Proposal e15 - Strengthen supervision of subcontractors	10.564	95	.000	.69	.56	.82
Quality Improvement Proposal e16 - Disallow uncontrolled subcontracting	1.833	96	.070	.21	-1.71E-02	.43
Quality Improvement Proposal e17 - Setup statutor Council	-.091	96	.928	-1.03E-02	-.23	.21
Quality Improvement Proposal e18 - HA strengther supervision	-.297	96	.767	-3.09E-02	-.24	.18

Note: The test for mean is a 1-sided test with significance level ∝ of 0.05, or t > 1.66. p-value indicated in this page is for a 2-sided test and should not be used.

Appendix H4 – Main Survey Statistical Results

Compare of Means

Mean comparison of summated scales

t-Test (for Factor A, variables a1, a2, a3, a4, a5, a6, a7, a8, a9)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
CLIENT	94	32.8511	4.0876	.4216

One-Sample Test

	Test Value = 27					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
CLIENT	13.878	93	.000	5.8511	5.0138	6.6883

t-Test (for Factor B, variables b1, b2, b3, b4, b5)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
STATUT	97	13.5567	4.1382	.4202

One-Sample Test

	Test Value = 15					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
STATUT	-3.435	96	.001	-1.4433	-2.2773	-.6093

t-Test (for Factor C, variables c3, c4)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
POOR_PER	95	7.3263	1.9594	.2010

One-Sample Test

	Test Value = 6					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
POOR_PER	6.598	94	.000	1.3263	.9272	1.7255

Appendix H4 – Main Survey Statistical Results

Compare of Means

Mean comparison of summated scales

t-Test (for Factor D, variables d1, d2, d3, d5)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SUPPLIER	94	15.0426	2.6957	.2780

One-Sample Test

	Test Value = 12					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
SUPPLIER	10.943	93	.000	3.0426	2.4904	3.5947

t-Test (for Factor E, variables e1, e3, e4)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SUPCHAIN	96	8.6563	2.2888	.2336

One-Sample Test

	Test Value = 9					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
SUPCHAIN	-1.472	95	.144	-.3438	-.8075	.1200

t-Test (for Factor F, variables d7, d8, d9, d10)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
STAFFING	94	10.9894	2.9748	.3068

One-Sample Test

	Test Value = 12					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
STAFFING	-3.294	93	.001	-1.0106	-1.6199	-.4013

Appendix H4 – Main Survey Statistical Results

Compare of Means

Mean comparison of summated scales

t-Test (for Factor G, variables e5, e6, e7, e8, e9, e10, e11)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
TRAINING	95	22.4000	3.9096	.4011

One-Sample Test

	Test Value = 21					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
TRAINING	3.490	94	.001	1.4000	.6036	2.1964

t-Test (for Factor H, variables e12, e13, e14, e16, e17, e18)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
IMPROVE	96	19.3854	4.3222	.4411

One-Sample Test

	Test Value = 18					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
IMPROVE	3.141	95	.002	1.3854	.5097	2.2612

Appendix H5 – Main Survey Statistical Results

Regression

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.682	.526		3.202	.002	.638	2.727		
	b1	2.23E-02	.163	-.017	-.137	.891	-.346	.302	.783	1.277
	b2	950E-02	.151	.078	.661	.510	-.200	.399	.814	1.228
	b3	-.133	.129	-.132	-1.031	.305	-.391	.124	.694	1.440
	b4	782E-02	.180	.035	.211	.834	-.319	.395	.424	2.358
	b5	433E-02	.216	.072	.436	.664	-.336	.525	.420	2.382

a. Dependent Variable: c1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.506	.269		5.609	.000	.973	2.040		
	b4	.183	.086	.219	2.132	.036	.012	.354	1.000	1.000

a. Dependent Variable: c2

Excluded Variables[b]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	b1	-.070[a]	-.647	.519	-.068	.914	1.094	.914
	b2	.028[a]	.261	.795	.028	.899	1.113	.899
	b3	-.149[a]	-1.238	.219	-.130	.729	1.372	.729
	b5	-.246[a]	-1.656	.101	-.173	.470	2.127	.470

a. Predictors in the Model: (Constant), b4

b. Dependent Variable: c2

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Rank / Post of Respondents	Number of Years Working in Firm	D1 - Housing Authority Registered Contractor	D2 - Works Bureau Registered Contractor
N	Valid	147	147	157	157
	Missing	10	10	0	0
Std. Deviation		1.46	2.57	.49	.45
Variance		2.14	6.61	.24	.20
Minimum		1	1	0	0
Maximum		5	10	1	1

Statistics

		Not HA and WB list	D3 - Main Area of Business	D4 - Latest Annual Turnover (1998/1999)	D5 - Number of full-time, directly employed staff
N	Valid	157	157	153	152
	Missing	0	0	4	5
Std. Deviation		1.16		1.67	1.56
Variance		1.35		2.78	2.45
Minimum		0		1	1
Maximum		3		5	5

Statistics

		D6 - Number of full-time directly employed artisans	D7 - Approximate Area of Workshop	D8 - Approximate Value of fixed plants, tools etc.
N	Valid	150	151	148
	Missing	7	6	9
Std. Deviation		1.48	1.41	1.68
Variance		2.18	2.00	2.81
Minimum		1	1	1
Maximum		5	5	5

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Frequency Tables

Rank / Post of Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	(a) General Manager (GM), Director, Dir & GM, Executive Dir, CEO, Partners	55	35.0	37.4	37.4
	(b) Deputy GM, AGM, Operations Director, Executive Manager	8	5.1	5.4	42.9
	(c) Senior Manager, Project Manager, Contracts Manager	27	17.2	18.4	61.2
	(d) Manager, Assistant Project Manager	43	27.4	29.3	90.5
	(e) Engineer and Similar Rank	14	8.9	9.5	100.0
	Total	147	93.6	100.0	
Missing	System	10	6.4		
Total		157	100.0		

Number of Years Working in Firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 3 Years	24	15.3	16.3	16.3
	4 years to 6 years	17	10.8	11.6	27.9
	7 years to 9 years	11	7.0	7.5	35.4
	10 years to 12 years	36	22.9	24.5	59.9
	13 years to 15 years	11	7.0	7.5	67.3
	16 years to 18 years	18	11.5	12.2	79.6
	19 years to 21 years	12	7.6	8.2	87.8
	22 years to 24 years	5	3.2	3.4	91.2
	25 years to 27 years	4	2.5	2.7	93.9
	28 years and above	9	5.7	6.1	100.0
	Total	147	93.6	100.0	
Missing	System	10	6.4		
Total		157	100.0		

D1 - Housing Authority Registered Contractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	(a) Not Housing Authority Registered Contractor	97	61.8	61.8	61.8
	(b) Housing Authority Registered Contractor	60	38.2	38.2	100.0
	Total	157	100.0	100.0	

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

D2 - Works Bureau Registered Contractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	(a) Not Works Bureau Registered Contractor	44	28.0	28.0	28.0
	(b) Works Bureau Registered Contractor	113	72.0	72.0	100.0
	Total	157	100.0	100.0	

Not HA and WB list

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	(a) Not on any list	39	24.8	24.8	24.8
	(b) Registered with HA only	5	3.2	3.2	28.0
	(c) Registered with WB only	58	36.9	36.9	65.0
	(d) Registered with HA and WB	55	35.0	35.0	100.0
	Total	157	100.0	100.0	

D3 - Main Area of Business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	(a) Air conditioning and mechanical ventilation	10	6.4	6.4	6.4
	(b) Building (substructure and superstructure)	20	12.7	12.7	19.1
	(c) Electrical Services	23	14.6	14.6	33.8
	(d) Fire Services	5	3.2	3.2	36.9
	(e) Landscaping	1	.6	.6	37.6
	(f) Lifts	1	.6	.6	38.2
	(g) Plumbing and Drainage	2	1.3	1.3	39.5
	(h) Others	39	24.8	24.8	64.3
	(i) More than one categories	56	35.7	35.7	100.0
	Total	157	100.0	100.0	

D4 - Latest Annual Turnover (1998/1999)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below $10M	34	21.7	22.2	22.2
	From $10M to $20M	17	10.8	11.1	33.3
	From $20M to $30M	13	8.3	8.5	41.8
	From $30M to $40M	16	10.2	10.5	52.3
	More than $40M	73	46.5	47.7	100.0
	Total	153	97.5	100.0	
Missing	System	4	2.5		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

D5 - Number of full-time, directly employed staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 25	63	40.1	41.4	41.4
	From 25 to 50	31	19.7	20.4	61.8
	From 50 to 75	13	8.3	8.6	70.4
	From 75 to 100	16	10.2	10.5	80.9
	More than 100	29	18.5	19.1	100.0
	Total	152	96.8	100.0	
Missing	System	5	3.2		
Total		157	100.0		

D6 - Number of full-time directly employed artisans

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 10	49	31.2	32.7	32.7
	From 10 - 20	29	18.5	19.3	52.0
	From 20 - 30	13	8.3	8.7	60.7
	Over 30	40	25.5	26.7	87.3
	Does not employ full time artisans	19	12.1	12.7	100.0
	Total	150	95.5	100.0	
Missing	System	7	4.5		
Total		157	100.0		

D7 - Approximate Area of Workshop

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 250 sq.m	42	26.8	27.8	27.8
	From 250 to 500 sq.m	24	15.3	15.9	43.7
	From 500 to 750 sq.m	15	9.6	9.9	53.6
	Over 750 sq.m	56	35.7	37.1	90.7
	Does not have any workshop	14	8.9	9.3	100.0
	Total	151	96.2	100.0	
Missing	System	6	3.8		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

D8 - Approximate Value of fixed plants, tools etc.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below HK$2.5M	70	44.6	47.3	47.3
	From HK$2.5M - HK$5.0M	21	13.4	14.2	61.5
	From HK$5.0M - HK$7.5M	9	5.7	6.1	67.6
	From HK$7.5M - HK$10M	13	8.3	8.8	76.4
	Over $10M	35	22.3	23.6	100.0
	Total	148	94.3	100.0	
Missing	System	9	5.7		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Main Contractor Business Practice a1 - No formal contract	Main Contractor Business Practice a2 - Flow on tactic	Main Contractor Business Practice a3 - Pay sub after paid by Client	Main Contractor Business Practice a4 - Defer payment
N	Valid	154	155	155	155
	Missing	3	2	2	2
Std. Deviation		1.04	1.04	1.15	1.43
Variance		1.07	1.09	1.33	2.06
Minimum		1	1	1	1
Maximum		5	5	5	5

Statistics

		Main Contractor Business Practice a5 - Rely solely on sub	Main Contractor Business Practice a6 - Sub to bear all running expenses	Main Contractor Business Practice a7 - Bid Shopping
N	Valid	155	155	155
	Missing	2	2	2
Std. Deviation		1.28	1.31	1.21
Variance		1.63	1.70	1.47
Minimum		1	1	1
Maximum		5	5	5

Frequency Tables

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Main Contractor Business Practice a1 - No formal contract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	3	1.9	1.9	1.9
	Slightly Critical	9	5.7	5.8	7.8
	Critical	27	17.2	17.5	25.3
	Very Critical	37	23.6	24.0	49.4
	Extremely Critical	78	49.7	50.6	100.0
	Total	154	98.1	100.0	
Missing	System	3	1.9		
Total		157	100.0		

Main Contractor Business Practice a2 - Flow on tactic

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	2	1.3	1.3	1.3
	Slightly Critical	15	9.6	9.7	11.0
	Critical	29	18.5	18.7	29.7
	Very Critical	48	30.6	31.0	60.6
	Extremely Critical	61	38.9	39.4	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Main Contractor Business Practice a3 - Pay sub after paid by Client

		Frequency	Percent	Valid Percent	Cumulativ e Percent
Valid	Not Critical	6	3.8	3.9	3.9
	Slightly Critical	17	10.8	11.0	14.8
	Critical	35	22.3	22.6	37.4
	Very Critical	42	26.8	27.1	64.5
	Extremely Critical	55	35.0	35.5	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Main Contractor Business Practice a4 - Defer payment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	22	14.0	14.2	14.2
	Slightly Critical	16	10.2	10.3	24.5
	Critical	34	21.7	21.9	46.5
	Very Critical	26	16.6	16.8	63.2
	Extremely Critical	57	36.3	36.8	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Main Contractor Business Practice a5 - Rely solely on sub

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	15	9.6	9.7	9.7
	Slightly Critical	20	12.7	12.9	22.6
	Critical	37	23.6	23.9	46.5
	Very Critical	42	26.8	27.1	73.5
	Extremely Critical	41	26.1	26.5	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Main Contractor Business Practice a6 - Sub to bear all running expenses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	16	10.2	10.3	10.3
	Slightly Critical	27	17.2	17.4	27.7
	Critical	40	25.5	25.8	53.5
	Very Critical	33	21.0	21.3	74.8
	Extremely Critical	39	24.8	25.2	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Main Contractor Business Practice a7 - Bid Shopping

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Critical	6	3.8	3.9	3.9
	Slightly Critical	20	12.7	12.9	16.8
	Critical	30	19.1	19.4	36.1
	Very Critical	33	21.0	21.3	57.4
	Extremely Critical	66	42.0	42.6	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Your Business Practice b1 - Subcontract ude to lack of expertise	Your Business Practice b2- Subcontract due to Workload	Your Business Practice b3 - Reduce Risk of Over-expansion	Your Business Practice b4 - Minimise Overhead
N	Valid	156	156	156	156
	Missing	1	1	1	1
Std. Deviation		1.22	1.20	1.36	1.34
Variance		1.49	1.44	1.84	1.79
Minimum		1	1	1	1
Maximum		5	5	5	5

Statistics

		Your Business Practice b5 - Price Only	Your Business Practice b6 No Regular Partner	Your Business Practice b7 Subcontract Amount
N	Valid	156	156	152
	Missing	1	1	5
Std. Deviation		1.31	1.33	1.27
Variance		1.70	1.76	1.60
Minimum		1	1	1
Maximum		5	5	5

Frequency Tables

Your Business Practice b1 - Subcontract ude to lack of expertise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	14	8.9	9.0	9.0
	Slightly Relevant	16	10.2	10.3	19.2
	Relevant	48	30.6	30.8	50.0
	Very Relevant	40	25.5	25.6	75.6
	Extremely Relevant	38	24.2	24.4	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Your Business Practice b2- Subcontract due to Workload

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	42	26.8	26.9	26.9
	Slightly Relevant	32	20.4	20.5	47.4
	Relevant	52	33.1	33.3	80.8
	Very Relevant	20	12.7	12.8	93.6
	Extremely Relevant	10	6.4	6.4	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Your Business Practice b3 - Reduce Risk of Over-expansion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	39	24.8	25.0	25.0
	Slightly Relevant	23	14.6	14.7	39.7
	Relevant	45	28.7	28.8	68.6
	Very Relevant	28	17.8	17.9	86.5
	Extremely Relevant	21	13.4	13.5	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Your Business Practice b4 - Minimise Overhead

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	44	28.0	28.2	28.2
	Slightly Relevant	23	14.6	14.7	42.9
	Relevant	41	26.1	26.3	69.2
	Very Relevant	33	21.0	21.2	90.4
	Extremely Relevant	15	9.6	9.6	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Your Business Practice b5 - Price Only

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	31	19.7	19.9	19.9
	Slightly Relevant	40	25.5	25.6	45.5
	Relevant	42	26.8	26.9	72.4
	Very Relevant	21	13.4	13.5	85.9
	Extremely Relevant	22	14.0	14.1	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Your Business Practice b6 No Regular Partner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Relevant	30	19.1	19.2	19.2
	Slightly Relevant	34	21.7	21.8	41.0
	Relevant	48	30.6	30.8	71.8
	Very Relevant	18	11.5	11.5	83.3
	Extremely Relevant	26	16.6	16.7	100.0
	Total	156	99.4	100.0	
Missing	System	1	.6		
Total		157	100.0		

Your Business Practice b7 Subcontract Amount

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Subcontract under 20%	35	22.3	23.0	23.0
	Subcontract from 20 - 40%	32	20.4	21.1	44.1
	Subcontract from 41 - 60%	43	27.4	28.3	72.4
	Subcontract from 61 - 80%	28	17.8	18.4	90.8
	Subcontract over 80%	14	8.9	9.2	100.0
	Total	152	96.8	100.0	
Missing	System	5	3.2		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Frequencies

Statistics

		Quality Improvement Proposal c1 - Worker Registration	Quality Improvement Proposal c2 - Strengthen Workers Supervision	Quality Improvement Proposal c3 - Strengthen Supervision by Clients	Quality Improvement Proposal c4 - Disallow subcontract
N	Valid	154	153	154	155
	Missing	3	4	3	2
Std. Deviation		1.12	.99	1.04	1.38
Variance		1.25	.98	1.07	1.92
Minimum		1	1	1	1
Maximum		5	5	5	5

Statistics

		Quality Improvement Proposal c5 - Setup REgistry of Subcontractor	Quality Improvement Proposal c6 - Award Contracts on Quality not just price	Quality Improvement Proposal c7 - Subcontractor as Business Partner	Quality Improvement Proposal c8 - Standard subcontract document
N	Valid	153	154	155	155
	Missing	4	3	2	2
Std. Deviation		1.16	1.05	1.00	1.19
Variance		1.34	1.11	1.00	1.41
Minimum		1	1	1	1
Maximum		5	5	5	5

Frequency Tables

Quality Improvement Proposal c1 - Worker Registration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	6	3.8	3.9	3.9
	Slightly Effective	20	12.7	13.0	16.9
	Effective	48	30.6	31.2	48.1
	Very Effective	41	26.1	26.6	74.7
	Extremely Effective	39	24.8	25.3	100.0
	Total	154	98.1	100.0	
Missing	System	3	1.9		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Quality Improvement Proposal c2 - Strengthen Workers Supervision

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	1	.6	.7	.7
	Slightly Effective	12	7.6	7.8	8.5
	Effective	41	26.1	26.8	35.3
	Very Effective	46	29.3	30.1	65.4
	Extremely Effective	53	33.8	34.6	100.0
	Total	153	97.5	100.0	
Missing	System	4	2.5		
Total		157	100.0		

Quality Improvement Proposal c3 - Strengthen Supervision by Clients

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	3	1.9	1.9	1.9
	Slightly Effective	18	11.5	11.7	13.6
	Effective	50	31.8	32.5	46.1
	Very Effective	46	29.3	29.9	76.0
	Extremely Effective	37	23.6	24.0	100.0
	Total	154	98.1	100.0	
Missing	System	3	1.9		
Total		157	100.0		

Quality Improvement Proposal c4 - Disallow subcontract

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	57	36.3	36.8	36.8
	Slightly Effective	33	21.0	21.3	58.1
	Effective	27	17.2	17.4	75.5
	Very Effective	21	13.4	13.5	89.0
	Extremely Effective	17	10.8	11.0	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Quality Improvement Proposal c5 - Setup REgistry of Subcontractor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	6	3.8	3.9	3.9
	Slightly Effective	27	17.2	17.6	21.6
	Effective	56	35.7	36.6	58.2
	Very Effective	26	16.6	17.0	75.2
	Extremely Effective	38	24.2	24.8	100.0
	Total	153	97.5	100.0	
Missing	System	4	2.5		
Total		157	100.0		

Quality Improvement Proposal c6 - Award Contracts on Quality not just price

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	5	3.2	3.2	3.2
	Slightly Effective	8	5.1	5.2	8.4
	Effective	26	16.6	16.9	25.3
	Very Effective	48	30.6	31.2	56.5
	Extremely Effective	67	42.7	43.5	100.0
	Total	154	98.1	100.0	
Missing	System	3	1.9		
Total		157	100.0		

Quality Improvement Proposal c7 - Subcontractor as Business Partner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	4	2.5	2.6	2.6
	Slightly Effective	5	3.2	3.2	5.8
	Effective	35	22.3	22.6	28.4
	Very Effective	47	29.9	30.3	58.7
	Extremely Effective	64	40.8	41.3	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I1 – Supplementary Survey Statistical Results

Descriptive Statistics

Quality Improvement Proposal c8 - Standard subcontract document

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Effective	8	5.1	5.2	5.2
	Slightly Effective	17	10.8	11.0	16.1
	Effective	29	18.5	18.7	34.8
	Very Effective	46	29.3	29.7	64.5
	Extremely Effective	55	35.0	35.5	100.0
	Total	155	98.7	100.0	
Missing	System	2	1.3		
Total		157	100.0		

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Reliability for Main Contractor Business Practice (a1-a7) (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Deviation	Cases
1.	a1	4.1688	1.0214	154.0
2.	a2	3.9610	1.0534	154.0
3.	a3	3.7857	1.1545	154.0
4.	a4	3.5260	1.4335	154.0
5.	a5	3.4805	1.2794	154.0
6.	a6	3.3377	1.3097	154.0
7.	a7	3.8506	1.2142	154.0

No. of Cases = 154.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	26.1104	32.6086	5.7104	7

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	3.7301	3.3377	4.1688	.8312	1.2490	.0869
Item Variances	1.4810	1.0432	2.0549	1.0117	1.9698	.1267
Inter-item Covariances	.5296	.1606	.7932	.6326	4.9390	.0260
Inter-item Correlations	.3606	.1362	.5144	.3782	3.7770	.0089

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
a1	21.9416	27.3364	.3960	.2274	.7907
a2	22.1494	25.3828	.5762	.4316	.7623
a3	22.3247	25.1227	.5317	.4125	.7685
a4	22.5844	23.4863	.5087	.3044	.7753
a5	22.6299	24.3654	.5230	.3207	.7700
a6	22.7727	23.9153	.5447	.3484	.7659
a7	22.2597	23.8014	.6190	.4035	.7517

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

Reliability Coefficients   7 items

Alpha = .7958   Standardised item alpha = .7979

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Reliability for Your Business Practice (b1-b7) (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	b1	3.4868	1.2124	152.0
2.	b2	2.5395	1.1954	152.0
3.	b3	2.8158	1.3589	152.0
4.	b4	2.7303	1.3321	152.0
5.	b5	2.7961	1.2987	152.0
6.	b6	2.8816	1.3169	152.0
7.	b7	2.6974	1.2662	152.0

No. of Cases = 152.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	19.9474	31.1230	5.5788	7

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	2.8496	2.5395	3.4868	.9474	1.3731	.0908
Item Variances	1.6491	1.4289	1.8466	.4177	1.2924	.0243
Inter-item Covariances	.4662	.0037	1.1155	1.1119	304.8095	.0661
Inter-item Correlations	.2805	.0022	.6163	.6141	280.7696	.0214

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
b1	16.4605	26.2501	.2739	.0816	.7395
b2	17.4079	23.3822	.5460	.3432	.6809
b3	17.1316	21.4130	.6252	.4797	.6566
b4	17.2171	21.3896	.6459	.4955	.6519
b5	17.1513	23.4273	.4780	.2835	.6951
b6	17.0658	25.8897	.2611	.1038	.7453
b7	17.2500	25.4073	.3222	.1533	.7305

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

Reliability Coefficients   7 items

Alpha = .7339   Standardised item alpha = .7318

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Reliability for Quality Improvement Proposals (c1-c8) (before factor analysis)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	c1	3.5629	1.1170	151.0
2.	c2	3.9007	.9917	151.0
3.	c3	3.6093	1.0391	151.0
4.	c4	2.4040	1.3817	151.0
5.	c5	3.4040	1.1557	151.0
6.	c6	4.0795	1.0297	151.0
7.	c7	4.0397	1.0059	151.0
8.	c8	3.8344	1.1456	151.0

No. of Cases = 151.0

Statistics for	Mean	Variance	Std Dev	No. of Variables
Scale	28.8344	31.0857	5.5755	8

	Mean	Minimum	Maximum	Range	Max/Min	Variance
Item Means	3.6043	2.4040	4.0795	1.6755	1.6970	.2913
Item Variances	1.2425	.9834	1.9091	.9257	1.9413	.0911
Inter-item Covariances	.3776	.2137	.6891	.4753	3.2239	.0137
Inter-item Correlations	.3111	.1560	.5383	.3823	3.4510	.0092

Appendix I2a – Supplementary Survey Statistical Results

Reliability Test

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
c1	25.2715	23.8791	.5459	.3895	.7420
c2	24.9338	25.1423	.4988	.4065	.7511
c3	25.2252	24.4290	.5430	.3646	.7435
c4	26.4305	23.9001	.3906	.2285	.7746
c5	25.4305	23.6735	.5403	.3465	.7426
c6	24.7550	25.1996	.4668	.2888	.7556
c7	24.7947	25.6442	.4348	.2920	.7605
c8	25.0000	24.5867	.4565	.2691	.7573

R E L I A B I L I T Y   A N A L Y S I S - S C A L E (A L P H A)

Reliability Coefficients   8 items

Alpha = .7774   Standardised item alpha = .7832

Appendix I2b – Supplementary Survey Statistical Results

Reliability Test (after factor analysis)

Reliability for a1 to a7 is the same as that in Appendix I2a.

Reliability for Your Business Practice (after factor analysis, dropping b6 and b7)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	b1	3.4615	1.2202	156.0
2.	b2	2.5128	1.1994	156.0
3.	b3	2.8013	1.3556	156.0
4.	b4	2.6923	1.3374	156.0
5.	b5	2.7628	1.3056	156.0

N of Cases = 156.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	14.2308	20.7335	4.5534	5

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
b1	10.7692	16.4109	.2866	.0859	.7833
b2	11.7179	14.3328	.5464	.3408	.6989
b3	11.4295	12.9047	.6151	.4601	.6699
b4	11.5385	12.5727	.6719	.4893	.6472
b5	11.4679	14.2377	.4863	.2802	.7196

Reliability Coefficients   5 items

Alpha = .7521   Standardized item alpha = .7488

Appendix I2b – Supplementary Survey Statistical Results

Reliability Test (after factor analysis)

Reliability for Quality Improvement Proposals (after factor analysis, dropping c8)

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

		Mean	Std Dev	Cases
1.	c1	3.5629	1.1170	151.0
2.	c2	3.9007	.9917	151.0
3.	c3	3.6093	1.0391	151.0
4.	c4	2.4040	1.3817	151.0
5.	c5	3.4040	1.1557	151.0
6.	c6	4.0795	1.0297	151.0
7.	c7	4.0397	1.0059	151.0

R E L I A B I L I T Y   A N A L Y S I S - S C A L E   (A L P H A)

N of Cases = 151.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	25.0000	24.5867	4.9585	7

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
c1	21.4371	18.2877	.5287	.3683	.7157
c2	21.0993	19.2234	.5037	.4063	.7228
c3	21.3907	18.6396	.5425	.3607	.7141
c4	22.5960	18.0424	.3949	.2284	.7532
c5	21.5960	18.1091	.5227	.3217	.7168
c6	20.9205	19.2203	.4769	.2859	.7275
c7	20.9603	20.0384	.3927	.2224	.7439

Reliability Coefficients   7 items

Alpha = .7573   Standardized item alpha = .7639

Appendix I3 – Supplementary Survey Statistical Results

Factor Analysis

Descriptive Statistics

	Mean	Std. Deviation	Analysis N	Missing N
a1 - No formal contract	4.17	1.02	154	3
a2 - Flow on tactic	3.97	1.05	155	2
a3 - Pay sub after paid by Client	3.79	1.15	155	2
a4 - Defer payment	3.52	1.43	155	2
a5 - Rely solely on sub	3.48	1.28	155	2
a6 - Sub to bear all running expenses	3.34	1.31	155	2
a7 - Bid Shopping	3.86	1.21	155	2
b1 - Subcontract ude to lack of expertise	3.46	1.22	156	1
b2- Subcontract due to Workload	2.51	1.20	156	1
b3 - Reduce Risk of Over-expansion	2.80	1.36	156	1
b4 - Minimise Overhead	2.69	1.34	156	1
b5 - Price Only	2.76	1.31	156	1
b6 - No Regular Partner	2.85	1.33	156	1
c1 - Worker Registration	3.56	1.12	154	3
c2 - Strengthen Workers Supervision	3.90	.99	153	4
c3 - Strengthen Supervision by Clients	3.62	1.04	154	3
c4 - Disallow subcontract	2.41	1.38	155	2
c5 - Setup Registry of Subcontractor	3.41	1.16	153	4
c6 - Award Contracts on Quality not just price	4.06	1.05	154	3
c7 - Subcontractor as Business Partner	4.05	1.00	155	2
c8 - Standard subcontract document	3.79	1.19	155	2

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.733
Bartlett's Test of Sphericity	Approx. Chi-Square	951.411
	df	210
	Sig.	.000

Appendix I3 – Supplementary Survey Statistical Results

Factor Analysis

Communalities

	Initial	Extraction
a1 - No formal contract	1.000	.585
a2 - Flow on tactic	1.000	.640
a3 - Pay sub after paid by Client	1.000	.679
a4 - Defer payment	1.000	.612
a5 - Rely solely on sub	1.000	.552
a6 - Sub to bear all running expenses	1.000	.560
a7 - Bid Shopping	1.000	.591
b1 - Subcontract ude to lack of expertise	1.000	.699
b2- Subcontract due to Workload	1.000	.613
b3 - Reduce Risk of Over-expansion	1.000	.673
b4 - Minimise Overhead	1.000	.684
b5 - Price Only	1.000	.474
b6 No Regular Partner	1.000	.610
c1 - Worker Registration	1.000	.696
c2 - Strengthen Workers Supervision	1.000	.693
c3 - Strengthen Supervision by Clients	1.000	.571
c4 - Disallow subcontract	1.000	.698
c5 - Setup Registry of Subcontractor	1.000	.634
c6 - Award Contracts on Quality not just price	1.000	.550
c7 - Subcontractor as Business Partner	1.000	.595
c8 - Standard subcontract document	1.000	.474

Extraction Method: Principal Component Analysis.

Appendix I3 – Supplementary Survey Statistical Results

Factor Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.637	22.081	22.081	4.637	22.081	22.081	3.068	14.608	14.608
2	2.669	12.709	34.790	2.669	12.709	34.790	2.692	12.817	27.425
3	1.987	9.463	44.253	1.987	9.463	44.253	2.411	11.481	38.906
4	1.314	6.255	50.508	1.314	6.255	50.508	1.838	8.755	47.661
5	1.203	5.731	56.239	1.203	5.731	56.239	1.578	7.514	55.174
6	1.073	5.111	61.350	1.073	5.111	61.350	1.297	6.175	61.350
7	.868	4.134	65.484						
8	.855	4.074	69.557						
9	.809	3.850	73.408						
10	.758	3.609	77.017						
11	.688	3.276	80.292						
12	.580	2.760	83.052						
13	.534	2.541	85.594						
14	.496	2.360	87.953						
15	.482	2.294	90.247						
16	.456	2.174	92.421						
17	.427	2.032	94.453						
18	.381	1.812	96.265						
19	.309	1.470	97.735						
20	.257	1.223	98.957						
21	.219	1.043	100.000						

Extraction Method: Principal Component Analysis.

Factor Analysis

Component Matrix[a]

	Component					
	1	2	3	4	5	6
a1 - No formal contract						
a2 - Flow on tactic		-.524				
a3 - Pay sub after paid by Client						
a4 - Defer payment	.462					
a5 - Rely solely on sub	.591					
a6 - Sub to bear all running expenses	.525					
a7 - Bid Shopping	.570	-.453				
b1 - Subcontract ude to lack of expertise				.451		.502
b2- Subcontract due to Workload		.471				
b3 - Reduce Risk of Over-expansion		.614				
b4 - Minimise Overhead	.473	.566				
b5 - Price Only		.463				
b6 - No Regular Partner						
c1 - Worker Registration	.564		-.461			
c2 - Strengthen Workers Supervision	.488		-.460			
c3 - Strengthen Supervision by Clients	.543					
c4 - Disallow subcontract	.488			-.658		
c5 - Setup Registry of Subcontractor	.535					
c6 - Award Contracts on Quality not just price	.489					
c7 - Subcontractor as Business Partner	.565					
c8 - Standard subcontract document	.472					

Extraction Method: Principal Component Analysis.

a. 6 components extracted.

Appendix I3 – Supplementary Survey Statistical Results

Factor Analysis

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
a1 - No formal contract	.641					
a2 - Flow on tactic	.687					
a3 - Pay sub after paid by Client	.560					
a4 - Defer payment	.547			.546		
a5 - Rely solely on sub	.636					
a6 - Sub to bear all running expenses	.723					
a7 - Bid Shopping	.721					
b1 - Subcontract ude to lack of expertise						.775
b2- Subcontract due to Workload		.757				
b3 - Reduce Risk of Over-expansion		.812				
b4 - Minimise Overhead		.805				
b5 - Price Only		.649				
b6 - No Regular Partner						
c1 - Worker Registration			.790			
c2 - Strengthen Workers Supervision			.741			
c3 - Strengthen Supervision by Clients			.663			
c4 - Disallow subcontract					.770	
c5 - Setup Registry of Subcontractor					.466	
c6 - Award Contracts on Quality not just price				.632		
c7 - Subcontractor as Business Partner				.689		
c8 - Standard subcontract document						

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 11 iterations. Drop values below 0.45.

Appendix I4 – Supplementary Survey Statistical Results

Compare of Means

Tests of Normality

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
D4 - Latest Annual Turnover (1998/1999)	.287	135	.000
D5 - Number of full-time, directly employed staff	.232	135	.000
D6 - Number of full-time directly employed artisans	.206	135	.000
D7 - Approximate Area of Workshop	.263	135	.000
D8 - Approximate Value of fixed plants, tools etc.	.270	135	.000
Main Contractor Business Practice a1 - No formal contract	.286	135	.000
Main Contractor Business Practice a2 - Flow on tactic	.230	135	.000
Main Contractor Business Practice a3 - Pay sub after paid by Client	.207	135	.000
Main Contractor Business Practice a4 - Defer payment	.225	135	.000
Main Contractor Business Practice a5 - Rely solely on sub	.190	135	.000
Main Contractor Business Practice a6 - Sub to bear all running expenses	.165	135	.000
Main Contractor Business Practice a7 - Bid Shopping	.247	135	.000
Your Business Practice b1 - Subcontract ude to lack of expertise	.176	135	.000
Your Business Practice b2- Subcontract due to Workload	.179	135	.000
Your Business Practice b3 - Reduce Risk of Over-expansion	.171	135	.000
Your Business Practice b4 - Minimise Overhead	.169	135	.000
Your Business Practice b5 - Price Only	.176	135	.000
Your Business Practice b6 No Regular Partner	.172	135	.000
Your Business Practice b7 Subcontract Amount	.170	135	.000
Quality Improvement Proposal c1 - Worker Registration	.174	135	.000
Quality Improvement Proposal c2 - Strengthen Workers Supervision	.211	135	.000
Quality Improvement Proposal c3 - Strengthen Supervision by Clients	.190	135	.000
Quality Improvement Proposal c4 - Disallow subcontract	.200	135	.000
Quality Improvement Proposal c5 - Setup REgistry of Subcontractor	.232	135	.000
Quality Improvement Proposal c6 - Award Contracts on Quality not just price	.264	135	.000
Quality Improvement Proposal c7 - Subcontractor as Business Partner	.249	135	.000
Quality Improvement Proposal c8 - Standard subcontract document	.213	135	.000

a. Lilliefors Significance Correction

All the data fits normal distribution, which is necessary for using t-tests.

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
a1 - No formal contract	14.201	153	.000	1.17	1.01	1.33
a2 - Flow on tactic	11.439	154	.000	.97	.80	1.13
a3 - Pay sub after paid by Client	8.555	154	.000	.79	.61	.98
a4 - Defer payment	4.481	154	.000	.52	.29	.74
a5 - Rely solely on sub	4.659	154	.000	.48	.27	.68
a6 - Sub to bear all running expenses	3.199	154	.002	.34	.13	.54
a7 - Bid Shopping	8.801	154	.000	.86	.67	1.05

Note: The test for mean is a 1-sided test with significance level $\propto$ of 0.05, or $t > 1.66$. p-value indicated in this page is for a 2-sided test and should not be used.

Appendix I4 – Supplementary Survey Statistical Results

Compare of Means

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
b1 - Subcontract ude to lack of expertise	4.724	155	.000	.46	.27	.65
b2- Subcontract due to Workload	-5.073	155	.000	-.49	-.68	-.30
b3 - Reduce Risk of Over-expansion	-1.831	155	.069	-.20	-.41	1.57E-02
b4 - Minimise Overhead	-2.874	155	.005	-.31	-.52	-9.62E-02
b5 - Price Only	-2.269	155	.025	-.24	-.44	-3.07E-02
b6 No Regular Partner	-1.450	155	.149	-.15	-.36	5.58E-02
b7 Subcontract Amount	-2.947	151	.004	-.30	-.51	-9.97E-02

Note: The test for mean is a 1-sided test with significance level ∝ of 0.05, or t > 1.66. p-value indicated in this page is for a 2-sided test and should not be used.

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
c1 - Worker Registration	6.261	153	.000	.56	.39	.74
c2 - Strengthen Workers Supervision	11.248	152	.000	.90	.74	1.06
c3 - Strengthen Supervision by Clients	7.468	153	.000	.62	.46	.79
c4 - Disallow subcontract	-5.336	154	.000	-.59	-.81	-.37
c5 - Setup REgistry of Subcontractor	4.407	152	.000	.41	.23	.60
c6 - Award Contracts on Quality not just price	12.561	153	.000	1.06	.90	1.23
c7 - Subcontractor as Business Partner	12.983	154	.000	1.05	.89	1.20
c8 - Standard subcontract document	8.315	154	.000	.79	.61	.98

Note: The test for mean is a 1-sided test with significance level ∝ of 0.05, or t > 1.66. p-value indicated in this page is for a 2-sided test and should not be used.

Appendix I4 – Supplementary Survey Statistical Results

Compare of Means

t-Test for Factor A1 (variables a1, a2, a3, a4, a5, a6, a7)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
MAINCON	154	26.1104	5.7104	.4602

One-Sample Test

	Test Value = 21					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
MAINCON	11.106	153	.000	5.1104	4.2013	6.0195

t-Test for Factor B1 (variables b1, b2, b3, b4, b5)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
SUBCON	156	14.2308	4.5534	.3646

One-Sample Test

	Test Value = 15					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
SUBCON	-2.110	155	.036	-.7692	-1.4894	-4.91E-02

t-Test for Factor C1 (variables c1, c2, c3, c4, c5, c6, c7)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
IMPROVE	151	25.0000	4.9585	.4035

One-Sample Test

	Test Value = 21					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
IMPROVE	9.913	150	.000	4.0000	3.2027	4.7973

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Oneway

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
D4 - Latest Annual Turnover (1998/1999)	Between Groups	135.566	3	45.189	23.486	.000
	Within Groups	286.683	149	1.924		
	Total	422.248	152			
D5 - Number of full-time, directly employed staff	Between Groups	43.799	3	14.600	6.631	.000
	Within Groups	325.879	148	2.202		
	Total	369.678	151			
D6 - Number of full-time directly employed artisans	Between Groups	6.561	3	2.187	1.003	.393
	Within Groups	318.432	146	2.181		
	Total	324.993	149			
D7 - Approximate Area of Workshop	Between Groups	18.066	3	6.022	3.138	.027
	Within Groups	282.119	147	1.919		
	Total	300.185	150			
D8 - Approximate Value of fixed plants, tools etc.	Between Groups	44.472	3	14.824	5.794	.001
	Within Groups	368.420	144	2.558		
	Total	412.892	147			

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Post Hoc Test - Multiple Comparisons

Tamhane

Dependent Variable	(I) D2a Status	(J) D2a Status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
D4 - Latest Annual Turnover (1998/1999)	Not on any list	HA only	.23	.66	1.000	-3.42	3.87
		WB only	-1.85*	.29	.000	-2.62	-1.08
		HA and WB	-2.26*	.30	.000	-3.03	-1.48
	HA only	Not on any list	-.23	.66	1.000	-3.87	3.42
		WB only	-2.08	.65	.303	-5.77	1.61
		HA and WB	-2.48	.65	.188	-6.17	1.21
	WB only	Not on any list	1.85*	.29	.000	1.08	2.62
		HA only	2.08	.65	.303	-1.61	5.77
		HA and WB	-.40	.26	.563	-1.11	.30
	HA and WB	Not on any list	2.26*	.30	.000	1.48	3.03
		HA only	2.48	.65	.188	-1.21	6.17
		WB only	.40	.26	.563	-.30	1.11
D5 - Number of full-time, directly employed staff	Not on any list	HA only	-.12	.71	1.000	-3.76	3.52
		WB only	-.78*	.31	.046	-1.55	-.01
		HA and WB	-1.38*	.32	.000	-2.23	-.53
	HA only	Not on any list	.12	.71	1.000	-3.52	3.76
		WB only	-.66	.69	.976	-4.35	3.04
		HA and WB	-1.26	.69	.728	-4.89	2.37
	WB only	Not on any list	.78*	.31	.046	8.E-03	1.55
		HA only	.66	.69	.976	-3.04	4.35
		HA and WB	-.60	.28	.227	-1.38	.18
	HA and WB	Not on any list	1.38*	.32	.000	.53	2.23
		HA only	1.26	.69	.728	-2.37	4.89
		WB only	.60	.28	.227	-.18	1.38
D6 - Number of full-time directly employed artisans	Not on any list	HA only	-.25	.70	1.000	-3.59	3.09
		WB only	-.54	.31	.436	-1.40	.31
		HA and WB	-.32	.32	.899	-1.19	.54
	HA only	Not on any list	.25	.70	1.000	-3.09	3.59
		WB only	-.29	.69	1.000	-3.71	3.13
		HA and WB	-.07	.69	1.000	-3.48	3.34
	WB only	Not on any list	.54	.31	.436	-.31	1.40
		HA only	.29	.69	1.000	-3.13	3.71
		HA and WB	.22	.28	.967	-.53	.97
	HA and WB	Not on any list	.32	.32	.899	-.54	1.19
		HA only	7.E-02	.69	1.000	-3.34	3.48
		WB only	-.22	.28	.967	-.97	.53
D7 - Approximate Area of Workshop	Not on any list	HA only	.63	.66	.930	-1.90	3.16
		WB only	-.44	.29	.636	-1.27	.39
		HA and WB	-.76	.30	.076	-1.56	5.E-02
	HA only	Not on any list	-.63	.66	.930	-3.16	1.90
		WB only	-1.08	.65	.599	-3.68	1.53
		HA and WB	-1.39	.65	.370	-4.02	1.24
	WB only	Not on any list	.44	.29	.636	-.39	1.27
		HA only	1.08	.65	.599	-1.53	3.68
		HA and WB	-.31	.27	.792	-1.01	.38
	HA and WB	Not on any list	.76	.30	.076	-.05	1.56
		HA only	1.39	.65	.370	-1.24	4.02
		WB only	.31	.27	.792	-.38	1.01
D8 - Approximate Value of fixed plants, tools etc.	Not on any list	HA only	-.86	.76	.947	-4.91	3.19
		WB only	-1.05*	.34	.003	-1.84	-.26
		HA and WB	-1.44*	.35	.000	-2.25	-.62
	HA only	Not on any list	.86	.76	.947	-3.19	4.91
		WB only	-.19	.75	1.000	-4.17	3.80
		HA and WB	-.58	.75	.992	-4.55	3.38
	WB only	Not on any list	1.05*	.34	.003	.26	1.84
		HA only	.19	.75	1.000	-3.80	4.17
		HA and WB	-.39	.31	.806	-1.28	.50
	HA and WB	Not on any list	1.44*	.35	.000	.62	2.25
		HA only	.58	.75	.992	-3.38	4.55
		WB only	.39	.31	.806	-.50	1.28

*. The mean difference is significant at the .05 level.

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Oneway

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Main Contractor Business Practice a1 - No formal contract	Between Groups	7.632	3	2.544	2.511	.061
	Within Groups	151.978	150	1.013		
	Total	159.610	153			
Main Contractor Business Practice a2 - Flow on tactic	Between Groups	11.628	3	3.876	3.676	.014
	Within Groups	159.210	151	1.054		
	Total	170.839	154			
Main Contractor Business Practice a3 - Pay sub after paid by Client	Between Groups	24.838	3	8.279	6.924	.000
	Within Groups	180.556	151	1.196		
	Total	205.394	154			
Main Contractor Business Practice a4 - Defer payment	Between Groups	11.369	3	3.790	1.874	.136
	Within Groups	305.341	151	2.022		
	Total	316.710	154			
Main Contractor Business Practice a5 - Rely solely on sub	Between Groups	.537	3	.179	.108	.955
	Within Groups	250.134	151	1.657		
	Total	250.671	154			
Main Contractor Business Practice a6 - Sub to bear all running expenses	Between Groups	3.412	3	1.137	.663	.576
	Within Groups	259.143	151	1.716		
	Total	262.555	154			
Main Contractor Business Practice a7 - Bid Shopping	Between Groups	3.875	3	1.292	.875	.456
	Within Groups	223.003	151	1.477		
	Total	226.877	154			

Post Hoc Tests

Questionnaires a5-a7, b1-b7, c1-c8 are not significant and were not shown. Only a1-a4 were shown in Table in next page.

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Post-Hoc Tests Multiple Comparisons

Tamhane

Dependent Variable	(I) D2a Status	(J) D2a Status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
a1	Not on any list	HA only	1.05	.53	.799	-2.99	5.09
		WB only	-.29	.21	.668	-.85	.27
		HA and WB	-.11	.21	.997	-.70	.48
	HA only	Not on any list	-1.05	.53	.799	-5.09	2.99
		WB only	-1.34	.52	.632	-5.53	2.85
		HA and WB	-1.16	.52	.734	-5.29	2.96
	WB only	Not on any list	.29	.21	.668	-.27	.85
		HA only	1.34	.52	.632	-2.85	5.53
		HA and WB	.18	.19	.922	-.32	.67
	HA and WB	Not on any list	.11	.21	.997	-.48	.70
		HA only	1.16	.52	.734	-2.96	5.29
		WB only	-.18	.19	.922	-.67	.32
a2	Not on any list	HA only	-2.56E-02	.54	1.000	-2.04	1.99
		WB only	-.31	.21	.711	-.93	.32
		HA and WB	.34	.21	.651	-.31	.98
	HA only	Not on any list	2.56E-02	.54	1.000	-1.99	2.04
		WB only	-.28	.53	.992	-2.54	1.98
		HA and WB	.36	.53	.972	-1.84	2.56
	WB only	Not on any list	.31	.21	.711	-.32	.93
		HA only	.28	.53	.992	-1.98	2.54
		HA and WB	.64*	.19	.003	.16	1.13
	HA and WB	Not on any list	-.34	.21	.651	-.98	.31
		HA only	-.36	.53	.972	-2.56	1.84
		WB only	-.64*	.19	.003	-1.13	-.16
a3	Not on any list	HA only	-7.69E-02	.57	1.000	-4.10	3.95
		WB only	-.27	.23	.768	-.85	.31
		HA and WB	.65*	.23	.043	1.26E-02	1.29
	HA only	Not on any list	7.69E-02	.57	1.000	-3.95	4.10
		WB only	-.19	.57	1.000	-4.36	3.97
		HA and WB	.73	.57	.945	-3.34	4.79
	WB only	Not on any list	.27	.23	.768	-.31	.85
		HA only	.19	.57	1.000	-3.97	4.36
		HA and WB	.92*	.21	.000	.37	1.47
	HA and WB	Not on any list	-.65*	.23	.043	-1.29	-1.26E-02
		HA only	-.73	.57	.945	-4.79	3.34
		WB only	-.92*	.21	.000	-1.47	-.37
a4	Not on any list	HA only	-1.01	.75	.082	-2.13	.11
		WB only	.23	.30	.951	-.51	.97
		HA and WB	.47	.30	.467	-.29	1.23
	HA only	Not on any list	1.01	.75	.082	-.11	2.13
		WB only	1.24*	.74	.029	.13	2.36
		HA and WB	1.48*	.74	.010	.37	2.59
	WB only	Not on any list	-.23	.30	.951	-.97	.51
		HA only	-1.24*	.74	.029	-2.36	-.13
		HA and WB	.24	.27	.957	-.53	1.00
	HA and WB	Not on any list	-.47	.30	.467	-1.23	.29
		HA only	-1.48*	.74	.010	-2.59	-.37
		WB only	-.24	.27	.957	-1.00	.53

*. The mean difference is significant at the .05 level.

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

The following t-tests splits respondents into listed contractors (whether Housing Authority or Works Bureau or both) and non-listed.

t-Test

Group Statistics

	Listed (HA and Govt) or Not	N	Mean	Std. Deviation	Std. Error Mean
D4 - Latest Annual Turnover (1998/1999)	Not Listed	37	2.03	1.32	.22
	Listed	116	3.97	1.48	.14
D5 - Number of full-time, directly employed staff	Not Listed	37	1.68	1.33	.22
	Listed	115	2.70	1.56	.15
D6 - Number of full-time directly employed	Not Listed	37	2.35	1.51	.25
	Listed	113	2.78	1.46	.14
D7 - Approximate Area of Workshop	Not Listed	37	2.43	1.46	.24
	Listed	114	2.97	1.38	.13
D8 - Approximate Value of fixed plants, tools etc.	Not Listed	35	1.54	1.09	.18
	Listed	113	2.76	1.72	.16

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
D4	Equal variances assumed	1.890	.171	-7.130	151	.000	-1.95	.27	-2.49	-1.41
	Equal variances not assumed			-7.566	67.277	.000	-1.95	.26	-2.46	-1.43
D5	Equal variances assumed	8.250	.005	-3.615	150	.000	-1.03	.28	-1.59	-.47
	Equal variances not assumed			-3.911	70.137	.000	-1.03	.26	-1.55	-.50
D6	Equal variances assumed	.075	.784	-1.535	148	.127	-.43	.28	-.98	.12
	Equal variances not assumed			-1.505	59.384	.138	-.43	.28	-1.00	.14
D7	Equal variances assumed	.274	.601	-2.043	149	.043	-.54	.26	-1.06	-.02
	Equal variances not assumed			-1.982	58.209	.052	-.54	.27	-1.09	5.E-03
D8	Equal variances assumed	43.818	.000	-3.939	146	.000	-1.22	.31	-1.83	-.61
	Equal variances not assumed			-4.954	90.174	.000	-1.22	.25	-1.71	-.73

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

t-Test

Group Statistics

	Listed (HA and Govt) or Not	N	Mean	Std. Deviation	Std. Error Mean
Main Contractor Business Practice a1 - No formal contract	Not Listed	39	4.05	1.05	.17
	Listed	115	4.21	1.01	9.45E-02
Main Contractor Business Practice a2 - Flow on tactic	Not Listed	39	3.97	1.22	.20
	Listed	116	3.97	1.00	9.24E-02
Main Contractor Business Practice a3 - Pay sub after	Not Listed	39	3.92	1.09	.17
	Listed	116	3.75	1.18	.11
Main Contractor Business Practice a4 - Defer	Not Listed	39	3.74	1.21	.19
	Listed	116	3.44	1.50	.14
Main Contractor Business Practice a5 - Rely solely	Not Listed	39	3.51	1.30	.21
	Listed	116	3.47	1.27	.12
Main Contractor Business Practice a6 - Sub to bear	Not Listed	39	3.31	1.28	.21
	Listed	116	3.34	1.32	.12
Main Contractor Business Practice a7 - Bid	Not Listed	39	4.03	1.14	.18
	Listed	116	3.80	1.24	.12

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
a1	Equal variances assumed	.219	.640	-.831	152	.407	-.16	.19	-.53	.22
	Equal variances not assumed			-.816	63.662	.417	-.16	.19	-.54	.23
a2	Equal variances assumed	4.060	.046	.045	153	.964	8.84E-03	.20	-.38	.40
	Equal variances not assumed			.041	55.837	.968	8.84E-03	.22	-.43	.44
a3	Equal variances assumed	2.274	.134	.809	153	.420	.17	.21	-.25	.60
	Equal variances not assumed			.843	70.442	.402	.17	.21	-.24	.58
a4	Equal variances assumed	5.688	.018	1.146	153	.254	.30	.27	-.22	.83
	Equal variances not assumed			1.275	80.448	.206	.30	.24	-.17	.78
a5	Equal variances assumed	.000	1.000	.200	153	.842	4.73E-02	.24	-.42	.52
	Equal variances not assumed			.198	64.520	.844	4.73E-02	.24	-.43	.52
a6	Equal variances assumed	.175	.676	-.153	153	.878	-3.71E-02	.24	-.52	.44
	Equal variances not assumed			-.155	67.145	.877	-3.71E-02	.24	-.51	.44
a7	Equal variances assumed	2.026	.157	.997	153	.321	.22	.22	-.22	.67
	Equal variances not assumed			1.041	70.760	.301	.22	.22	-.21	.65

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

t-Test

Group Statistics

	Listed (HA and Govt) or Not	N	Mean	Std. Deviation	Std. Error Mean
Your Business Practice b1 - Subcontract ude to lack of expertise	Not Listed	39	3.72	1.12	.18
	Listed	117	3.38	1.24	.11
Your Business Practice b2- Subcontract due to Workload	Not Listed	39	2.64	1.20	.19
	Listed	117	2.47	1.20	.11
Your Business Practice b3 - Reduce Risk of	Not Listed	39	3.05	1.30	.21
	Listed	117	2.72	1.37	.13
Your Business Practice b4 - Minimise Overhead	Not Listed	39	3.03	1.44	.23
	Listed	117	2.58	1.29	.12
Your Business Practice b5 - Price Only	Not Listed	39	2.97	1.39	.22
	Listed	117	2.69	1.28	.12
Your Business Practice b6 No Regular Partner	Not Listed	39	3.03	1.27	.20
	Listed	117	2.79	1.34	.12
Your Business Practice b7 Subcontract Amount	Not Listed	37	2.76	1.23	.20
	Listed	115	2.68	1.28	.12

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
b1	Equal variances assumed	.793	.375	1.522	154	.130	.34	.22	-.10	.79
	Equal variances not assumed			1.602	71.531	.114	.34	.21	-.08	.77
b2	Equal variances assumed	.017	.896	.770	154	.443	.17	.22	-.27	.61
	Equal variances not assumed			.769	65.071	.445	.17	.22	-.27	.61
b3	Equal variances assumed	2.014	.158	1.333	154	.184	.33	.25	-.16	.83
	Equal variances not assumed			1.371	68.430	.175	.33	.24	-.15	.82
b4	Equal variances assumed	.422	.517	1.810	154	.072	.44	.25	-.04	.93
	Equal variances not assumed			1.711	59.536	.092	.44	.26	-.08	.96
b5	Equal variances assumed	.072	.789	1.170	154	.244	.28	.24	-.19	.76
	Equal variances not assumed			1.122	60.927	.266	.28	.25	-.22	.78
b6	Equal variances assumed	1.193	.276	.976	154	.330	.24	.25	-.24	.72
	Equal variances not assumed			1.006	68.719	.318	.24	.24	-.24	.71
b7	Equal variances assumed	.506	.478	.327	150	.744	7.85E-02	.24	-.40	.55
	Equal variances not assumed			.333	62.911	.740	7.85E-02	.24	-.39	.55

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

t-Test

Group Statistics

	Listed (HA and Govt) or Not	N	Mean	Std. Deviation	Std. Error Mean
Quality Improvement Proposal c1 - Worker Registration	Not Listed	38	3.79	1.17	.19
	Listed	116	3.49	1.10	.10
Quality Improvement Proposal c2 - Strengthen Workers Supervision	Not Listed	38	4.05	1.01	.16
	Listed	115	3.85	.98	9.18E-02
Quality Improvement Proposal c3 - Strengthen	Not Listed	38	3.71	1.23	.20
	Listed	116	3.59	.97	9.00E-02
Quality Improvement Proposal c4 - Disallow	Not Listed	38	3.00	1.45	.24
	Listed	117	2.21	1.31	.12
Quality Improvement Proposal c5 - Setup	Not Listed	38	3.55	1.13	.18
	Listed	115	3.37	1.16	.11
Quality Improvement Proposal c6 - Award	Not Listed	38	4.26	.89	.14
	Listed	116	4.00	1.10	.10
Quality Improvement Proposal c7 -	Not Listed	38	4.24	.88	.14
	Listed	117	3.98	1.03	9.56E-02
Quality Improvement Proposal c8 - Standard	Not Listed	38	4.00	1.12	.18
	Listed	117	3.73	1.21	.11

Appendix I5 – Supplementary Survey Statistical Results

Compare Mean between Different Categories of Contractors

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
c1	Equal variances assumed	.313	.577	1.429	152	.155	.30	.21	-.11	.71
	Equal variances not assumed			1.387	60.044	.171	.30	.21	-.13	.73
c2	Equal variances assumed	.813	.369	1.081	151	.282	.20	.19	-.17	.57
	Equal variances not assumed			1.066	61.796	.291	.20	.19	-.18	.58
c3	Equal variances assumed	5.410	.021	.596	152	.552	.12	.19	-.27	.50
	Equal variances not assumed			.529	52.915	.599	.12	.22	-.32	.55
c4	Equal variances assumed	.686	.409	3.126	153	.002	.79	.25	.29	1.28
	Equal variances not assumed			2.968	57.926	.004	.79	.26	.26	1.32
c5	Equal variances assumed	.008	.929	.866	151	.388	.19	.22	-.24	.62
	Equal variances not assumed			.879	64.852	.383	.19	.21	-.24	.61
c6	Equal variances assumed	.532	.467	1.342	152	.182	.26	.20	-.12	.65
	Equal variances not assumed			1.489	76.673	.141	.26	.18	-.09	.62
c7	Equal variances assumed	.054	.817	1.361	153	.176	.25	.19	-.11	.62
	Equal variances not assumed			1.474	72.655	.145	.25	.17	-.09	.60
c8	Equal variances assumed	1.739	.189	1.235	153	.219	.27	.22	-.16	.71
	Equal variances not assumed			1.287	67.455	.203	.27	.21	-.15	.70

Appendix I6 – Supplementary Survey Statistical Results

Regression

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95% Confidence Interval for B Lower Bound	95% Confidence Interval for B Upper Bound
1	(Constant)	1.884	.226		8.337	.000	1.438	2.331
	Your Business Practic b3 - Reduce Risk of Over-expansion	.289	.072	.310	3.993	.000	.146	.432
2	(Constant)	1.581	.267		5.916	.000	1.053	2.109
	Your Business Practic b3 - Reduce Risk of Over-expansion	.231	.077	.248	3.015	.003	.080	.383
	Your Business Practic b5 - Price Only	.166	.080	.171	2.070	.040	.008	.325

a. Dependent Variable: Your Business Practice b7 Subcontract Amount

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Your Business Practice b1 - Subcontract ude to lack of expertise	.068[a]	.859	.391	.070	.966
	Your Business Practice b2- Subcontract due to Workload	.183[a]	2.004	.047	.162	.710
	Your Business Practice b4 - Minimise Overhead	.126[a]	1.284	.201	.105	.620
	Your Business Practice b5 - Price Only	.171[a]	2.070	.040	.167	.869
		a				
2	Your Business Practice b1 - Subcontract ude to lack of expertise	.048[b]	.613	.541	.050	.951
	Your Business Practice b2- Subcontract due to Workload	.161[b]	1.763	.080	.143	.698
	Your Business Practice b4 - Minimise Overhead	.056[b]	.532	.596	.044	.527
		b				

a. Predictors in the Model: (Constant), Your Business Practice b3 - Reduce Risk of Over-expansion

b. Predictors in the Model: (Constant), Your Business Practice b3 - Reduce Risk of Over-expansion, Your Business Practice b5 - Price Only

c. Dependent Variable: Your Business Practice b7 Subcontract Amount

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

TEST 1

```
--> ORDERED;Lhs=D2A;Rhs=ONE,D4,D5,D6,D7,D8,A1,A2,A3,A4,A5,A6,A7,B1,B2,B3,B4,B5
    ,B6,B7,C1,C2,C3,C4,C5,C6,C7,C8;Marginal Effects;List$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .7515923567    , S.D.=    .4334721319    |
| Model size: Observations =     157, Parameters =  28, Deg.Fr.=    129 |
| Residuals:  Sum of squares= 379.1857192    , Std.Dev.=        1.71447 |
| Fit:        R-squared=*********, Adjusted R-squared =       -14.64372 |
| Diagnostic: Log-L =   -291.9931, Restricted(b=0) Log-L =     -91.0311 |
|             LogAmemiyaPrCrt.=    1.242, Akaike Info. Crt.=      4.076 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .7060365562     .25667818        2.751    .0059
 D4        .4390655228E-03 .10938102E-02     .401    .6881 -22.038217
 D5       -.2179048737E-04 .24513717E-02    -.009    .9929 -29.439490
 D6       -.1163485610E-03 .17989828E-02    -.065    .9484 -41.987261
 D7       -.1243837519E-03 .25736486E-02    -.048    .9615 -35.445860
 D8        .3164544048E-03 .10758619E-02     .294    .7687 -54.936306
 A1       -.1558103139E-01 .13535742        -.115    .9084 -15.000000
 A2        .4096512730E-01 .17755061         .231    .8175 -8.8089172
 A3       -.1139989552E-01 .16734313        -.068    .9457 -8.9808917
 A4       -.3996704382E-01 .13259466        -.301    .7631 -9.2547771
 A5        .3027823075E-01 .14204587         .213    .8312 -9.2929936
 A6        .2828244111E-01 .14779613         .191    .8482 -9.4331210
 A7       -.3288253513E-01 .15479328        -.212    .8318 -8.9171975
 B1       -.9831175100E-02 .12014951        -.082    .9348 -2.9235669
 B2        .4860339084E-02 .15858716         .031    .9756 -3.8662420
 B3        .6777406976E-02 .15104000         .045    .9642 -3.5796178
 B4       -.3009300856E-01 .16072306        -.187    .8515 -3.6878981
 B5        .1587207864E-01 .12918329         .123    .9022 -3.6178344
 B6        .1209691080E-01 .11632202         .104    .9172 -3.5350318
 B7        .3026649017E-03 .91125717E-03     .332    .7398 -29.203822
 C1       -.3121796678E-03 .17986867E-02    -.174    .8622 -15.592357
 C2        .1652205754E-04 .19472161E-02     .008    .9932 -21.649682
 C3        .2347047719E-01 .12810214         .183    .8546 -15.535032
 C4       -.6212998966E-01 .11805611        -.526    .5987 -10.350318
 C5       -.1707857828E-03 .27697608E-02    -.062    .9508 -22.127389
 C6       -.8278765609E-02 .14855214        -.056    .9556 -15.101911
 C7       -.8867057816E-04 .16835185        -.001    .9996 -8.7324841
 C8        .4762119853E-01 .13735875         .347    .7288 -8.9808917

Normal exit from iterations. Exit status=0.
                 +---------------------------------------------+
                 | Ordered Probit Model                        |
                 | Maximum Likelihood Estimates                |
                 | Dependent variable                 D2A      |
                 | Weighting variable                 ONE      |
                 | Number of observations             157      |
                 | Iterations completed                50      |
                 | Log likelihood function      -170.3742      |
                 | Restricted log likelihood    -186.9955      |
                 | Chi-squared                   33.24263      |
                 | Degrees of freedom                  27      |
                 | Significance level            .1891806      |
                 |    Cell frequencies for outcomes            |
                 |  Y Count Freq  Y Count Freq  Y Count Freq   |
                 |  0    39 .248  1     5 .031  2    57 .369   |
                 |  3    55 .350                               |
                 +---------------------------------------------+
```

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	1.502464752	.56885314	2.641	.0083	
D4	.8506621929E-03	.67225043E-03	1.265	.2057	-22.038217
D5	-.3344082239E-03	.21613349E-01	-.015	.9877	-29.439490
D6	-.5505576012E-01	.61424795E-01	-.896	.3701	-41.987261
D7	.5508002004E-01	.60927173E-01	.904	.3660	-35.445860
D8	.3512970208E-03	.61824801E-03	.568	.5699	-54.936306
A1	-.8712823309E-02	.10667046	-.082	.9349	-15.000000
A2	.9976627637E-02	.12439663	.080	.9361	-8.8089172
A3	-.2131540566	.12026827	-1.772	.0763	-8.9808917
A4	-.1084629253	.10414997	-1.041	.2977	-9.2547771
A5	.2291456914	.11505434	1.992	.0464	-9.2929936
A6	.6674300731E-01	.10244785	.651	.5147	-9.4331210
A7	.2496955591E-01	.11754189	.212	.8318	-8.9171975
B1	-.1122948266	.92484152E-01	-1.214	.2247	-2.9235669
B2	-.1350744402	.10820921	-1.248	.2119	-3.8662420
B3	.1050409997	.11073128	.949	.3428	-3.5796178
B4	-.2282825879	.10561321	-2.161	.0307	-3.6878981
B5	.8637712251E-01	.92045522E-01	.938	.3480	-3.6178344
B6	.8203472911E-02	.90723627E-01	.090	.9280	-3.5350318
B7	.1431340810E-02	.92585252E-03	1.546	.1221	-29.203822
C1	-.3198565632E-02	.50815624E-01	-.063	.9498	-15.592357
C2	.3753972654E-03	.10736914	.003	.9972	-21.649682
C3	-.4081962043E-01	.11586257	-.352	.7246	-15.535032
C4	-.1004179640	.10199848	-.985	.3249	-10.350318
C5	-.7585105873E-03	.96109468E-01	-.008	.9937	-22.127389
C6	.4954395674E-01	.11374340	.436	.6631	-15.101911
C7	.4821510157E-01	.11611623	.415	.6780	-8.7324841
C8	.4773124182E-01	.10497665	.455	.6493	-8.9808917
	Threshold parameters for index				
Mu(1)	.1066047386	.50717908E-01	2.102	.0356	
Mu(2)	1.206097340	.13742816	8.776	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	10	0	22	7	39
1	3	0	1	1	5
2	11	0	30	17	58
3	2	0	22	31	55
Total	26	0	75	56	157

Predicted Values (* => observation was not in estimating sample.)

Corrected predictions = 10+30+31 = 71 out of 157.
A5 and B4 is significant.

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

TEST 2

```
--> ORDERED;Lhs=D2A;Rhs=ONE,D4,D5,D6,D7,D8,A1,A2,A3,A4,A5,A6,A7,
    B1,B2,B3,B4,B5,B6,B7;Marginal Effects;List$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .7515923567    , S.D.=   .4334721319    |
| Model size: Observations =     157, Parameters =  20, Deg.Fr.=   137 |
| Residuals:  Sum of squares= 382.8461778    , Std.Dev.=       1.67168 |
| Fit:        R-squared=*********, Adjusted R-squared =       -13.87241 |
| Diagnostic: Log-L =   -292.7473, Restricted(b=0) Log-L =     -91.0311 |
|             LogAmemiyaPrCrt.=    1.148, Akaike Info. Crt.=     3.984 |
+-----------------------------------------------------------------------+
+---------+-------------+---------------+--------+---------+----------+
|Variable | Coefficient | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+-------------+---------------+--------+---------+----------+
 Constant  .7794326147     .17889599        4.357   .0000
 D4        .2712408180E-03 .97762056E-03    .277   .7814 -22.038217
 D5        .6220108373E-04 .22897068E-02    .027   .9783 -29.439490
 D6       -.1510557950E-03 .17513486E-02   -.086   .9313 -41.987261
 D7       -.1330968128E-03 .24966440E-02   -.053   .9575 -35.445860
 D8        .3717816237E-03 .10370320E-02    .359   .7200 -54.936306
 A1       -.5397206309E-03 .21151477E-02   -.255   .7986 -15.000000
 A2        .3496584926E-01 .16212888        .216   .8292 -8.8089172
 A3       -.2108062247E-01 .15921109       -.132   .8947 -8.9808917
 A4       -.2976779369E-01 .11978516       -.249   .8037 -9.2547771
 A5        .1710219714E-01 .12757625        .134   .8934 -9.2929936
 A6        .2744121513E-01 .13446013        .204   .8383 -9.4331210
 A7       -.2841731606E-01 .14933056       -.190   .8491 -8.9171975
 B1       -.2808057961E-02 .11244624       -.025   .9801 -2.9235669
 B2        .1280826990E-01 .14815291        .086   .9311 -3.8662420
 B3        .6575850476E-02 .14365637        .046   .9635 -3.5796178
 B4       -.2518839627E-01 .15054974       -.167   .8671 -3.6878981
 B5        .6741196979E-02 .12253952        .055   .9561 -3.6178344
 B6        .1466477866E-02 .10815130        .014   .9892 -3.5350318
 B7        .3306106430E-03 .87163081E-03    .379   .7045 -29.203822

Normal exit from iterations. Exit status=0.

           +---------------------------------------------+
           | Ordered Probit Model                        |
           | Maximum Likelihood Estimates                |
           | Dependent variable               D2A        |
           | Weighting variable               ONE        |
           | Number of observations           157        |
           | Iterations completed              35        |
           | Log likelihood function    -173.0486        |
           | Restricted log likelihood  -186.9955        |
           | Chi-squared                 27.89375        |
           | Degrees of freedom                19        |
           | Significance level         .8549485E-01     |
           |    Cell frequencies for outcomes            |
           |  Y Count Freq  Y Count Freq  Y Count Freq   |
           |  0    39 .248  1     5 .031  2    57 .369   |
           |  3    55 .350                               |
           +---------------------------------------------+
```

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	1.650848304	.57790690	2.857	.0043	
D4	.5958451340E-03	.60443712E-03	.986	.3242	-22.038217
D5	.5011061287E-04	.21921005E-01	.002	.9982	-29.439490
D6	-.6433464391E-01	.57529213E-01	-1.118	.2634	-41.987261
D7	.6417169750E-01	.56948631E-01	1.127	.2598	-35.445860
D8	.3993114840E-03	.63713045E-03	.627	.5308	-54.936306
A1	-.3580830731E-03	.49253784E-01	-.007	.9942	-15.000000
A2	.6108860828E-02	.11668857	.052	.9582	-8.8089172
A3	-.2139346276	.11618035	-1.841	.0656	-8.9808917
A4	-.7358691260E-01	.96979817E-01	-.759	.4480	-9.2547771
A5	.1873087556	.10046955	1.864	.0623	-9.2929936
A6	.6956875188E-01	.97807181E-01	.711	.4769	-9.4331210
A7	.2521542620E-01	.11232003	.224	.8224	-8.9171975
B1	-.9554557393E-01	.89113369E-01	-1.072	.2836	-2.9235669
B2	-.8489297026E-01	.10267025	-.827	.4083	-3.8662420
B3	.9452176883E-01	.11008423	.859	.3905	-3.5796178
B4	-.2415166546	.10421351	-2.318	.0205	-3.6878981
B5	.7006747567E-01	.87445398E-01	.801	.4230	-3.6178344
B6	-.1468926972E-01	.87726774E-01	-.167	.8670	-3.5350318
B7	.1495902151E-02	.80953489E-03	1.848	.0646	-29.203822
	Threshold parameters for index				
Mu(1)	.1045779476	.50443866E-01	2.073	.0382	
Mu(2)	1.183619140	.13015858	9.094	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	8	0	22	9	39
1	3	0	1	1	5
2	9	0	35	14	58
3	2	0	25	28	55
Total	22	0	83	52	157

Corrected predictions = 8+35+28 = 71 out of 157.

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

TEST 3

```
-->
ORDERED;Lhs=D2A;Rhs=ONE,D4,D5,D6,D7,D8,A1,A2,A3,A4,A5,A6,A7,C1,C2,C3,C4,C...
    Marginal Effects;List$
```

```
+----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                   |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .7515923567     , S.D.=   .4334721319   |
| Model size: Observations =      157, Parameters =  21, Deg.Fr.=   136 |
| Residuals:  Sum of squares= 382.8270552     , Std.Dev.=       1.67777 |
| Fit:        R-squared=*********, Adjusted R-squared =       -13.98102 |
| Diagnostic: Log-L =   -292.7433, Restricted(b=0) Log-L =     -91.0311 |
|             LogAmemiyaPrCrt.=     1.160, Akaike Info. Crt.=     3.997 |
+----------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.6868564827	.23334885	2.943	.0032	
D4	.4198843060E-03	.10668016E-02	.394	.6939	-22.038217
D5	-.2323789604E-04	.22982844E-02	-.010	.9919	-29.439490
D6	-.1434677736E-03	.17178157E-02	-.084	.9334	-41.987261
D7	-.1051990056E-03	.24262566E-02	-.043	.9654	-35.445860
D8	.3367768710E-03	.10026768E-02	.336	.7370	-54.936306
A1	-.1287600552E-01	.12967905	-.099	.9209	-15.000000
A2	.4007080060E-01	.16946147	.236	.8131	-8.8089172
A3	-.4293070094E-02	.15922283	-.027	.9785	-8.9808917
A4	-.4367951437E-01	.12571310	-.347	.7283	-9.2547771
A5	.2484820989E-01	.13324149	.186	.8521	-9.2929936
A6	.2829080026E-01	.13572737	.208	.8349	-9.4331210
A7	-.3270439843E-01	.14756668	-.222	.8246	-8.9171975
C1	-.3545540231E-03	.17218940E-02	-.206	.8369	-15.592357
C2	.1252655312E-03	.18352966E-02	.068	.9456	-21.649682
C3	.1585910805E-01	.12332368	.129	.8977	-15.535032
C4	-.6193536547E-01	.11132301	-.556	.5780	-10.350318
C5	-.1649017317E-03	.26715342E-02	-.062	.9508	-22.127389
C6	-.3567302664E-02	.14076706	-.025	.9798	-15.101911
C7	.1672297200E-02	.15832533	.011	.9916	-8.7324841
C8	.4845470025E-01	.13151578	.368	.7126	-8.9808917

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable                  D2A     |
| Weighting variable                  ONE     |
| Number of observations              157     |
| Iterations completed                 36     |
| Log likelihood function       -177.8306     |
| Restricted log likelihood     -186.9955     |
| Chi-squared                    18.32973     |
| Degrees of freedom                   20     |
| Significance level             .5656972     |
|    Cell frequencies for outcomes            |
|  Y Count Freq  Y Count Freq  Y Count Freq   |
|  0    39 .248  1     5 .031  2    57 .369   |
|  3    55 .350                               |
+---------------------------------------------+
```

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	.6003618749	.23673834	2.536	.0112	
D4	.5456178132E-03	.61813078E-03	.883	.3774	-22.038217
D5	.4258130072E-05	.22471744E-01	.000	.9998	-29.439490
D6	-.8547408594E-01	.59999293E-01	-1.425	.1543	-41.987261
D7	.8520621946E-01	.59045830E-01	1.443	.1490	-35.445860
D8	.3929344378E-03	.54737717E-03	.718	.4729	-54.936306
A1	.6350441623E-01	.97658355E-01	.650	.5155	-15.000000
A2	.2863354390E-01	.10788791	.265	.7907	-8.8089172
A3	-.2011692142	.11556223	-1.741	.0817	-8.9808917
A4	-.8788753672E-01	.99817070E-01	-.880	.3786	-9.2547771
A5	.1569993893	.10495233	1.496	.1347	-9.2929936
A6	.3329769451E-01	.97359639E-01	.342	.7323	-9.4331210
A7	.6655696520E-02	.10557319	.063	.9497	-8.9171975
C1	-.3215292711E-02	.57014580E-01	-.056	.9550	-15.592357
C2	.4650932192E-03	.11237702	.004	.9967	-21.649682
C3	-.8527509727E-01	.10886896	-.783	.4335	-15.535032
C4	-.7342284592E-01	.91878924E-01	-.799	.4242	-10.350318
C5	-.4406481121E-04	.92847061E-01	.000	.9996	-22.127389
C6	.2063945849E-01	.10379033	.199	.8424	-15.101911
C7	.7741873892E-01	.11232912	.689	.4907	-8.7324841
C8	.6374871845E-01	.95994764E-01	.664	.5066	-8.9808917
	Threshold parameters for index				
Mu(1)	.1020205559	.50014993E-01	2.040	.0414	
Mu(2)	1.138852407	.13224734	8.612	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	5	0	27	7	39
1	2	0	2	1	5
2	7	0	36	15	58
3	4	0	23	28	55
Total	18	0	88	51	157

Corrected predictions = 5+36+28 = 69 out of 157.

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

TEST 4

```
--> ORDERED;Lhs=D2A;Rhs=ONE,D4,D5,D6,D7,D8,B1,B2,B3,B4,B5,B6,B7,
    C1,C2,C3,C4,C5,C6,C7,C8;Marginal Effects;List$
```

```
+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Y=0/Not0 Mean=    .7515923567    , S.D.=    .4334721319    |
| Model size: Observations =     157, Parameters =  21, Deg.Fr.=    136 |
| Residuals:  Sum of squares= 381.8580871     , Std.Dev.=       1.67564 |
| Fit:        R-squared=*********, Adjusted R-squared =       -13.94310 |
| Diagnostic: Log-L =    -292.5444, Restricted(b=0) Log-L =    -91.0311 |
|             LogAmemiyaPrCrt.=     1.158, Akaike Info. Crt.=     3.994 |
+-----------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.7131591834	.22957461	3.106	.0019	
D4	.3744585300E-03	.97472547E-03	.384	.7009	-22.038217
D5	-.1303226589E-03	.22449331E-02	-.058	.9537	-29.439490
D6	-.1611370664E-03	.17285902E-02	-.093	.9257	-41.987261
D7	-.8451019568E-04	.24600117E-02	-.034	.9726	-35.445860
D8	.3497782959E-03	.10384889E-02	.337	.7363	-54.936306
B1	-.1639827482E-01	.11127202	-.147	.8828	-2.9235669
B2	.9517427567E-02	.14849906	.064	.9489	-3.8662420
B3	.6923625040E-02	.14361070	.048	.9615	-3.5796178
B4	-.3364902510E-01	.15348587	-.219	.8265	-3.6878981
B5	.1659083791E-01	.12494477	.133	.8944	-3.6178344
B6	.1659744655E-01	.10842936	.153	.8783	-3.5350318
B7	.2671656118E-03	.87542736E-03	.305	.7602	-29.203822
C1	-.2091556534E-03	.17211113E-02	-.122	.9033	-15.592357
C2	-.2343773067E-03	.17596969E-02	-.133	.8940	-21.649682
C3	.2796895438E-01	.11289587	.248	.8043	-15.535032
C4	-.5033695621E-01	.10066770	-.500	.6171	-10.350318
C5	-.3677435952E-03	.18394283E-02	-.200	.8415	-22.127389
C6	-.2791977870E-01	.11317569	-.247	.8051	-15.101911
C7	.1841106192E-01	.13449905	.137	.8911	-8.7324841
C8	.3290312386E-01	.12848373	.256	.7979	-8.9808917

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable                D2A       |
| Weighting variable                ONE       |
| Number of observations            157       |
| Iterations completed               53       |
| Log likelihood function     -176.0645       |
| Restricted log likelihood   -186.9955       |
| Chi-squared                  21.86199       |
| Degrees of freedom                 20       |
| Significance level           .3480461       |
|    Cell frequencies for outcomes            |
|  Y Count Freq  Y Count Freq  Y Count Freq   |
|  0    39 .248  1     5 .031  2    57 .369   |
|  3    55 .350                               |
+---------------------------------------------+
```

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	1.206824649	.47497843	2.541	.0111	
D4	.4225552517E-03	.54513061E-03	.775	.4383	-22.038217
D5	-.9465066259E-03	.23347726E-01	-.041	.9677	-29.439490
D6	-.4152022619E-01	.57498094E-01	-.722	.4702	-41.987261
D7	.4192509978E-01	.57418947E-01	.730	.4653	-35.445860
D8	.5507690926E-03	.56334535E-03	.978	.3282	-54.936306
B1	-.1404908452	.90042181E-01	-1.560	.1187	-2.9235669
B2	-.8118324985E-01	.10923297	-.743	.4574	-3.8662420
B3	.9839119480E-01	.11060842	.890	.3737	-3.5796178
B4	-.1988203238	.10553529	-1.884	.0596	-3.6878981
B5	.1107798678	.85461739E-01	1.296	.1949	-3.6178344
B6	.1852232527E-01	.83332084E-01	.222	.8241	-3.5350318
B7	.9812357923E-03	.64907512E-03	1.512	.1306	-29.203822
C1	-.2545218301E-02	.41922928E-01	-.061	.9516	-15.592357
C2	-.2763456369E-03	.89613231E-01	-.003	.9975	-21.649682
C3	.5036149710E-02	.10319902	.049	.9611	-15.535032
C4	-.8887958366E-01	.77344872E-01	-1.149	.2505	-10.350318
C5	.1887996270E-03	.10086989	.002	.9985	-22.127389
C6	-.5164954121E-02	.11088811	-.047	.9628	-15.101911
C7	.8823663924E-01	.10379949	.850	.3953	-8.7324841
C8	.3710489935E-02	.97720578E-01	.038	.9697	-8.9808917
	Threshold parameters for index				
Mu(1)	.1046306092	.47159093E-01	2.219	.0265	
Mu(2)	1.154158446	.12999794	8.878	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	7	0	23	9	39
1	2	0	2	1	5
2	7	0	34	17	58
3	6	0	18	31	55
Total	22	0	77	58	157

Corrected predictions = 7+34+31 = 72 out of 157.

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

TEST 5

```
--> ORDERED;Lhs=D2A;Rhs=ONE,A1,A2,A3,A4,A5,A6,A7,B1,B2,B3,B4,B5
    ,B6,B7,C1,C2,C3,C4,C5,C6,C7,C8;Marginal Effects;List$

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .7515923567    , S.D.=   .4334721319     |
| Model size: Observations =     157, Parameters =  23, Deg.Fr.=   134 |
| Residuals:  Sum of squares= 381.8447237    , Std.Dev.=        1.68807 |
| Fit:        R-squared=*********, Adjusted R-squared =        -14.16560 |
| Diagnostic: Log-L =   -292.5417, Restricted(b=0) Log-L =     -91.0311 |
|             LogAmemiyaPrCrt.=    1.184, Akaike Info. Crt.=      4.020 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .6992584288      .25017532        2.795   .0052
 A1       -.5904517710E-02  .12831144        -.046   .9633 -15.000000
 A2        .3638556315E-01  .17171196         .212   .8322 -8.8089172
 A3       -.1094591859E-01  .15998343        -.068   .9455 -8.9808917
 A4       -.2517816420E-01  .12691958        -.198   .8427 -9.2547771
 A5        .2899240355E-01  .13754432         .211   .8331 -9.2929936
 A6        .1712240355E-01  .14051801         .122   .9030 -9.4331210
 A7       -.4071658158E-01  .14998264        -.271   .7860 -8.9171975
 B1       -.1508113105E-01  .11398196        -.132   .8947 -2.9235669
 B2        .1840925395E-01  .14611600         .126   .8997 -3.8662420
 B3       -.5683812965E-03  .14527220        -.004   .9969 -3.5796178
 B4       -.3105824768E-01  .15473791        -.201   .8409 -3.6878981
 B5        .1292172778E-01  .12704863         .102   .9190 -3.6178344
 B6        .1502827173E-01  .11318976         .133   .8944 -3.5350318
 B7        .2822495458E-03  .89451932E-03     .316   .7524 -29.203822
 C1       -.2541060714E-03  .17662736E-02    -.144   .8856 -15.592357
 C2       -.1013820267E-03  .19029871E-02    -.053   .9575 -21.649682
 C3        .2022265888E-01  .12369904         .163   .8701 -15.535032
 C4       -.5584815688E-01  .11161073        -.500   .6168 -10.350318
 C5       -.1838490148E-03  .25168789E-02    -.073   .9418 -22.127389
 C6       -.1425071693E-01  .14260345        -.100   .9204 -15.101911
 C7        .1721730094E-01  .16033123         .107   .9145 -8.7324841
 C8        .3335092655E-01  .13087271         .255   .7989 -8.9808917

Normal exit from iterations. Exit status=0.

+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable                 D2A      |
| Weighting variable                 ONE      |
| Number of observations             157      |
| Iterations completed                39      |
| Log likelihood function      -172.1630      |
| Restricted log likelihood    -186.9955      |
| Chi-squared                   29.66500      |
| Degrees of freedom                  22      |
| Significance level            .1268366      |
|   Cell frequencies for outcomes             |
|  Y Count Freq  Y Count Freq  Y Count Freq   |
|  0    39 .248  1     5 .031  2    57 .369   |
|  3    55 .350                               |
+---------------------------------------------+
```

Appendix I7 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable D2A

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	1.472947475	.53889540	2.733	.0063	
A1	-.4590355114E-02	.99234692E-01	-.046	.9631	-15.000000
A2	.9109501669E-02	.11700377	.078	.9379	-8.8089172
A3	-.2114516224	.11410487	-1.853	.0639	-8.9808917
A4	-.7695926171E-01	.93096947E-01	-.827	.4084	-9.2547771
A5	.2357026749	.11106568	2.122	.0338	-9.2929936
A6	.4999589988E-01	.99106154E-01	.504	.6139	-9.4331210
A7	-.1251690900E-02	.11575325	-.011	.9914	-8.9171975
B1	-.1216388197	.87384119E-01	-1.392	.1639	-2.9235669
B2	-.1169184692	.10367192	-1.128	.2594	-3.8662420
B3	.9844216367E-01	.10830979	.909	.3634	-3.5796178
B4	-.2297445733	.10486869	-2.191	.0285	-3.6878981
B5	.7893712122E-01	.90409044E-01	.873	.3826	-3.6178344
B6	.2556858081E-01	.87759733E-01	.291	.7708	-3.5350318
B7	.1434856375E-02	.91060232E-03	1.576	.1151	-29.203822
C1	-.3300239161E-02	.56732768E-01	-.058	.9536	-15.592357
C2	.1793996861E-03	.96166657E-01	.002	.9985	-21.649682
C3	-.4134289301E-01	.10346009	-.400	.6894	-15.535032
C4	-.8968003250E-01	.85639657E-01	-1.047	.2950	-10.350318
C5	-.5970319657E-03	.94323720E-01	-.006	.9949	-22.127389
C6	.4645380022E-01	.11447540	.406	.6849	-15.101911
C7	.7396098332E-01	.10903471	.678	.4976	-8.7324841
C8	.1501417084E-01	.96916886E-01	.155	.8769	-8.9808917
	Threshold parameters for index				
Mu(1)	.1039695929	.49204088E-01	2.113	.0346	
Mu(2)	1.190472276	.13393764	8.888	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted				
Actual	0	1	2	3	Total
0	8	0	22	9	39
1	3	0	1	1	5
2	12	0	32	14	58
3	1	0	22	32	55
Total	24	0	77	56	157

Corrected predictions = 8+32+32 = 72 out of 157.

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

TEST 1

```
--> RESET
--> OPEN; output=C:\Logit\output.lst$
--> Read ; Nobs = 157 ; Nvar = 35 ; file = C:\Logit\chinese\data1.csv;
    names =Code,RANKING,WORKYEAR,YEAR1,D1,D2,D2A,D3,D4,D5,D6,D7,D8,
    A1,A2,A3,A4,A5,A6,A7,B1,B2,B3,B4,B5,B6,B7,C1,C2,C3,C4,C5,C6,C7,C8$
--> create; plan=0$
--> create; if(B7=1) plan=0$
--> create; if(B7=2) plan=1$
--> create; if(B7=3) plan=2$
--> create; if(B7=4) plan=3$
--> create; if(B7=5) plan=4$
--> ORDERED;Lhs=plan;Rhs=ONE,D4,D5,D6,D7,D8,B1,B2,B3,B4,B5,B6,
    A1,A2,A3,A4,A5,A6,A7;Marginal Effects;List$
```

```
+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary    least squares regression    Weighting variable = none     |
| Dep. var. = Y=0/Not0 Mean=   .7452229299    , S.D.=   .4371301895     |
| Model size: Observations =     157, Parameters =  19, Deg.Fr.=    138 |
| Residuals:  Sum of squares= 363.9558533    , Std.Dev.=        1.62400 |
| Fit:        R-squared=*********, Adjusted R-squared =       -12.80219 |
| Diagnostic: Log-L =   -288.7751, Restricted(b=0) Log-L =     -92.3505 |
|             LogAmemiyaPrCrt.=    1.084, Akaike Info. Crt.=      3.921 |
+-----------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.7955828335	.17180407	4.631	.0000	
D4	.2531425668E-03	.94940061E-03	.267	.7898	-22.038217
D5	.2157941247E-03	.22242408E-02	.097	.9227	-29.439490
D6	-.5289732743E-04	.16970286E-02	-.031	.9751	-41.987261
D7	-.2369541938E-03	.24228115E-02	-.098	.9221	-35.445860
D8	.1495305466E-03	.10074386E-02	.148	.8820	-54.936306
B1	-.1091588151E-02	.10903254	-.010	.9920	-2.9235669
B2	-.3515627877E-02	.14383855	-.024	.9805	-3.8662420
B3	.4670705002E-01	.13856229	.337	.7361	-3.5796178
B4	.3986361427E-01	.14564435	.274	.7843	-3.6878981
B5	.1751235099E-01	.11902132	.147	.8830	-3.6178344
B6	-.9855350723E-01	.10501209	-.938	.3480	-3.5350318
A1	-.5681801427E-03	.20546915E-02	-.277	.7821	-15.000000
A2	.2470475837E-02	.15748954	.016	.9875	-8.8089172
A3	-.7563439999E-02	.15336532	-.049	.9607	-8.9808917
A4	-.1368406906E-01	.11635992	-.118	.9064	-9.2547771
A5	.1592729832E-01	.12335087	.129	.8973	-9.2929936
A6	.4751433434E-01	.13004343	.365	.7148	-9.4331210
A7	-.4333726257E-01	.14498377	-.299	.7650	-8.9171975

Normal exit from iterations. Exit status=0.

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

```
+-------------------------------------------+
| Ordered Probit Model                      |
| Maximum Likelihood Estimates              |
| Dependent variable                 PLAN   |
| Weighting variable                 ONE    |
| Number of observations             157    |
| Iterations completed               39     |
| Log likelihood function      -219.7734    |
| Restricted log likelihood    -243.3917    |
| Chi-squared                   47.23670    |
| Degrees of freedom                 18     |
| Significance level        .1953368E-03    |
|    Cell frequencies for outcomes          |
|  Y Count Freq  Y Count Freq  Y Count Freq |
|  0    40 .254  1    32 .203  2    43 .273 |
|  3    27 .178  4    13 .089               |
+-------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	-.4910993932	.39760489	-1.235	.2168	
D4	.1685226260E-03	.95346646E-03	.177	.8597	-22.038217
D5	-.1013302433E-03	.37222798E-01	-.003	.9978	-29.439490
D6	-.9705132416E-03	.29913504E-01	-.032	.9741	-41.987261
D7	.5048086535E-03	.43629110E-01	.012	.9908	-35.445860
D8	.1184493023E-02	.87349470E-03	1.356	.1751	-54.936306
B1	.4198298685E-01	.81738139E-01	.514	.6075	-2.9235669
B2	.1255936421	.10088633	1.245	.2132	-3.8662420
B3	.1614830301	.86750018E-01	1.861	.0627	-3.5796178
B4	.6813450421E-01	.98228931E-01	.694	.4879	-3.6878981
B5	.1869255183	.89575491E-01	2.087	.0369	-3.6178344
B6	-.9177144997E-01	.79587076E-01	-1.153	.2489	-3.5350318
A1	-.6026884655E-03	.11412489	-.005	.9958	-15.000000
A2	-.9376601178E-01	.11955473	-.784	.4329	-8.8089172
A3	-.1369153494E-02	.10277151	-.013	.9894	-8.9808917
A4	.1913080316E-01	.85063474E-01	.225	.8221	-9.2547771
A5	-.2623382730E-01	.10713714	-.245	.8066	-9.2929936
A6	.3860701759E-01	.99866385E-01	.387	.6991	-9.4331210
A7	.6864834159E-01	.95656277E-01	.718	.4730	-8.9171975
	Threshold parameters for index				
Mu(1)	.6886343891	.11844581	5.814	.0000	
Mu(2)	1.527659639	.15590887	9.798	.0000	
Mu(3)	2.326800543	.20268662	11.480	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted					
Actual	0	1	2	3	4	Total
0	28	0	11	1	0	40
1	11	0	18	2	1	32
2	8	0	30	4	1	43
3	5	0	18	3	2	28
4	3	0	7	3	1	14
Total	55	0	84	13	5	157

Corrected predictions = 28+30+3+1 = 62 out of 157.

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

TEST 2

```
--> RESET
--> OPEN; output=C:\Logit\output.lst$
--> Read ; Nobs = 157 ; Nvar = 35 ; file = C:\Logit\chinese\data1.csv;
    names =Code,RANKING,WORKYEAR,YEAR1,D1,D2,D2A,D3,D4,D5,D6,D7,D8,
    A1,A2,A3,A4,A5,A6,A7,B1,B2,B3,B4,B5,B6,B7,C1,C2,C3,C4,C5,C6,C7,C8$
--> create; plan=0$
--> create; if(B7=1) plan=0$
--> create; if(B7=2) plan=1$
--> create; if(B7=3) plan=2$
--> create; if(B7=4) plan=3$
--> create; if(B7=5) plan=4$
--> ORDERED;Lhs=plan;Rhs=ONE,D4,D5,D6,D7,D8,A1,A2,A3,A4,A5,A6,A7,
    B1,B2,B3,B4,B5,B6,C1,C2,C3,C4,C5,C6,C7,C8;
    Marginal Effects;List$
```

```
+---------------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                        |
| Ordinary    least squares regression    Weighting variable = none          |
| Dep. var. = Y=0/Not0 Mean=    .7452229299    , S.D.=    .4371301895       |
| Model size: Observations =      157, Parameters =  27, Deg.Fr.=     130   |
| Residuals:  Sum of squares= 362.7850936    , Std.Dev.=         1.67053    |
| Fit:        R-squared=*********, Adjusted R-squared =        -13.60443    |
| Diagnostic: Log-L =    -288.5222, Restricted(b=0) Log-L =     -92.3505    |
|             LogAmemiyaPrCrt.=     1.185, Akaike Info. Crt.=      4.019    |
+---------------------------------------------------------------------------+
```

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
Constant	.7850271783	.24426534	3.214	.0013	
D4	.1889314322E-03	.10653830E-02	.177	.8592	-22.038217
D5	.3764017164E-03	.23884131E-02	.158	.8748	-29.439490
D6	-.4159619070E-04	.17494325E-02	-.024	.9810	-41.987261
D7	-.2250746710E-03	.25045066E-02	-.090	.9284	-35.445860
D8	.1491786709E-03	.10482023E-02	.142	.8868	-54.936306
A1	-.1055196676E-01	.13179618	-.080	.9362	-15.000000
A2	.4343504108E-02	.17297594	.025	.9800	-8.8089172
A3	-.1061766274E-01	.16165777	-.066	.9476	-8.9808917
A4	-.2098254836E-01	.12913535	-.162	.8709	-9.2547771
A5	.1665041086E-01	.13792071	.121	.9039	-9.2929936
A6	.5973853839E-01	.14335452	.417	.6769	-9.4331210
A7	-.3826311817E-01	.15071204	-.254	.7996	-8.9171975
B1	.2705162461E-02	.11681983	.023	.9815	-2.9235669
B2	-.1361410081E-01	.15449200	-.088	.9298	-3.8662420
B3	.5400033623E-01	.14598270	.370	.7115	-3.5796178
B4	.4354184426E-01	.15589614	.279	.7800	-3.6878981
B5	.1538627031E-01	.12585501	.122	.9027	-3.6178344
B6	-.1010609804	.11311199	-.893	.3716	-3.5350318
C1	-.5374091576E-03	.17525760E-02	-.307	.7591	-15.592357
C2	.8337992722E-04	.18972741E-02	.044	.9649	-21.649682
C3	-.1052375376E-01	.12347911	-.085	.9321	-15.535032
C4	-.4679018286E-02	.11459324	-.041	.9674	-10.350318
C5	.5922529201E-03	.26956677E-02	.220	.8261	-22.127389
C6	.1979404585E-01	.14411691	.137	.8908	-15.101911
C7	-.9114831721E-02	.16390230	-.056	.9557	-8.7324841
C8	.4129649092E-02	.13358504	.031	.9753	-8.9808917

Normal exit from iterations. Exit status=0.

```
+---------------------------------------------+
| Ordered Probit Model                        |
| Maximum Likelihood Estimates                |
| Dependent variable                 PLAN     |
| Weighting variable                  ONE     |
```

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

Number of observations	157
Iterations completed	53
Log likelihood function	-216.0127
Restricted log likelihood	-243.3917
Chi-squared	54.75814
Degrees of freedom	26
Significance level	.8139550E-03

Cell frequencies for outcomes

Y	Count	Freq	Y	Count	Freq	Y	Count	Freq
0	40	.254	1	32	.203	2	43	.273
3	27	.178	4	13	.089			

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	-.3736933962	.47034144	-.795	.4269	
D4	.1205453877E-03	.98252302E-03	.123	.9024	-22.038217
D5	-.6395424675E-03	.36581165E-01	-.017	.9861	-29.439490
D6	-.9968093938E-03	.36543367E-01	-.027	.9782	-41.987261
D7	.4980632173E-03	.47204812E-01	.011	.9916	-35.445860
D8	.1310820855E-02	.93068525E-03	1.408	.1590	-54.936306
A1	.2534002236E-01	.11758597	.216	.8294	-15.000000
A2	-.1085175194	.12475356	-.870	.3844	-8.8089172
A3	-.2237870903E-01	.11472141	-.195	.8453	-8.9808917
A4	.4187155206E-01	.88057128E-01	.476	.6344	-9.2547771
A5	-.2692947302E-01	.10444414	-.258	.7965	-9.2929936
A6	.1203478599E-01	.11066913	.109	.9134	-9.4331210
A7	.8132631747E-01	.10697324	.760	.4471	-8.9171975
B1	.7742778949E-02	.95518615E-01	.081	.9354	-2.9235669
B2	.9923591129E-01	.11393998	.871	.3838	-3.8662420
B3	.1811568395	.92495129E-01	1.959	.0502	-3.5796178
B4	.1100482871	.10584139	1.040	.2985	-3.6878981
B5	.1791998365	.91537814E-01	1.958	.0503	-3.6178344
B6	-.1090371319	.86382316E-01	-1.262	.2069	-3.5350318
C1	-.1510246606E-02	.45099353E-01	-.033	.9733	-15.592357
C2	-.2046776558E-03	.11731918	-.002	.9986	-21.649682
C3	-.1588446110E-02	.12282992	-.013	.9897	-15.535032
C4	.3495324060E-01	.87856092E-01	.398	.6907	-10.350318
C5	.2295493344E-02	.79663724E-01	.029	.9770	-22.127389
C6	-.2619303730E-01	.13051389	-.201	.8409	-15.101911
C7	.1604328437	.11938608	1.344	.1790	-8.7324841
C8	-.1672591273	.10424391	-1.604	.1086	-8.9808917
	Threshold parameters for index				
Mu(1)	.7000786683	.12198998	5.739	.0000	
Mu(2)	1.573286277	.15790453	9.964	.0000	
Mu(3)	2.406860768	.22275960	10.805	.0000	

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted					
Actual	0	1	2	3	4	Total
0	28	0	11	1	0	40
1	16	0	14	2	0	32
2	8	0	29	5	1	43
3	3	0	19	4	2	28
4	2	0	6	3	3	14
Total	57	0	79	15	6	157

Corrected predictions = 28+29+4+3 = 64 out of 157.

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

TEST 3

```
--> RESET
--> OPEN; output=C:\Logit\output.lst$
--> Read ; Nobs = 157 ; Nvar = 35 ; file = C:\Logit\chinese\data1.csv;
    names =Code,RANKING,WORKYEAR,YEAR1,D1,D2,D2A,D3,D4,D5,D6,D7,D8,
    A1,A2,A3,A4,A5,A6,A7,B1,B2,B3,B4,B5,B6,B7,C1,C2,C3,C4,C5,C6,C7,C8$
--> create; plan=0$
--> create; if(B7=1) plan=0$
--> create; if(B7=2) plan=1$
--> create; if(B7=3) plan=2$
--> create; if(B7=4) plan=3$
--> create; if(B7=5) plan=4$
--> ORDERED;Lhs=plan;Rhs=ONE,D4,D5,D6,D7,D8,B1,B2,B3,B4,B5,B6;Marginal
Effect...

+-----------------------------------------------------------------------+
| Dependent variable is binary, y=0 or y not equal 0                    |
| Ordinary     least squares regression    Weighting variable = none    |
| Dep. var. = Y=0/Not0 Mean=   .7452229299    , S.D.=    .4371301895    |
| Model size: Observations =      157, Parameters =  12, Deg.Fr.=   145 |
| Residuals:  Sum of squares= 367.7746419    , Std.Dev.=       1.59260 |
| Fit:        R-squared=*********, Adjusted R-squared =      -12.27371 |
| Diagnostic: Log-L =    -289.5945, Restricted(b=0) Log-L =   -92.3505 |
|             LogAmemiyaPrCrt.=    1.004, Akaike Info. Crt.=     3.842 |
+-----------------------------------------------------------------------+
+---------+--------------+----------------+--------+---------+----------+
|Variable | Coefficient  | Standard Error |b/St.Er.|P[|Z|>z] | Mean of X|
+---------+--------------+----------------+--------+---------+----------+
 Constant  .7595778873     .15395972          4.934   .0000
 D4        .1396237284E-03 .89499620E-03      .156   .8760 -22.038217
 D5        .5331592406E-03 .19987790E-02      .267   .7897 -29.439490
 D6       -.1133247572E-03 .16365458E-02     -.069   .9448 -41.987261
 D7       -.1909217388E-03 .23216436E-02     -.082   .9345 -35.445860
 D8        .2349935627E-04 .82714094E-03      .028   .9773 -54.936306
 B1        .8150169528E-02 .10178831          .080   .9362 -2.9235669
 B2        .1011345187E-02 .13353483          .008   .9940 -3.8662420
 B3        .3928614557E-01 .13078057          .300   .7639 -3.5796178
 B4        .2668335005E-01 .13539206          .197   .8438 -3.6878981
 B5        .2277559218E-01 .11294451          .202   .8402 -3.6178344
 B6       -.9712904803E-01 .97737499E-01     -.994   .3203 -3.5350318

Normal exit from iterations. Exit status=0.

              +---------------------------------------------+
              | Ordered Probit Model                        |
              | Maximum Likelihood Estimates                |
              | Dependent variable                PLAN      |
              | Weighting variable                 ONE      |
              | Number of observations             157      |
              | Iterations completed                24      |
              | Log likelihood function      -224.4857      |
              | Restricted log likelihood    -243.3917      |
              | Chi-squared                   37.81214      |
              | Degrees of freedom                  11      |
              | Significance level          .8415660E-04    |
              |    Cell frequencies for outcomes            |
              |  Y Count Freq  Y Count Freq  Y Count Freq   |
              |  0    40 .254  1    32 .203  2    43 .273   |
              |  3    27 .178  4    13 .089                 |
              +---------------------------------------------+
```

Appendix I8 – Supplementary Survey Statistical Results

Ordered Probit Analysis - Dependent Variable B7

Variable	Coefficient	Standard Error	b/St.Er.	P[|Z|>z]	Mean of X
	Index function for probability				
Constant	-.4845950957	.34306123	-1.413	.1578	
D4	.1507847422E-03	.93488393E-03	.161	.8719	-22.038217
D5	.2521990726E-04	.33336843E-01	.001	.9994	-29.439490
D6	-.1013059157E-02	.29062017E-01	-.035	.9722	-41.987261
D7	.6220347787E-03	.40421579E-01	.015	.9877	-35.445860
D8	.9986680879E-03	.88877539E-03	1.124	.2612	-54.936306
B1	.5234735604E-01	.72756556E-01	.719	.4718	-2.9235669
B2	.1278024653	.94743231E-01	1.349	.1774	-3.8662420
B3	.1301933701	.85582575E-01	1.521	.1282	-3.5796178
B4	.6567694461E-01	.94429480E-01	.696	.4867	-3.6878981
B5	.1731977361	.86091028E-01	2.012	.0442	-3.6178344
B6	-.8369469352E-01	.66867931E-01	-1.252	.2107	-3.5350318
	Threshold parameters for index				
Mu(1)	.6603936969	.10925519	6.045	.0000	
Mu(2)	1.477154241	.14357283	10.289	.0000	
Mu(3)	2.259679365	.18991171	11.899	.0000	

	Predicted					
Actual	0	1	2	3	4	Total
0	30	0	8	1	1	40
1	12	0	18	1	1	32
2	8	0	32	3	0	43
3	5	0	19	1	3	28
4	3	0	8	1	2	14
Total	58	0	85	7	7	157

Corrected predictions = 30+32+1+2 = 65 out of 157.