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**CRITICAL FACTORS AFFECTING
THE PROJECT ENVIRONMENTAL PERFORMANCE
AS PERCEIVED BY
LISTED CONSTRUCTION COMPANIES
IN HONG KONG**

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Department of Building and Real Estate

Critical Factors Affecting
the Project Environmental Performance
as Perceived by
Listed Construction Companies
in Hong Kong

PONG Kam Keung

A thesis submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy

October 2018

CERTIFICATE OF ORIGINALITY

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Signed _____
PONG Kam Keung, James Kenneth

ABSTRACT

Construction activity has major impact on the environment (Ofori, 2000). This research endeavors to find out, from the perspective of listed construction companies, the critical factors affecting their project environmental performance so that strategies and measures can be applied to improve the environment of Hong Kong.

The first step is to find out a model which encapsulates a list of elements that can influence the environmental performance of companies. The corporate governance approach emphasizes the importance of three elements, namely the board of directors, the corporate cultures and the environmental management system. The most commonly used system being the ISO 14000. The corporate governance approach focuses on the internal elements which are under the control of the company. The stakeholders' approach, as enunciated by Freeman (1984), reveals that various stakeholders such as the government and media would have an impact on the environmental performance of a company. By modifying Freeman's model to suit the energy industry in Sweden, Lindblom & Ohlsson (2011) have successfully established another stakeholders' model which lists out all the stakeholder elements that affect the environmental strategy of energy companies in Sweden.

By combining results of the literature reviews on the corporate governance approach and the stakeholders' approach, ten elements which affect the environmental performance of companies in general have been identified, they are : (a) 'board of directors'; (b) 'green corporate culture'; (c) 'environmental management system'; (d) 'customer'; (e) 'shareholders'; (f) 'government regulations'; (g) 'subcontractors and suppliers'; (h) 'competitors'; (i) 'media and green NGOs' and (j) 'trade union'.

These ten elements were brought up to five local leaders in construction industry to seek their opinions and comments. During the interviews, the industry leaders suggested to add two more elements, they were : (a) 'financial institutions and credit rating agencies' which includes banks and Moody's credit rating institute; and (b) 'building project team' which includes the project manager, architect, various types of engineer, surveyor and construction manager. Upon combining their views and the findings from literature review, a new '12-element model' applicable to the listed construction companies in Hong Kong was devised.

Questionnaires have been sent to directors and senior managers of listed construction

companies requesting to, based on their perceptions, grade the influence of the twelve elements on their project environmental performance. Eighty eight valid returns of questionnaires have been received. Statistical Exploratory Factor Analysis (“EFA”) was conducted and the results revealed that the twelve elements so identified could be grouped into four critical factors. In order of their priorities, they were : (i) the “Business Competitiveness” factor, (ii) the “Corporate Governance” factor, (iii) the “Government Requirements” factor and (iv) the “Collaborators” factor. In contrary to the research results of western countries that government regulatory control is of paramount importance (Fraj-Andres et al, 2009; Wong et al, 1996), the statistical analyses show that in Hong Kong it is only third on the list.

Since statistical results indicate that the ‘board of directors’ is the most important constituent within the “Corporate Governance” critical factor, this research also examines whether the attributes and compositions of the board can have any significant influence on the project environmental performance of the listed construction companies in Hong Kong. Eight attributes and compositions of the board have been identified, and hypotheses are set up for testing. The eight attributes and composition are : (a) the size of the board, (b) the number of female directors

inside the board, (c) the average age of board directors, (d) the chairman and CEO duality, (e) the possession of green qualification by board directors, (f) the percentage of independent non-executive directors within the board, (g) the existence of a green committee within the board, and (h) the remuneration of directors tie in with company's environmental performance.

Another set of questionnaires have been sent to board directors of listed construction companies requesting them to, based on their perceptions, grade the influence of the eight attributes of elements on their project environmental performance. One sample Z-test statistical analyses on thirty one valid returns of questionnaires revealed that six elements, namely : (i) 'average age of the board'; (ii) 'chairman and CEO duality'; (iii) 'green qualifications of the board directors'; (iv) 'setting up of green committees within the board', (v) 'number of INED in the board'; and (vi) 'remuneration of board directors tie in with the environmental performance of the company', they all had significant influence on the project environmental performance of listed construction companies in Hong Kong, while the other two elements, namely : (a) 'size of the board', and (b) 'number of female directors' did not. The latter part of the results is in contrary to the research results obtained from western countries.

KEY WORDS

Listed construction companies; project environmental performance; competitiveness, corporate governance; board of directors; government regulations; 12-element Model

GLOSSARY

Project Environmental Performance

Measurable results of the environmental management system, related to an organization's control of the environmental aspects of their construction projects, based on its environmental policy, objectives, and targets. (U.S. Department of Energy)

Listed Company

Company whose shares are traded on a recognized stock exchange (OECD)

Construction Company

A type of business, company, enterprise or similar organization created and operating to construct a wide variety of buildings, developments, housing, path, pavement, roads, motorway and other type of construction projects.

Perceived

Interpret or regard (someone or something) in a particular way (Oxford English Dictionary)

Board of Directors

A group of people elected by shareholders to oversee the management of a corporation (US Securities and Exchange Commission)

Executive Directors

An executive director is a member of the board of directors of a firm who also has management responsibilities. (www.nedonboard.com)

Non-Executive Directors

A board member without responsibilities for daily management or operations of the company/organisation. (www.nedonboard.com)

Independent Non-Executive Directors

A board member without responsibilities for daily management or operations of the company/organisation and is independent from the company/organization's shareholders (www.nedonboard.com)

Stakeholders

A person or organization with an interest or concern in something, especially a business. (Oxford English Dictionary)

Audit Committee

One of the major operating committees of a company's board of directors in charge of overseeing financial reporting and disclosure. (www.investopedia.com)

Green Committee

One of the operating committee of a company's board of directors in charge of overseeing environmental performance of the company.

Green Bond

A green bond is a bond specifically earmarked to be used for climate and environmental projects. These bonds are typically asset-linked and backed by the issuer's balance sheet, and are also referred to as climate bonds. (www.investopedia.com)

Corporate Governance

The mechanisms, processes and relations by which corporations are controlled and directed. It identifies the distribution of rights and responsibilities among different participants in the corporation (such as the board of directors, managers, shareholders, creditors, auditors, regulators, and other stakeholders) and includes the rules and procedures for making decisions in corporate affairs.

Corporate Culture

The beliefs and behaviors that determine how a company's employees and management interact and handle outside business transactions. (www.investopedia.com)

Environmental Management System

A system and database which integrates procedures and processes for training of personnel, monitoring, summarizing, and reporting of specialized environmental performance information to internal and external stakeholders of a firm. (Sroufe & Robert 2003)

Non-government Organization (NGO)

Organizations which are independent of governments and are active in humanitarian, educational, health care, public policy, social, human rights, environmental, and other areas to affect changes according to their objectives. (Claiborne, 2004)

Financial Institutions and Credit Rating Agencies

An institution that assigns credit ratings, which rate a debtor's ability to pay back debt by making timely principal and interest payments and the likelihood of default. (Alessi & Christopher, 2012)

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CHAPTER 1

Introduction

- 1.1 Research Background
- 1.2 Problem Statement
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- 1.4 Aim and Objectives
- 1.5 Research Methodologies
- 1.6 Research Framework
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Chapter Summary

Chapter 1 : Introduction

1.1 Research Background

Construction activity has major impact on the environment (Ofori, 2000). In spite of the enactment of 10 pieces of environmental legislation¹ by the Environmental Protection Department, pollution complaints arising from construction sites remain high in Hong Kong. There is a need to improve the project environmental performance of construction companies.

Environmental concern has been one of the major issues of the Policy Address of the Chief Executive of the Hong Kong Special Administrative Region for a number of years. Even back in 1999, the Policy Address titled “Quality People, Quality Home, Positioning Hong Kong for the 21st Century” has already put a lot of emphases on the way to minimize or combat air pollution, water pollution and the problem of solid waste.

In Hong Kong, quite a lot of the air, noise, waste, water and other pollutions are

¹ (1) Air Pollution Control Ordinance Cap. 311; (2) Noise Pollution Control Ordinance Cap 400; (3) Water Pollution Control Ordinance Cap 358; (4) Waste Disposal Ordinance Cap. 354; (5) Environmental Impact Assessment Ordinance Cap. 499; (6) Dumping at Sea Ordinance Cap. 466; (7) Ozone Layer Protection Ordinance Cap. 403; (8) Hazardous Chemical Control Ordinance Cap. 595; (9) Product Eco-responsibility Ordinance Cap. 603; (10) Motor Vehicle Idling (Fixed Penalty) Ordinance Cap. 611

emanated from construction sites. These construction project pollutions often present themselves as a kind of public nuisance to the residents living in the vicinity of the pollution source. Public nuisance is a crime (Winfield & Jolowicz, 1994)².

These construction project environmental nuisances have culminated into a lot of environmental complaints (Figure 1.1). Statistics from the Environmental Protection Department for 2006 – 2017 shows there were on average about 22% of all the environmental complaints³ (Appendix G) originated from construction and renovation works, which is the worst amongst all sources of pollution in Hong Kong.

Efforts and attempts have been made to curb construction project pollutions through extensive environmental legislation and enforcement. To control those nuisances caused by construction companies, legislations have been amended or enacted since 1980 by the Government to deal with such pollutions. They include⁴ :-

- ✧ the Noise Pollution Control Ordinance Cap. 400

- ✧ the Air Pollution Control Ordinance Cap. 311

² "... A public nuisance is a crime, while a private nuisance is only a tort. A public or common nuisance is one which materially affects the reasonable comfort and convenience of life of a class of Her Majesty's subjects who come within the sphere or neighbourhood of its operation" (W. V. H. Rogers (1994), Winfield & Jolowicz on Tort, 14th Edn., Sweet and Maxwell at p. 402)

³ The complaints include those made to the Environmental Protection Department as well as the Police under the Summary Offences Ordinance.

⁴ Other pieces of legislation are : The Dumping at Sea Ordinance Cap. 466, The Hazardous Chemical Control Ordinance Cap. 595, The Ozone Layer Protection Ordinance Cap. 403, The Product Eco-Responsibility Ordinance Cap 603, and the Motor Vehicle Idling (Fixed Penalty) Ordinance Cap. 611.

- ✧ the Water Pollution Control Ordinance Cap. 358
- ✧ the Waste Disposal Ordinance Cap. 354 and
- ✧ the Environmental Impact Assessment Ordinance Cap. 499

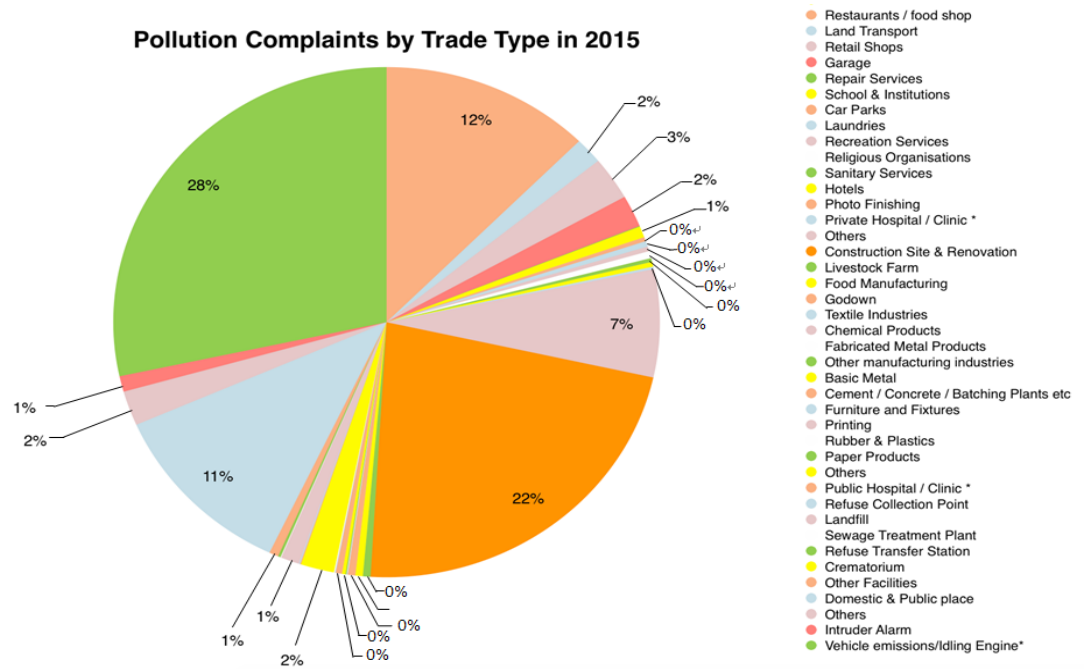


Figure 1.1 Environmental pollution complaints by trade type in 2015 published by Environmental Protection Department of Hong Kong⁵.

However, the number of complains and prosecutions arising out of construction pollution remains high. This is in contrary to the research results from western countries which accord the regulatory regime a very critical and effective factor to curb pollution.

⁵ https://www.epd.gov.hk/epd/english/laws_regulations/enforcement/pollution_complaints_statistics_2015.html

Listed companies are the engines for achieving business sustainability in an economy (Hong Kong Sustainability Index⁶). Rather than examining all construction companies, this research focuses on listed construction companies, which are invariably large construction companies. Under the Hong Kong Stock Exchange listing rule, a company can be listed at the main board if its market capitalization is at least HK\$500,000,000 and there is a minimum profit of HK\$50,000,000 for a rolling period of three years before the listing (Appendix A). Improving the project environmental performance of Hong Kong listed construction companies will logically enhance the environment of Hong Kong.

Benefits of environmental actions are quite often intangibles which cannot be easily quantified. Perceptions of the construction companies are used in this research because there is no objective environmental performance index for construction industry in Hong Kong which can gauge the benefits of environmental actions of construction companies based on agreed criteria (Para. 1.1.1 – 1.1.4 below). Besides, the objective assessments of environmental actions by parties who are not the construction companies themselves may not reflect the accurate picture of how the

⁶ <http://www.polyu.edu.hk/mm/sme>

construction companies perceive on how a stakeholder⁷ can affect their environmental performance. Further, during the interviews in completing the questionnaires, there will be interactions of ideas through which senior managers and directors of construction companies can give their personal opinions and experience, information and data on why they perceive the issues in a particular direction. The explanation and data provided will definitely enrich their answers. In this way, the use of perceptions is better than random questionnaire surveys from parties outside the construction industry.

1.1.1 Sustainability Index in Hong Kong not relevant to the construction sector

In 2015, the Sustainability Management Research Centre (“SMRC”) of the Hong Kong Polytechnic University announced and launched the first Hong Kong Business Sustainability Index (“HKBSI”). The companies under assessment are those of the Hang Seng Index Constituents (Appendix B), as well as the Hong Kong SME Business Sustainability Index (Appendix C), the companies under assessment are those most progressive in their corporate social responsibility (“CSR”) practices.

⁷ For example the media and green NGOs

By assessing the performance of each company in the “Value-Process-Impact (“VPI”) Assessment Model”, which consists of three major areas, namely Corporate Social Responsibility (CSR) value, CSR process (comprising CSR management and practices) and CSR impact, as well as the company's contributions to economic, social and environmental sustainability, SMRC compiles the results into relevant indices (Appendix D).

The assessment results shown in the Sustainability Index capture the development and performance of CSR of listed companies in the previous year. It reflects the trends and achievements of these listed companies in CSR practices and serves as a benchmark of business sustainability for the Hang Seng Index constituent companies and SME sector respectively.

However, up to 2017, out of 54 representative companies in the Hong Kong Business Sustainability Index 2017 (as listed in Appendix B) or out of 34 representative companies in the Hong Kong SME Business Sustainability Index 2017 (as listed in Appendix C), none of them is a construction company. Further, the HKBSI measures the combined social, economic and environmental sustainability which is more akin to a CSR index. It cannot be regarded as an environmental performance index for a

company.

1.1.2 Environmental performance indicator in United States

In the US, researchers adopt the proprietary KLD index (Kinder, Lydenberg, Domini Research & Analytics ratings) to measure the environmental performance of companies, in particular agricultural companies, chemical companies and energy companies in the US. KLD employs a proprietary system to evaluate corporations' environmental, social, and governance performance and to generate annual company ratings (Chatterji, et al., 2008). It uses a total of 14 environmental strength and concern variables for evaluating the environmental performance of companies (Appendix E).

1.1.3 KLD Index not applicable to Hong Kong

Hong Kong does not have a generally accepted environmental index for the construction industry. The KLD index, which is US-based and applying to all industries, may not directly address the environmental concerns in construction industry, nor the unique features of Hong Kong. Construction industry in Hong Kong involves a lot of sub-contracting, sometimes even on the back-to-back basis. Further, foreign research results may not be applicable to the Hong Kong construction

industry scenario as the ethnic majority of Hong Kong is Chinese, her culture is bound to be more eastern-tainted than those of the US companies (Schultz, 2002). Even though Northern Europe seems more akin to the US in upholding environmental protection, research shows that Nordic managers strive to strengthen the competitive edge of their firms through accomplishments in the environment, much more so than their US counterparts (Lindell and Karagozoglu, 2001). Further, in contrary to US managers, Nordic managers feel that environmental investments can improve their financial performance and increase their market shares.

The legal system of Hong Kong in relation to environmental control is also different from that of the US. For instance, in the US environmental culprits can negotiate with the prosecutor to settle the environmental breaches for a fine (as if it is a civil litigation) without going through any prosecution, while in Hong Kong the purviews of criminal and civil law are separate and distinct. The criminal law sanction under various environmental legislations in Hong Kong is always on the low side⁸ (Appendix F). In fact, for the past 10 years, no environmental culprit in Hong Kong has been sentenced to imprisonment, and none of the fines imposed was higher than

⁸ Environmental Prosecution Statistics
https://www.epd.gov.hk/epd/english/laws_regulations/enforcement/resource_enfor2.html

HK\$200,000⁹, which is a peanut to hundred millions, if not billions, construction contract sum. Instead of imposing custodial sentence, the environmental legislation in Hong Kong concentrates on the abatement of the environmental nuisances which are typical environmental problems in very congested living space like Hong Kong. There is no imprisonment provision throughout the whole piece of Noise Control Ordinance Cap. 400. In the Environmental Law Conference held by the Department of Justice of the HKSAR Government on 27 April 2012, in the presence of the Director of Public Prosecutions Mr. Kevin Zervos, it was presented that most of the environmental complaints were due to nuisances. Quite a lot of prosecutions are the subsequence of such nuisance complaints. Indeed, the Air Pollution Control Ordinance Cap. 311 defines air pollution to encompass the emission of air pollutant which causes a nuisance.¹⁰

Due to the above differences, KLD index cannot be directly applicable to Hong Kong. It can only be used as a reference based on which Hong Kong should develop her own environmental performance index.

⁹ Information obtained from the Central Prosecution Unit of EPD in April 2019

¹⁰ s.2 of the Air Pollution Control Ordinance define "air pollution" means an emission of air pollutant which either alone or with another emission of air pollutant :- (a) is prejudicial to health; (b) is a nuisance; (c) imperils or is likely to imperil the safety of or otherwise interferes with the normal operation of aircraft; or (d) is determine to be air pollution under a technical memorandum.

1.1.4 The environmental, social and governance reports (ESG reports)

Recently, the Hong Kong Stock Exchange has made the first stride towards establishing a common ground for measuring environmental performance by making it mandatory for all listed companies to publish their environmental social and governance reports (ESG reports) in their annual reports. However, the environmental performance information required to be provided by the listed companies are either qualitative, or are unspecific or not wide enough to formulate an environmental index as a barometer for measuring the environmental performance of all the listed companies in Hong Kong. The ESG reports by and large are qualitative, and the emphasis can be skewed towards those areas in accordance with the wish of the companies to report.

1.2 Problem Statement

This study attempts to answer the following questions so as to fully understand the critical factors which can affect the project environmental performance of listed construction companies in Hong Kong :-

Question 1 : What are the elements of corporate governance which can affect the

project environmental performance of listed construction companies in Hong Kong ?

Background : Various researchers have found that corporate governance of a company does have effects on her environmental performance (Kock, et al., 2011; Wall, et al., 2011).

Question 2 : What are the stakeholders which can affect the site environmental performance of listed construction companies in Hong Kong ?

Background : The stakeholders identified by Lindblom and Ohlsson (2011) can affect the environmental strategies adopted by Swedish energy companies.

Question 3 : What are the critical factors that affects the project environmental performance of listed construction companies in Hong Kong, and what are their order of priorities ?

Background : From literature review, there are quite a number of elements from corporate governance approach and stakeholder approach that can affect the project environmental performance of listed construction companies in Hong Kong. This research will endeavor to find out any correlation of these elements, and by grouping the correlated elements together we can have a better understanding of the underlying critical factor that affects the project environmental performance of listed construction

companies in Hong Kong.

Question 4 : Why construction companies in Hong Kong are not harnessed by environmental legislations in Hong Kong ?

Background : In spite of the enactment of 10 pieces of environmental legislation¹¹ by the Environmental Protection Department, pollution complaints arising from construction sites remain high in Hong Kong (Para. 1.1).

Question 5 : Do the composition and attributes of the board of directors affect the project environmental performance of listed construction companies in Hong Kong ?

Background : Literature reviews on overseas research show that composition and attributes of the board of directors can affect the project environmental performance of listed construction companies in Hong Kong, such as the number of female directors in the board (McGuinness, Vieito & Wang, 2016), the average age of the board (Ingram & Dato, 2006), the size of the board (Zahra & Pearce, 1989; Goodstein, 1994; Walls, et al., 2011) and number of independent non-executive directors in the board (Post, et al., 2011). This research attempts to find out whether these attributes will have

¹¹ Air Pollution Control Ordinance Cap. 311; Noise Pollution Control Ordinance Cap 400; Water Pollution Control Ordinance Cap 358; Waste Disposal Ordinance Cap. 354; Environmental Impact Assessment Ordinance Cap. 499; Dumping at Sea Ordinance Cap. 466; Ozone Layer Protection Ordinance Cap. 403; Hazardous Chemical Control Ordinance Cap. 595; Product Eco-responsibility Ordinance Cap. 603; Motor Vehicle Idling (Fixed Penalty) Ordinance Cap. 611

implications in the Hong Kong perspective, given there are differences in ethnic, cultural, economic and business competition between western countries and Hong Kong (Schultz, 2002) ?

1.3 Research Gap

Previous research or studies in western countries show that corporate governance and certain stakeholders (Freeman, 1984) can affect the environmental performance of companies (Figure 1.2)

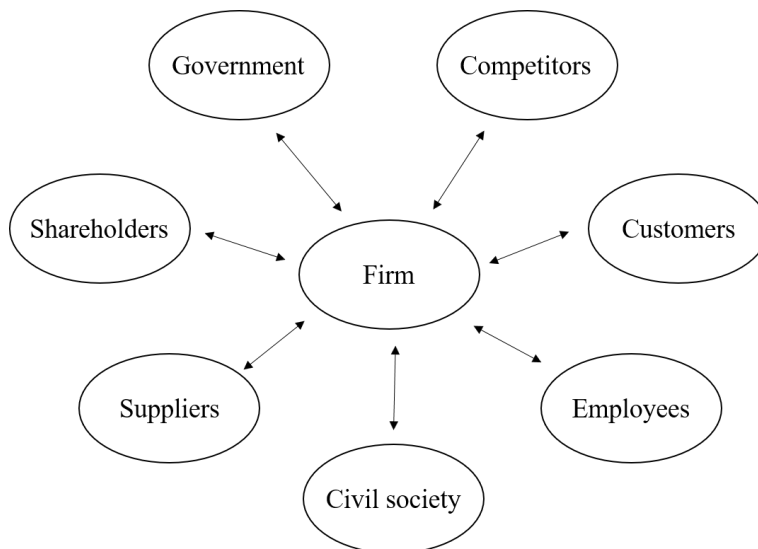


Figure 1.2 : The Freeman's stakeholder model (Freeman, 1984)

By modifying the Freeman's stakeholder model, Lindblom and Ohlsson (2011) have

developed their own stakeholders approach in investigating the influence of various stakeholders on the environmental strategies adopted by companies in the Swedish energy industry (Figure 1.3).

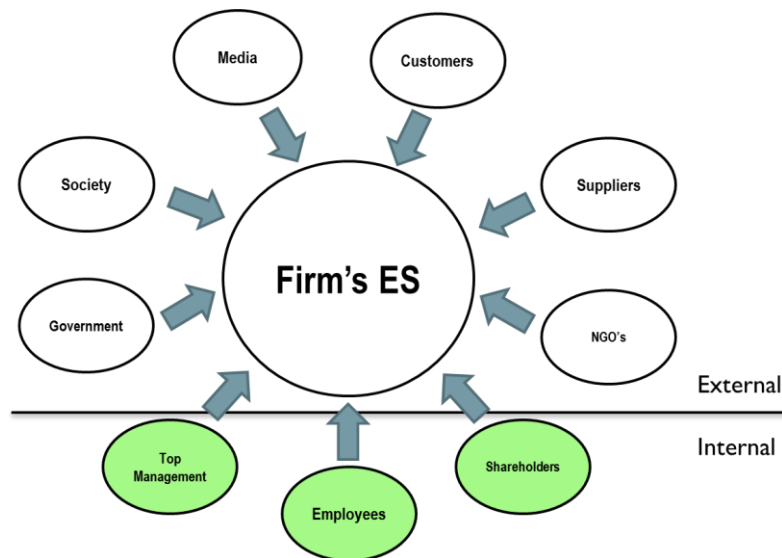


Figure 1.3 : Model of Theoretical Framework (Lindblom & Ohlsson, 2011)

As the Lindblom & Ohlsson's model is based on Swedish energy industry, there is a research gap between a theoretical framework enlisting all the elements which can affect the environmental performance of listed construction companies in Hong Kong and the Lindblom & Ohlsson's model or Freeman's stakeholder model. Can we build up such new model based on the corporate governance and the stakeholders concepts ?

Further, although there were some studies (Post, et al., 2011; Walls, et al., 2011;

Kassinis & Vafeas, 2002) which directly addressed on the association of the size and composition of the board on green corporate governance or environmental litigations, they were using data from US companies and the great majority of companies under their observations were outside the construction industry.

Knowing that there is difference in ethnic, cultural, and environmental penalty (Introduction of Chapter 1) between Hong Kong and the western countries, will :-

- (a) the size of the board,
- (b) the number of female directors inside the board,
- (c) the average age of board directors,
- (d) the chairman and CEO duality
- (e) the possession of green qualification by board directors,
- (f) the percentage of independent non-executive directors within the board,
- (g) the existence of a green committee within the board, and
- (h) the remuneration of directors tie in with company's environmental performance,

individually has a significant impact on the project environmental performance of listed construction companies in Hong Kong in a way similar to those in the western countries ? These are also the research gaps that need to be filled up in this study.

1.4 Aim and Objectives

1.4.1 Research Aim

This study aims at analyzing the various elements that affects the project environmental performance of listed construction companies in Hong Kong so that the underlying critical factors affecting the project environmental performance can be identified.

1.4.2 Research Objectives

- (1) To review the elements that may affect the project environmental performance of construction companies;
- (2) Based on Freeman's (1984) stakeholder map and Lindblom and Ohlsson's (2011) stakeholder model, to build up a new "12-element" model", which identifies all the elements that affect the project environmental performance of listed construction companies in Hong Kong;
- (3) Through analysing the 12-element model by statistical methods, to identify the critical factors that affect the project environmental performance of listed construction companies in Hong Kong;
- (4) To find out whether the composition and attributes of a board of directors can affect the project environmental performance of listed construction companies in

Hong Kong; and

- (5) To validate the statistical results on the identified critical factors and the attributes and composition of board of directors that affect the project environmental performance of listed construction companies in Hong Kong by interviews and case studies.

1.5 Research Methodology

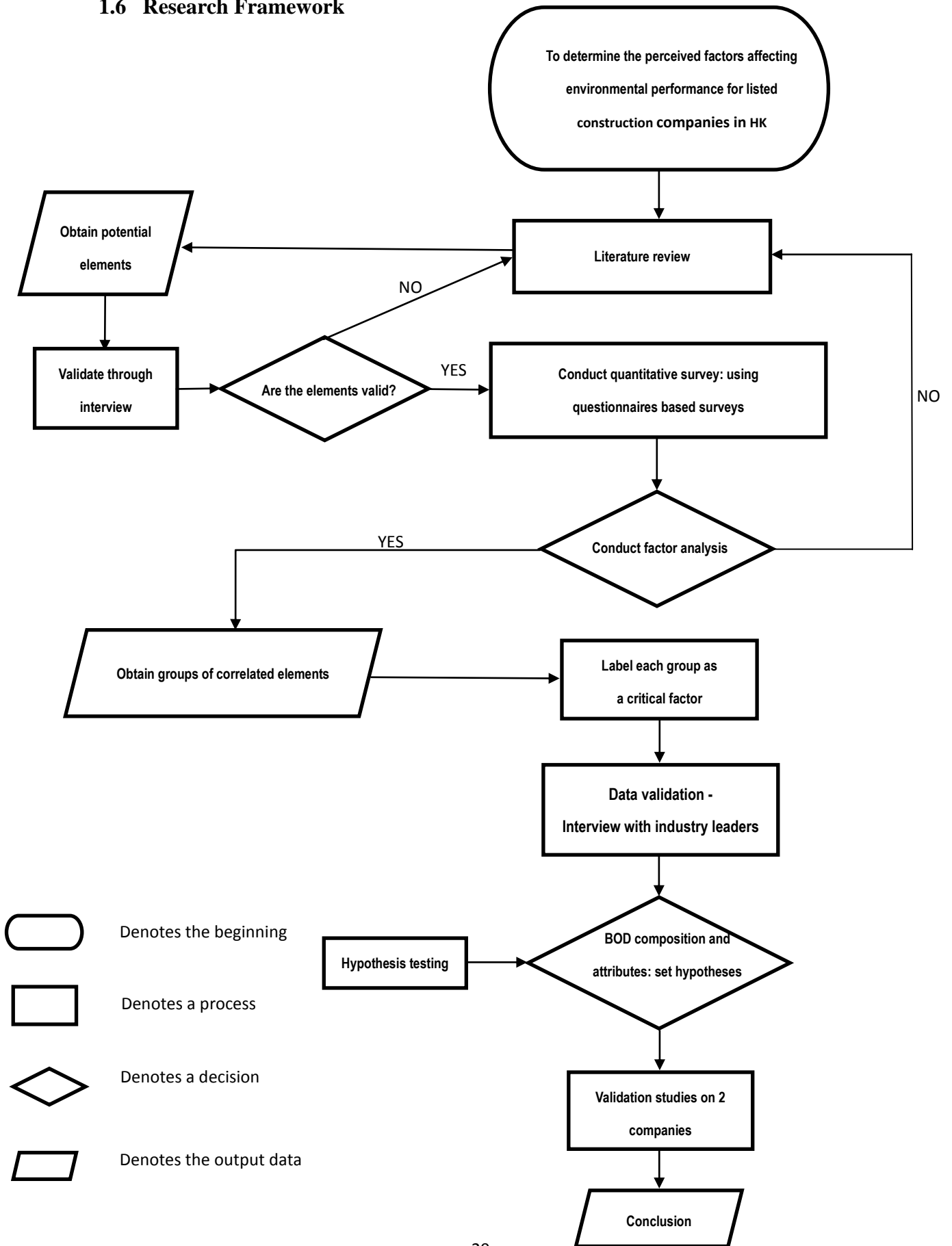
Through literature reviews, stakeholders and corporate governance elements affecting the environmental performance of construction companies are identified as the basis for this research. These elements are brought up to five industry leaders in construction for interviews to seek their opinions and confirmation. Upon collecting their views, a model similar to the Lindblom & Ohlsson (2011) will be formulated.

With such a model, questionnaire-surveys on a sample of directors and senior management of listed construction companies are conducted, asking them to grade the degree of influence for these elements on the project environmental performance of their companies, in other words what is their perceived importance for these elements to their project environmental performance. Factor analysis will be carried out to group those elements into critical factors with similar scores. Validation will be

carried out by interviewing those five industry leaders again to see if they agree with such results generated from factor analysis, if not what are their reasons behind.

To have a closer examination on the board of directors, which is the most crucial corporate governance constituent within a company affecting the project environmental performance, a detail study on the extent of the characteristics of the board of directors will be carried out. Through literature reviews six board characteristics have found to have an impact on the environmental performance. This together with two more parameters, i.e. (i) the setting up of green committee within the board, and (ii) the green qualifications possessed by the board directors, will form the basis of setting up eight hypotheses for testing on how the composition and attributes of the board can affect the environmental performance. With the results obtained from such hypothesis testing, two listed companies with specific board characteristics that have different environmental performance would be examined to validate the statistical results.

1.6 Research Framework



1.7 Structure of this Thesis

This thesis contains eight chapters. The research gap and the research framework are introduced in Chapter 1. Literature reviews to examine what are the elements of corporate governance that can exert an impact on the environmental performance of companies are contained in Chapter 2. As the board of directors has been identified as an important element, and since this element can be controlled internally by the company, literature reviews on how the composition and attributes of the board of directors that can have a significant impact on the environmental performance of companies are also explored in Chapter 2. Following stakeholder approach literature review, other elements affecting the environmental performance will be discussed in details in Chapter 3. Chapter 4 contains the results of the interviews with industry leaders and their comments on the preliminary elements identified by literature review, based on which a new model which encapsulates all the elements affecting the environmental performance of listed construction companies in Hong Kong will be formulated. Chapter 5 will elaborate the details of the methodologies employed in this research, and Chapter 6 is consisted of the data analyses and the research results. Chapter 7 will encapsulate the validation of the results so obtained, together with observations and discussions. Finally, Chapter 8 is the conclusion and suggestions for future research.

Chapter Summary

This study aims to analyze the various elements affecting the project environmental performance of listed construction companies in Hong Kong so that the underlying critical factors can be identified. The research objectives are : (1) to review the elements that may affect the project environmental performance of construction companies; (2) to build up a new “12-element” model”, which identifies all the elements affecting the project environmental performance of listed construction companies in Hong Kong; (3) to identify the critical factors affecting the project environmental performance of listed construction companies in Hong Kong; (4)to find out whether the composition and attributes board of directors can affect the project environmental performance of listed construction companies in Hong Kong; and (5) to validate the statistical results by interviews and case studies.

CHAPTER 2

Literature Review on Corporate Governance Elements

- 2.1 Corporate Governance Approach
- 2.2 Board of Directors' Leadership
 - 2.2.1 Size of board
 - 2.2.2 Female directors within the board
 - 2.2.3 The average age of the directors in the board
 - 2.2.4 Chairman and CEO duality
 - 2.2.5 Directors holding green qualification
 - 2.2.6 The percentage of independent non-executive director in the board
 - 2.2.7 Green Committee
 - 2.2.8 Remunerations tie-in with the environment performance
- 2.3 Corporate Culture
- 2.4 Environmental Management

Chapter Summary

Chapter 2 : Literature Review on Corporate Governance Elements

Literature reviews show that there are two approaches to explore the elements affecting the environmental performance of companies. Previous studies have elucidated on how the corporate governance approach and the stakeholder approach could influence the environmental performance of a company.

2.1 Corporate Governance Approach

Depending on the scope and the context that corporate governance is used, corporate governance has many definitions. Definitions of corporate governance have been hotly debated within the literature (Shleifer and Vishny, 1997; Bradley, et al., 1999). Corporate governance can be interpreted to be about promoting corporate fairness, openness and transparency in regard to its responsibilities to stakeholders. The Cadbury Committee Report (1992) attempts to define it in the classical sense :

“Corporate governance is the system by which companies are directed and combined. Boards of directors are responsible for the governance of their companies. The shareholders’ role in governance is to appoint the directors and auditors and satisfy themselves that the appropriate governance structure is in place.”

In 1999 the World Bank endeavored to refine the definition in the perspectives of a corporate and the public as : *“From the standpoint of the corporation, the emphasis is put on the relations between the owners, management board and other stakeholders (the employees, customers, suppliers, investors and communities). Major significance in corporate governance is given to the board of directors and its ability to attain long term sustained value by balancing these interests. From a public policy perspective, corporate governance refers to providing for the survival, growth and development of the company and at the same time its accountability in the exercise of power and control over companies. The role of public policy is to discipline companies and, at the same time, to stimulate them to minimize differences between private and social interest.”*

Though the shareholders, usually composed of a lot of individual small investors from the public, are the owners of a listed company, it is the board of directors of the company which exercises the control and management of such company. With the collapse of some of the large companies in the States in 60s and those in the UK in 70s, the greediness and appropriation of company fund by the directors have been exposed. Small individual investors suffered a lot of monetary and financial losses and such happenings have drawn grave concern of the government and legislators.

Various researchers have found that corporate governance of a company did have an effect on its environmental performance (Kock, et al., 2011; Wall, et al., 2011). In particular, Kock et al. (2011) found that commonly employed corporate governance mechanisms had affected firm's environmental performance by increasing managers' sensitivity towards stakeholders' environmental preferences. They also showed that companies which provided greater market-based compensation to the CEO and greater representation of pro-stakeholder directors in their boards could achieve a superior level of environmental performance. Walls et al. (2012) showed that the environmental concerns of a company had significant relationship with the board structure such as the environmental committee, board independence, board size and board diversity, together with the shareholder activism and CEO's salary. Thus, these evidence all suggest the proposition that the corporate governance of a construction company in Hong Kong does have an effect on her environmental performance.

The corporate governance approach, which encompasses the influence of the board of directors, company culture and environmental management system on environmental performance, is a better way to depict the planning, organization, coordination, interactions, culture, beliefs, leadership and control within a company. Rather than

identifying the distinctive influence of the employees and top management staff discretely under the stakeholders' approach, the corporate governance approach provides a better understanding on how the top management and employees share and interact with each other, in terms of their beliefs, value perceptions and ethics, which ultimately exert an impact on the environmental performance of a company. Besides, the distinction between top management staff and employees might be rather blurred especially at the middle layer of management.

2.2 Board of Directors' Leadership

Monks & Minow (2004) by referring to the Business Roundtable¹² describe the five primary functions of the board as follows :-

- ✧ Select, regularly evaluate, and, if necessary, replace the chief executive officer.
Determine management compensation. Review succession planning;
- ✧ Review and, where appropriate, approve the financial objectives, major strategies, and plans of the corporation;
- ✧ Provide advice and counsel to top management;
- ✧ Select and recommend to shareholders for election an appropriate slate of candidates for the board of directors; evaluate board processes and performance;

¹² The Business Roundtable, 1990. *Corporate Governance and American Competitiveness*, March 1990, p.7

- ✧ Review the adequacy of the systems to comply with all applicable laws / regulations.

The environmental performance of a company is a reflection of its corporate governance and the board of directors is the central key element in corporate governance. The composition of the board and the various attributes of the directors, such as the size of the board (Zahra & Pearce, 1989), the average age of the board (Post, et al., 2011), the gender diversity of the board, the average academic level of the board, can pre-empt the directions and performance of the company in terms of its environmental aspects.

There are established research results in the western countries which showed how the environmental performance of a company could be affected by the composition and attributes of the board of directors in particular the following parameters :-

- (a) Size of the board (Zehra and Pearce, 1989; Goodstein, 1994);
- (b) Number of female directors in the board (Mcguinness, et al., 2016);
- (c) The average age of the directors in the board (Post, et al., 2011; Ingram & Dato, 2006);
- (d) Chairman and CEO duality (McKendall, et al., 1999; Berrone, et al., 2010)

- (e) The percentage of independent non-executive director (“INED”) in a board (Wang & Coffee, 1992; Post, et al., 2011; Walls et al. 2011); and
- (f) Remuneration tie-in with the environmental performance (Cordeiro & Sarkis, 2008; Wall, et al., 2011).

However, Hong Kong with its cultural difference from the western world, the environmental performance of listed construction companies may not have significant relationship with the above six parameters. One of the purposes of this research is to find out whether there is such relationship or not. Further, this research would also attempt to explore whether the holding of green qualifications by directors and the establishment of green committee, similar to audit committee and nomination committee as required by the Hong Kong Stock Exchange, would affect the environmental performance of listed construction companies in Hong Kong. Thus, on top of the above six parameters, two more are added in our research to make it a total of eight parameters :-

- (g) Directors holding green qualification; and
- (h) Setting up of Green committee within the board.

For the sake of completeness, the attributes and composition of the board of directors

that affect the environmental performance of company will be investigated through literature reviews as follows :-

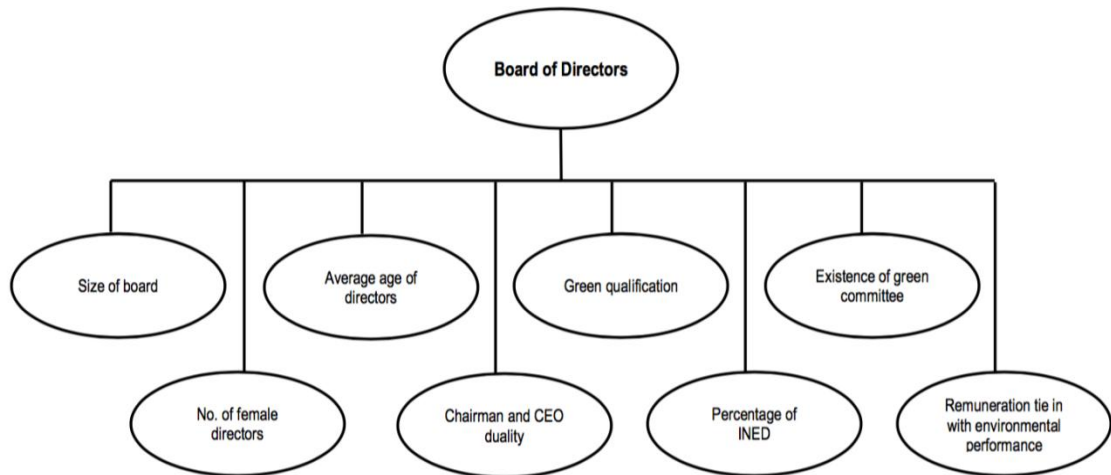


Figure 2.1 : 8 parameters of the board of directors which may influence the environmental performance of a construction company

2.2.1 Size of the board

The contribution of the directors to the company through the board is an important factor for the success of a company (Cadbury Report, 1992). It should apply to construction companies. Some of the directors have special expertise and have the knowledge of key technologies in construction because they are engineers, surveyors, architects or chartered builders, accountants or even lawyers. Some of them might have very good external contacts, good clientele connections and high visibility in the construction field. Therefore, as the brain of a company, the board of directors can

take up a cardinal role in procuring a good environmental management and performance for the company.

Zahra & Pearce (1989) asserted that the greater the number of directors sitting in the board, the more likely the management could gain expert advice which would otherwise unobtainable. This resource dependence view also suggested that larger board could enhance company performance by ensuring a greater ability for companies to form links to their environment to secure critical resources (Goodstein, et al., 1994). Consistent with this resource dependence theory, Villiers & Naiker (2011) showed that environmental performance was better in firms that had larger boards and more legal experts on the board.

However, Goodstein (1994) found that larger boards were less participative and cohesive than smaller boards and are less apt to initiate strategic actions. Besides, agency theory suggested that larger boards could experience process losses, while they also hindered the free exchange of ideas among board members. Yermack (1996) empirically showed that there was an inverse association between board size and firm value from a sample of 452 large U.S. industrial corporations between 1984 and 1991.

The Higgs Report (2003)¹³ suggested that an effective board should not be so large as to become unwieldy. It should be of sufficient size that the balance of skills and experience would be appropriate for the requirement of the business and that changes in the board's composition could be managed without undue disruption.

Using 209 listed US companies that were named as defendants in environmental lawsuits brought by EPA or Department of Justice of the United States and settled in the period 1994 – 1998, Kassinis & Vafeas (2002) showed that the number of lawsuits against a company in the US increased with the size of its board of directors. They empirically illustrated that larger boards were less effective in preventing behaviour that led to environmentally based lawsuits. The likelihood of becoming a lawsuit defendant increased with board size. Larger boards which performing less strategic planning might encounter more problems in setting and implementing an acceptable agenda on the environment. However, the samples selected were those companies which have breached the environmental law for the first time from the period of 1994 to 1998. Those companies with repeated offence were not counted again during that period. The hypothesis tested was the likelihood having the first environmental litigation, and not the number of environmental prosecutions, related to the board size.

¹³ Higgs Report (2003), Paragraph 4.10

While researching on the influence of the environmental strength and environmental concerns by the composition of the board of directors, the characteristics of CEO and shareholders activism, Walls, et al. (2011) showed that for US companies selected from Fortune 500, the board size had no significant effect on the environmental strength but a contrary result on the environmental concerns. (For environmental strength and environmental concerns, please refer to Appendix C)

The research results are so far not very coherent, and the previous researches are US based and they do not address the Hong Kong ethnic cultural difference nor put any emphasis on the construction sector.

2.2.2 Female directors within the board

Women are more concerned than men about the environment, especially in relation to local and community level issues, and such gender difference is commonly attributed to traditional gender socialization (Hunter, et al., 2004). Ali and Isa (2018) have found that females were more socialized and had a greater concern for the needs of others and they possessed a closer feeling for social responsibility (Ciocirlan &

Pettersson, 2012; Rao & Tilt, 2016 and McGuinness, et al., 2016). Katnon et al. (2017) viewed that boards with women representation had a good monitoring of environmental pollution parameters, could improve the quality of disclosure of environmental performance through better reporting in the companies' annual reports.

In Hong Kong, women are socialized to be caregivers and nurturers and extend to the development of a protective attitude nature, while men are expected to be the main economic provider that causes men to place a greater value on economic success than on environment (Hunter et al., 2004; Wong & Wan, 2009).

An empirical analysis survey data from 398 corporate directors from Standard and Poor's Registered Corporations showed that compared to their male counterparts, female directors exhibited a stronger orientation towards the discretionary component of corporate responsibility (Ibrahim & Angelidis, 1994) The composition of the respondents to the research questionnaires was : services (22%), manufacturing (20%), financial (16%), retail trade (15%), transportation (10%), wholesale trade (7%), communications (1%), and others (9%). Male board members, in contrast to female directors were more concerned about economic performance. However, results further revealed that there was no significant difference between the two genders with

respect to both the legal and ethical dimensions.

Other researchers suggested that companies with a higher percentage of female board members do in fact have a higher level of charitable giving (Wang & Coffey, 1992; Williams, 2003) and more favorable to environmental work (Bernardi et al., 2006). Bear, et al. (2010) showed that the number of women board members was positively associated with CSR strength ratings.

Post, et al. (2011) showed that firms with boards composed of three or more female directors received higher KLD strengths scores, which was a measure on CSR rating, in a sample of 452 large US industrial corporations between 1984 and 1991.

2.2.3 The average age of directors in the board

The young are more environmentally concerned than the old (Dunlap & Jones, 2000). This is probably due to generational and historical cohort differences, as well as to changes in socio-economic position that correspond with aging. In Hong Kong, younger people tend to have a more idealistic belief system and are more willing to advocate for the environment, while older people are more inclined to maintain the

status quo (Wong & Wan, 2009)

Further, the capacity for moral reasoning is thought to develop over time. Age consistently explains a large proportion of variance in moral judgment, with older individuals exhibiting higher moral reasoning (Forte, 2004; Ruegger & King, 1992; McCabe, et al., 2006). Therefore, one may expect boards with older directors to have higher environmental corporate social responsibility (ECSR) because of the more developed moral reasoning of its older members. However, age can also associate with the measure of environmental attitudes and knowledge. Researchers showed that younger individuals exhibited more concern about the environment than the elderly (Phillips, 1999; Diamantopoulos et al., 2003), and they had more knowledge of environmental issues, even though older individuals appeared to behave with more environmental consciousness than younger individuals (Gardyn, 2003).

Post, et al. (2011), used the sample consists of the 49 electronic firms found in 2006 list of Fortune 1000 companies and the 40 chemical firms found in the 2007 list of Fortune 1000 companies, together with the disclosed company data and the natural environment ratings data from Kinder Lydenberg Domini (KLD) Inc for these 89 Fortune 1000 companies, revealed that boards whose directors' average age closer to

56 were more likely to implement environmental governance structures or processes.

They also found that the relationship between board age and ECSR was curvilinear, such that companies with younger boards and those with older boards exhibited less ECSR. Fifty six years' old was found to be the golden age in exhibiting environmental corporate social responsibility !

Though there were quite a lot of studies from the western world, not much research on the influence of the average age of a Hong Kong board on the environmental performance for the construction sector was found.

2.2.4 Chairman and CEO duality

According to data collected from the Corporate Library in 2002, in the US 519 out of the largest 1900 publicly traded companies had a separate CEO and Chairman. However, in the UK, only 3 out of the 202 companies in the database had the same person as chairman and CEO.

What are the advantages and disadvantages of separating these two positions?

Monks and Minow (2004) have discussed the pros and cons of having the Chairman

and CEO duality. If the chairman of the board is also the CEO, it makes the management accountable to a body led by management. It can mean that the CEO is put in the position of evaluating his own performance. Harold Geneen, who was the former CEO and chairman of ITT Corporation, said: *“If the board of directors is really there to represent the interests of the stockholders, what is the chief executive doing on the board? Doesn’t he have a conflict of interest? He’s the professional manager. He cannot represent the shareholders and impartially sit in judgment of himself.”* (Monks and Minow, 2004)

In 1992, survey of company directors, Korn/Ferry¹⁴ found that just under 20% believed that separating the CEO and chairman position would have a “very negative impact” on boardroom performance. A little more than 20% thought that it would have a “very positive impact” and not quite 60% thought the impact of separating the role would be neutral. Those who believed separating the roles would have a negative impact advocated that it was important that a company be led by one person, who should be both the Chairman and the CEO.

In Hong Kong, the Main Board Listing Rule Code Provisions A.2.1 of Appendix 14

¹⁴ <https://www.kornferry.com/>

recommends that the Chairman and CEO of a listed company should be separate persons¹⁵. However, under the Main Board Listing Rules, the code provisions and recommended best practices are not mandatory rules, and the departures from code provisions are not regarded as breaches of the Listing Rules. Where a listed company considers a more suitable alternative to a code provision exists, it should adopt it and give reasons. However, such listed company must explain to its shareholders why good corporate governance was achieved by means other than strict compliance with the code provision (Appendix 14 of the Listing Rules). Unlisted companies are free from such requirements.

While the CEO is in charge of all the executive function of the listed company in particular the day-to-day management of the business and is invariably one of the executive directors of the board, the Listing Rules recommends that chairman should provide leadership for the board. The chairman should take primary responsibility for ensuring that good corporate governance practices and procedures are established (Listing Rule Code Provision A.2.5).

¹⁵ The roles of chairman and chief executive should be separate and should not be performed by the same individual. The division of responsibilities between the chairman and chief executive should be clearly established and set out in writing (Code Provision A.2.1 of Appendix 14)

The Listing Rules also advocate that the chairman should promote a culture of openness and debate by facilitating the effective contribution of non-executive directors in particular and ensuring constructive relations between executive and non-executive directors. The chairman should also encourage all directors to make a full and active contribution to the board's affairs and take the lead to ensure that it acts in the best interests of the listed company. The chairman should encourage directors with different views to voice their concerns, allow sufficient time for discussion of issues and ensure that board decisions fairly reflect board consensus (Listing Rule Code Provisions A.2.6 and A.2.9)

Chairman and CEO duality is a common governance structure studied in the context of CSR, and findings in this area have been mixed. Wang & Dewhirst (1992) found that CEO/chairpersons viewed stakeholders differently from their non-director peers. Webb (2004) found that chairman and CEO duality was negatively associated with socially responsible firms, while McKendall et al. (1999) reported no relationship between chairman and CEO duality and environmental violations. Similarly, Berrone et al. (2010) discerned no association between chairman CEO duality and environmental performance for non-family controlled public companies.

As discussed above, the results were mixed and there was no awareness of any previous research which has been conducted in the perspective of Hong Kong listed construction sector.

2.2.5 Directors holding green qualification

Environmental concern is positively related to education attainment (Guber, 1996). It has been suggested that education increases individual's ability to appreciate complex problems and his/her ability to access information about the environment. Wong & Wan (2009) asserted that acquiring education could help a person to develop a worldwide view about the environment through its relation with human (Guber, 1996; Wong & Wan, 2009)

Educational attainment was positively associated with measures of environmental concern (Elm, et al., 2001), such that the more educated showed more concern about the environment than those with less education, perhaps in part because those with more education learned to hold broader views and developed a larger breadth of understanding (Rest & Narvaez, 1994). Post, et al. (2011) found that a company with board having a higher proportion of directors with an advance degree exhibited more environmental corporate social responsibility.

Riding on this result, it is logical to expect that a higher proportion of directors in the board of a Hong Kong construction company with green education will render the construction company to better perform in terms of environmental protection.

In this research, green qualification is defined as :-

- (a) a certificate, diploma or degree of ‘related disciplines’ granted by a university recognized by the Government of Hong Kong or a professional institute in Hong Kong, and attending at least 36 hours’ training, which include attending continuing professional development (CPD) training or seminars or conference, covering topics in environment, and/or sustainability, and/or green building; or
- (b) A ‘BEAM Professional’ certificate awarded by the Hong Kong Green Building Council.

Courses which offers bachelor degree or master degree of science in environmental management and technology, environmental sustainability, architecture, surveying, planning and engineering or building studies with environmental related modules are all qualified as ‘related disciplines’.

2.2.6 The percentage of independent non-executive director (“INED”) in the board

Why do we need to have INED in a board? In the UK, the first clear proposal for the renaissance of INED was from the Confederation of British Industry (CBI), an industrial association. The report of the Company Affairs Committee of the CBI published in 1973 concludes that: “[T]he inclusion on the board of public companies of non-executive directors is highly desirable. Non-executive directors can make a valuable contribution by reason of their ability,

(a) to bring to bear an independent and entirely objective and detached approach to policy making;

(b) to give the board the benefit of their knowledge and their experience in other areas over a wide field of activities.

By virtue of the fact that, unlike executive directors, non-executives are not closely involved in the day-to-day affairs of the company, they are in a better position to see the company as a whole and to take a critical view of it.” (Company Affairs

Committee, Confederation of British Industry, *The Responsibilities of the British*

Public Company : Final Report of the Company Affairs Committee, Part IX, at 37 –

38)

Concentration of power on a few directors of the board is susceptible to have their powers abused to serve their personal goals rather than the company objectives. In or around 1990, the Cadbury Committee was set up to review the corporate financial system, mostly focusing on issues relating to audit and accounting, in response to several market scandals which had resulted in the unaffordable unlimited liability for auditors and accountancy firms involved. (Zhao, 2011)

The Cadbury Report (1992), which is widely accepted and is still today regarded as a measure of good practice, recommended the inclusion of non-executive directors in the board. It advocated that the non-executives could provide the necessary objectivity in the boardroom and useful advice which the executives might otherwise lack. It made the principal recommendation that the majority of the non-executive directors should be independent. The Higgs Report (2003) suggested that at least a proportion of non-executive directors needed to be independent in a stricter sense because there was natural potential for conflict between the interests of executive management and shareholders in the case of director remuneration, or audit or appointment of directors for succession.

Besides, the Cadbury Report regarded supervision as a domain in which

‘non-executive’ directors could play an important role. This independent supervisory or overseeing role of independent non-executive director is nowadays still being adopted as a good practice in contemporary corporate governance.

Wang & Coffee (1992) showed that boards with higher ratios of outside to inside directors exhibited more corporate social responsibility (through charitable contributions) than those with lower ratio. Outside directors appeared less attached to economic performance (Ibrahim & Angelidis, 1995) and more concerned with corporate social responsibility, firm’s reputation and sustainability (Ibrahim & Angelidis, 1995; Ibrahim, et al., 2003; Webb, 2004). While inside directors might be more attentive to short-term economic performance goals, outsider directors in contrast might be more likely to advocate investments required for long-term sustainability, even if they conflict with short-term economic performance goals because they might feel that attending to the environmental issues was in the best long-term interest of shareholders (Johnson & Greening, 1999).

Kassinis & Vafeas (2002) through empirical analysis demonstrated that the environmental wrongdoing of a company increased with the portion of the shares owned by the executive and directors of that company. Post, et al. (2011) found that

companies with a higher proportion of outside directors, i.e. they did not own any shares of the company, exhibited more ECSR. Walls, et al. (2011) showed that the outside director was significantly associated with environmental concerns but not environmental strength.

In Hong Kong, the Main Board Listing Rules stipulate that listed companies should include a balanced composition of executive and non-executive directors (including independent non-executive directors) so that there is a strong independent element on the board, which can effectively exercise independent judgement (Appendix 14, A3 of the Listing Rules)

Under Chapter 5 of the Main Board Listing Rules, every board of directors of a listed company must include at least 3 independent non-executive directors, and all listed companies must appoint independent non-executive directors representing at least one-third of the board. (Listing Rules 5.05 and 5.05A). In Hong Kong, a lot of listed companies comply with the listing rules by including the statutory minimum of 3

INED on their board, and in order to make them one third of the board, the board size is limited to 9. There are very few board with board member larger than 9.

2.2.7 Green Committee

If there is a green committee formed by board members, it is thought that it would have the senior management attentively looking after all environmental issues so that there is a lesser chance of infringing the environmental law. However, McKendall et al (1999) showed that there was no association between the setting up of an environmental committee and environmental violation, although some work suggested that committees could encourage extra vigilance (Kassinis & Vafeas, 2002). Berrone & Gomez-Mejia (2009) found that environmental governance captured in part through environmental committees did not influence the relationship between environmental performance and remuneration of chief executive officer (CEO).

The research carried out by Berrone & Gomez-Mejia (2009) suggested that environmental governance mechanisms were merely symbolic actions and casted doubts on the efficacy of environmental committees. Alternative monitoring mechanisms, such as external environmental audits, may be more effective.

At the moment, unlike the mandatory setting up of audit committee or remuneration committee, there is no requirement under the Hong Kong Listing Rules for the formation of any green board committee. Further, there is no awareness of any research carried out in Hong Kong on whether the setting up of a green committee on the board can improve the environmental performance of listed construction companies. Null hypothesis that there is no significant relationship between the setting up of a green committee and the project environmental performance of Hong Kong listed companies will be proposed for testing in the later part of this thesis.

2.2.8 Remunerations tie-in with the environment performance

The design of optimal executive compensation contracts has received much attention in the economics literature. Much of the theoretical work has stressed the need for a contract in which shareholders were able to monitor the performance of top executives and awarded them pay increases that were concomitant with their work effort: as such, one needs to specify a contract that ensured that top directors act in the shareholders' interest (Rosen, 1990).

Using DATASTREAM databank of company accounts which report that the total annual remuneration of the highest paid director and after considering almost 300 large quoted companies, Gregg, Machin & Szymanski (1993) were unable to detect any important relationship between directors' compensation and the performance of their companies.

Jensen & Murphy (1990) revealed that whatever the statistical significance and whatever the relative size of the various remuneration effects, in overall quantitative terms top executives were very poorly rewarded for enriching shareholders. They computed that, for every extra \$10,000 of shareholder wealth created, the typical top executive's current pay rises was \$0.033 (\$0.178 if options were included).

Cordeiro & Sarkis (2008) empirically showed that the remuneration of CEO which was expressly linked up with the environmental performance of the company was positively correlated to the environmental performance of that company. Further, Walls, et al. (2011) found that firms with higher CEO salaries generally did less well environmentally. Perhaps CEOs emphasize shorter-term goals such as financial performance to the detriment of environmental ones, hinting at tensions that may be experienced by CEOs who have to make trade-offs between these two organizational

outcomes. This is consistent with a large number of studies that suggested that when the fixed component of compensation (i.e. salary) was large, managerial behaviours tended to be conservative and CEOs avoided risky decisions, favouring the status quo (Walls, et al., 2011)

As the research results are rather mixed, it will be a good research area to investigate the association of directors' remuneration with the project environment performance for the construction sector of Hong Kong.

2.3 Corporate Culture

Much has been discussed on how the board of directors could affect the project environmental performance of a listed construction company in Hong Kong. Let us now turn to the next corporate governance element, that is, the Corporate Culture. The concept of organizational culture first emerged in the 1970s and 1980s (Hofstede, 1981; Ouchi & Price, 1993; Pettigrew, 1979; Schwartz & Davis, 1981). There has been a wide diversity in its interpretation and no consensus on its exact definition (Ashkanasy, et al., 2000). One frequently cited definition is that of Schein who defines corporate cultures as *'the basic assumptions and beliefs that are shared by*

members of an organization which are learned responses to a group's problems of survival in its external environment and its internal integration' (Schein, 1985).

Corporate culture could be further elaborated in terms of the three-level typology of culture by asserting that it was a kind of :-

(a) accepted behavioral rules, norms and rituals (Trice & Beyer, 1984);

(b) shared values, ideologies and beliefs (Schwartz & Davis, 1981); and

(c) at an underlying level, shared pattern of meaning or understanding (Frost, et al., 1985; Smircich, 1983).

Organizations were seen as open, dynamic systems having a certain amount of interaction with their socio-political environment (Cramer, 1998). Stacey (1993) and Dankbaar (2011) suggested that the interaction planked mainly on the extent to which the environment dictated the actions of organizations and vice versa (Stacey, 1993; Dankbaar, 2011). Proposed by Mintzberg (1980), the structure of organization could be divided into five parts : (a) the operating core which includes all those employees who themselves produce the basic products and services of the organization, or directly support their production, (b) the strategic apex consists of the top general managers of the organization, and their personnel staff, (c) the middle line comprises those managers who sit in a direct line of formal authority between the people of the

strategic apex and of the operating core, (d) the technostructure consists of those analysts, out of the formal line structure, who apply analytic techniques to the design and maintenance of the structure and to the adaptation of the organization to its environment for instance accountants, work schedulers, long-range planners, and (e) the support staff who includes those groups that provide indirect support to the rest of the organization, for instance legal counsel and public relations, payroll and cafeteria.

Besides, various researchers came to the following conclusions :-

- (i) Regarding the insights into organizational structure and culture, it was predicted that companies wishing to excel in environmental matters would do so on the environmental basis of a certain dedication and environmental ethics (Hoffman, 1991).
- (ii) Cramer (1998) concluded that tasks and responsibilities would shift as a company's environmental policy became more ambitious (Byrne & Kavanagh, 1996). There was a shift from a centralized structure, in which environmental tasks were delegated to staff departments, to a decentralized and ultimately a holistic structure, in which the environment was seen as the responsibility of the entire company.
- (iii) Scholars who relied on theories from organizational psychology highlighted how

top managers' environmental beliefs, values, and attitudes used to assess firms' competitive alternatives and their outcomes played a crucial role in corporate environmental management choices (Cordano & Frieze, 2002; Rivera & Delmas, 2004).

- (iv) In recent years, many companies have introduced or changed policies, their production process and even their products to address minimization of pollution emission and use of natural resources so as to improve community and stakeholders' relationships (Crane 2000). In order to fully respond to environmental and social challenges, companies have also undergone significant cultural changes and transformation (Stead & Stead, 1995; Welford, 1995).

The research carried out by Wehrmeyer & Parker (1995) revealed that several important correlations had existed between the corporate culture and the company's relative environmental performance :

- (a) Firms with a better environmental performance were found more frequently to adopt team approaches to management and decision-making. It might be that the ability to 'take-ownership' of environmental problems on site was greater in team effort (Wehrmeyer & Parker, 1995)
- (b) Those companies adopting a rather self-serving attitude towards technology had

a worse environmental performance.

- (c) Cultures which adopted a longer term, strategic view were found in companies with above-average environmental performance.
- (d) Poor environmental performances were closely related to an apparent reliance on crisis management as a continual response within the corporate culture (Shrivastava, 1995)
- (e) Companies which regarded profit as the prime and core cultural value had poorer environmental performance and vice versa. They also had below average economic performance. However, it did not connote good environmental performance would necessarily bring economic success (Wehrmeyer & Parker, 1995).
- (f) Companies which put weight on quality and did things because they were 'right' rather than 'profitable' had better environmental performance (James, 1994)

In the premises, there are plenty of studies and research findings showing that the corporate culture does have an influence on the environmental performance of a company in general. As listed construction companies are a subset of all the companies in general, corporate culture will have an influence on the environmental performance of listed construction companies.

2.4 Environmental Management

The third element identified under the corporate governance approach is the implementation of an environmental management system within the company. Through empirical studies, Potoski & Prakash (2005) showed that joining ISO 14001 could improve the companies' compliance with environmental regulations. Adopting an environmental management system demonstrated a company's commitment to environmental performance and improved its corporate image, thus increasing its clientele base (Shen & Tam, 2002; Shen, et al., 2006). The implementation of an EMS ISO 14001, which built-in an inherent device for continual improvement of the environmental performance, could be neatly summed up in the following diagram (ISO, 1996) :-

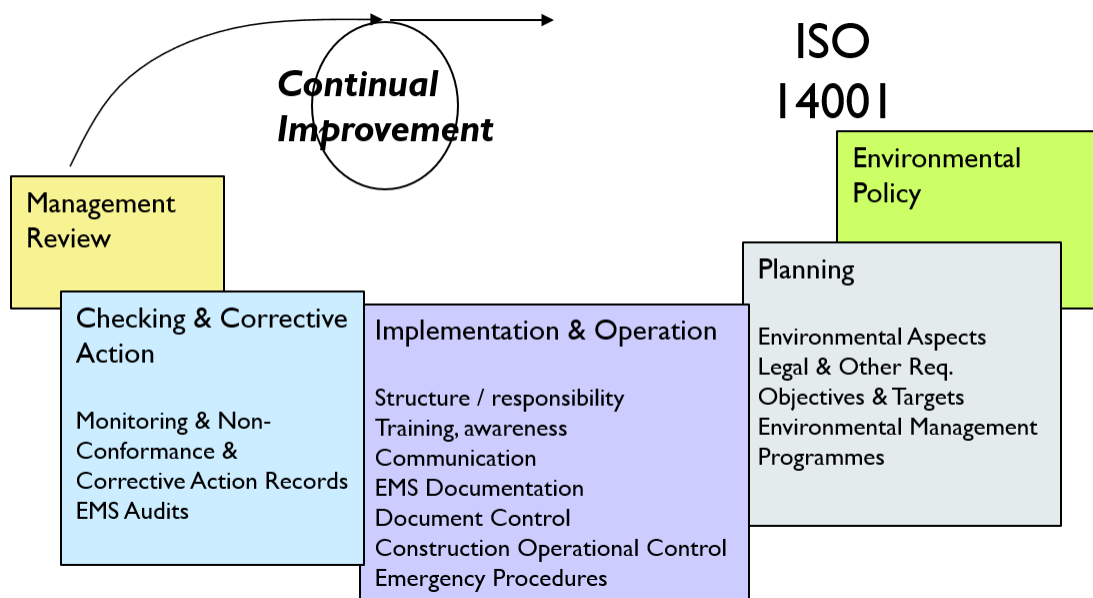


Figure 2.2 : Inherent device for continual improvement (ISO 14000, 1992)

The benefits of ISO 14001 membership are the excludable branding certification that allows members to publicize their ‘club membership’ for improving their reputation hence enhancing their competitiveness and attracting potential clients (Shen & Tam, 2002; Chan, 1999). Potoski & Prakash (2005) find that joining ISO 14001 reduces companies’ time spent in compliance by 7% or about 25 days in a year. It is important to notice that ISO 14001 is the largest and most widely recognized voluntary environmental program in the world. Moreover, ISO 14001 has a positive brand image among the government regulators, it has been depicted as the “golden standard” among the EMS based voluntary regime (Potoski & Prakash, 2005). Further, it has been found that effective EMS could help facilities to identify and correct regulatory problems before these problems became violations, hence avoiding the charges from violations and worsening its reputation. If companies’ noncompliance stemmed from poor management such as ignorance of regulatory requirements (Brehm & Hamilton; Winter & May as cited in Potoski & Prakash, 2005) or other internal problems (Dasgupta, Hettige & Wheeler, 2000; Potoski & Prakash, 2005), ISO 14001’s EMS focus might help the facilities to improve their performance.

In the premises, based on the above studies and research findings, the implementation of the environmental management system ISO 14 000 does have an influence on the environmental performance of a company in general. As listed construction companies are a subset of all the companies in general, the implementation of the environmental management system ISO 14 000 will have an influence on the environmental performance of listed construction companies.

Chapter Summary

The corporate governance approach, which encompasses the influence of the board of directors, company culture and environmental management system on environmental performance, depicts the planning, organization, coordination, interactions, culture, beliefs, leadership and control within a company. Rather than identifying the distinctive influence of the employees and top management staff, the corporate governance approach provides a better understanding on how the top management and employees share and interact with each other, in terms of their beliefs, value perceptions and ethics, which ultimately exert an impact on the environmental performance of a company.

The board of directors' leadership has been one of the very important facets of corporate governance, there are established research results in the western countries which show how the environmental performance of a company might be affected by the composition and attributes of the board of directors in particular the following parameters :-

(a) Size of the board

Yermack (1996) empirically showed that there was an inverse association between board size and firm value. Kassinis & Vafeas (2002) showed that the number of lawsuits against a company in US increased with the size of the board of directors. However, Walls, Berrone & Phan (2011) showed that the board size had no significant effect on the environmental strength. The research results were not very coherent.

(b) Number of female directors in the board

Bear, Rahman & Post (2012) showed that the number of women board members was positively associated with CSR strength ratings.

(c) The average age of the directors in the board

Younger individuals could exhibit more concern about the environment than the elderly (Phillips, 1999; Diamantopoulos et al, 2003), and they had more knowledge of environmental issues, even though older individuals appeared to behave with more environmental consciousness than younger individuals (Gardyn, 2003). Post, Rahman & Rubow (2011) showed that the boards whose directors' average age closer to 56 years in age were more likely to implement environmental governance structures and processes.

(d) Chairman and CEO duality

Webb (2004) has found that chairman CEO duality was negatively associated with socially responsible firms, whilst McKendall et al. (1999) reported no relationship between chairman CEO duality and environmental violations.

(e) The percentage of independent non-executive director (“INED”) in a board

Post, Rahman & Rubow (2011) have found that companies with higher proportion of outside directors exhibited more ECSR. Walls, Berrone & Phan (2011) showed that the outside director was significantly associated with environmental concerns but not environmental strength.

(f) Remuneration tie-in with the environmental performance.

Cordeiro & Sarkis (2008) showed that the remuneration of CEO which was expressly linked up with the environmental performance of the companies was positively correlated to the environmental performance of that company. Walls, Berrone & Phans (2011) found that when fixed component of compensation was large, managerial behaviours tended to be conservative and CEOs avoided risky decisions, favouring status quo.

(g) Establishment of Green Committee within the board

McKendall (1999) showed that there was no association between the setting up of an environmental committee and environmental violations.

(h) Directors holding green qualifications

There was scarcity of research on environmental performance with green qualification, however environmental concern was shown to be positively related to education attainment (Guber 1996; Elm, Kenney & Lawton, 2001). Post, Rahman & Rubow have found that a company whose board had a higher proportion of directors with an advance degree exhibited more environmental corporate social responsibility.

CHAPTER 3

Literature Review on Stakeholders' Elements

- 3.1 Stakeholders Approach
- 3.2 Shareholders' influence
- 3.3 Customers' influence
- 3.4 Government Regulatory Control
- 3.5 Subcontractors and Suppliers
- 3.6 Competitors
- 3.7 Media and Green Non-governmental Organizations
- 3.8 Trade Union

Chapter Summary

Chapter 3 : Literature Review on Stakeholders' Elements

Further to the literature review on the corporate governance elements of the board of director, corporate culture and environmental management as delineated in Chapter 2, literature review on the stakeholder elements will be provided in this chapter.

3.1 Stakeholders' Approach

Stakeholders are those individuals and groups that can affect a company's performance or are affected by a company's action (Freeman, 1984). In terms of environmental responsibility, stakeholders generally demand integrity, respect, standards, transparency and accountability (Waddock et al., 2002). Freeman (1984) in his stakeholder map identified the following 7 stakeholders who might have an impact on companies, they are :- 'Government', 'Competitors', 'Customers', 'Employees', 'Civic Society', 'Suppliers', and 'Shareholders'. Freeman's model of stakeholders' influence on firms depicts a holistic and general picture. Each trade and industry has its own characteristics, the model might be adjusted for construction industry to be more specific in terms of the stakeholders involved.

Clarkson (1995) subdivided stakeholders into primary stakeholders and secondary

stakeholders. The former were those stakeholders without whose participation and support the organization could not survive, for instance customers, shareholders, suppliers, employees. The latter comprised of those stakeholders, which affected or were affected by the organization, but were not engaged in transactions with it and were not essential for its survival, for instance media and non-governmental organizations. Government and other regulatory bodies were regarded as primary stakeholders as a specific public stakeholder group.

Buysee & Verbeke (2003) further subdivided primary stakeholders into internal primary stakeholders and external primary stakeholders. Internal primary stakeholders included employees, shareholders and financial institutions and credit rating agencies, whilst external primary stakeholders included customers and suppliers.

Henriques & Sadorsky (1999) subdivided stakeholders into regulatory stakeholders, organization stakeholders and community stakeholders. Regulatory stakeholders included governments and trade associations. Organization stakeholders included customers, suppliers, employees and shareholders. Community stakeholders included non-governmental organizations and social group.

Gonzalez-Benito & Gonzalez-Benito (2008) summed up the following types of stakeholders which might exert pressure on the companies' environmental performance. They were divided into two categories, namely the internal and external stakeholders. External stakeholders were governments and regulatory agents, customers or consumers, subcontractors and suppliers, NGO / Media / communities and social groups and trade competitors. Internal stakeholders were the shareholders and the financial institutions.

Gonzalez-Benito & Gonzalez-Benito (2008) examined the effect of stakeholder environmental pressure perceived by companies, with respect to their size, internalization, location of manufacturing activities, position in the supply chain and industrial sector. They discovered that non-governmental pressure had played a more significant role than governmental pressure in influencing corporation's environmental strategies.

By modifying Freeman's findings appropriate and applicable to energy industry, and aware of Gonzalez-Benito & Gonzalez-Benito's analyses, Lindblom & Ohlsson (2011) identified the elements that could have an impact on the environmental strategy of

energy companies, they were : ‘Media’, ‘Customers’, ‘suppliers’, ‘NGO’, ‘Society’, ‘Government’, ‘Top Management’, ‘Employees’ and ‘Shareholders’. They regarded the ‘Top Management’, ‘Employees’ and ‘Shareholders’ as internal stakeholders and the rest were external stakeholders. Similarly, construction industry has its uniqueness and should have its own set of stakeholders.

Rather than identifying the distinctive influence of the employees and top management staff discretely under the stakeholders’ approach, the corporate governance approach provides a better understanding on how the top management and employees share and interact with each other, in terms of their beliefs, value perceptions and ethics, which ultimately exert an impact on the environmental performance of a company. Besides, the distinction between top management staff and employees might be rather blurred especially at the middle layer of management. With the application of corporate governance concepts, the elements of ‘Top Management’ and ‘Employees’ under the stakeholders approach can be replaced.

Based on literature reviews, seven elements have been identified and they are : (i) shareholders, (ii) customers influence, (iii) government regulatory control, (iv) subcontractors and suppliers, (v) competitors, (vi) media and green non-governmental

organizations, and (vii) trade union.

3.2 Shareholders' Influence

According to Hamilton (1995), poor environmental performance could lead to environmental damage, which in turn could result in monetary losses for the shareholders. Shareholders could exert pressure on the company. They might not only look for economic return from the companies, and if they did not agree with the environmental performance and directions of the company, they could sell their shares or refuse to provide loan financing to the company (Buyesse & Verkebe, 2003).

Shareholders would suffer financial losses on their investments if a company was found liable for environmental damage or its poor environmental record made the news (Hamilton, 1995). As a result, shareholders as well as financial institutions and credit rating agencies perceived companies with a poor environmental record as riskier to invest in, and might demand a higher risk premium (Henriques & Sadorsky, 1996), or might voice their discontent by withdrawing capital or refusing to extend new loans. Johnson & Greening (1999) asserted that pension fund equity was positively related to both people (women and minorities, community, and employee relations) and product

quality (product and environment) dimension of corporate social performance (CSP), but mutual and investment bank funds exhibited no direct relationship with CSP.

Literature reviews by Perrault & Clark (2016) on shareholders activism (Entine, 2003; Goranova & Ryan, 2014) showed that the responses of company for shareholders activism largely depended on the activist's identity (Goranova & Ryan, 2014), the importance of the issue (Eesley & Lenox, 2006; Reid & Toffel, 2009), or a desire to enhance their company's position (David et al., 2007; Johnson & Greening, 1999; Logsdon & Van Buren, 2009) as well as the activists' financial resources and their relative proportion of the company's ownership (Den Hond & De Bakker, 2007; Rutland, 2008). Perrault & Clark (2016) found that company responded positively to shareholders activists' high status and reputation which could threaten the company.

3.3 Customers' Influence

Customers' pressure or demand has been proven to be a factor influencing the environmental strategy and hence the environmental performance of a company to a high extent (Henriques & Sadosky, 1996). The result is in contrary to that of Buysse & Verbeke (2003) which showed that customers had only a limited influence on the

proactiveness in implementing environmental measures and strategies.

Depending on the pressure from the customer, the company would end up in a more or less proactive or even reactive environmental strategy. Sparks and McColl-Kennedy (2001) have found that customers' satisfaction was one of the key factors to corporate success since profits were generated through meeting consumer needs and wants. There are three determinants in satisfying customers, they are perceived quality, perceived value and customer expectation. The notion of environmental governance echoes with perceived quality and perceived value since they both emphasize the quality of production. Besides, sound environmental management can satisfy environment-conscious customers' expectations and attract more business (Tang, et al., 2012)

Chan (1999) asserted that heavy green consumers had a strong self-identity as someone who had concern about green issues and they could cultivate a general concern on the environmental condition in Hong Kong. Therefore, it is a natural deduction that marketers such as the developers and property buyers can put emphasis on the contractors to improve the environmental condition in Hong Kong. Kess, et al. (1999) suggested that some companies chose to comply with ISO 14000 standard due

to improved corporate image and the possibility of gaining extra customers.

The HKSAR government encourages developers to construct green buildings, which should be rated by the Hong Kong BEAM Society Limited via the Hong Kong Green Building Council (“HKGBC”), by allowing them to construct green features which might be exempted from gross floor areas (GFA) and site coverage (SC) calculations as stipulated under the Buildings Ordinance and Regulations. By selling these exempted GFA, developers can increase their profits which might acts as an inducement for the developers to give pressure on the contractor to pursue green construction. As a result, the project environmental performance of the contractor can be enhanced.

Further, Shen, et al. (2006) pointed out that construction companies undertook works in response to clients’ requirements, and if clients did not show much interest in improving environmental performance, the construction companies would not invest resources voluntarily to implement environmental management methods. Clients can exert their momentum to implement environmental management through the construction chain in the design and construction processes. A lack of participation by clients in promoting environmental management can end up with ineffective

implementation of EMS along the whole construction chain from designers, consultants, contractors, subcontractors and suppliers (Shen, et al., 2006). Osmani, et al. (2008) found that the lack of interest from clients could act as a disincentive to proactive and sustainable implementation of waste reduction strategies during the design process.

3.4 Government Regulatory Control

Wong et al. (1996) found that environmental regulation represented a major thrust in encouraging companies to invest in less harmful environmental technologies. Saha & Darnton (2005) further asserted that environmental regulation represented a strong thrust for companies to adopt an environmental strategy, and thus to enhance their environmental performance.

Government regulations can impose a huge influence on the industry and if companies do not meet these requirements they will have to pay fines and penalties, which in turn would lead companies to adapt and respect the environment more (Fraj-Andres et al., 2009). The pressure from government was proven to create a higher environmental performance (Christmann, 2004; Henriques & Sadosky, 1996). This is why the

government was considered to be one of the very influential stakeholders, if not the most influential one (Lindblom & Ohlsson, 2011).

In Hong Kong, most of the environmental legislations are demand and control regulations, and they encompass the following ordinances and their regulations:-

- Air Pollution Control Ordinance, Cap. 311
- Noise Control Ordinance, Cap. 400
- Water Pollution Control Ordinance, Cap. 358
- Waste Disposal Ordinance, Cap. 354
- Environmental Impact Assessment Ordinance, Cap. 499
- Dumping at Sea Ordinance, Cap. 466
- Ozone Layer Protection Ordinance, Cap. 403
- Hazardous Chemical Control Ordinance, Cap. 595
- Product Eco-responsibility Ordinance, Cap. 603
- Motor Vehicle Idling (Fixed Penalty) Ordinance Cap. 611

With the backdrop of regulations, enforcement and monitoring is another dimension of policy instruments. Other than the nature and substance of the regulations, the way the law is enforced will definitely have a greater impact on a company's reaction and

its competitive ability (Anex, 2000). For instance, if Environmental Protection Department is very stringent in enforcing noise regulations, much more than the air and water regime, construction companies will invest more in the quiet pneumatic mechanical equipment instead of spending more resources in reducing water pollution on site.

Following the policy of the HKSAR Government to curb environmental pollution, the Development Bureau ('DEVB') has provided a scoring system for construction contract bidding. Contractors with environmental conviction records will be penalized on their scores. Further, their technical circular DEVB TCW No.3/2009 sets out the particular policy and procedure to be followed when considering regulatory action against a contractor who has been convicted of five or more environmental offences committed by the contractor on a construction site or construction sites under the same contract (or sub-contract where the contractor is acting as a sub-contractor). Voluntary suspension will be recommended where the government panel considers that the contractor took insufficient measures to prevent the environmental offences as appropriate, or the contractor's unsatisfactory effort in an attempt to prevent contravention leading to further convictions for similar offences at construction sites. The length of voluntary suspension period if recommended can

vary from one month to three months (or longer). This acts as a deterrent for construction companies not to comply with environmental legislations.

3.5 Subcontractors and Suppliers

Sub-contractors and suppliers play an important role in the construction industry because the main contractors, who win the bid and sign the building contract with the developer, will very often sublet most of its contract work to subcontractors. The subcontractors are invariably the actual organizations that carry out the supply and installation of the construction work. The subcontractors and suppliers are part and parcel of the supply chain in the construction industry.

According to Xue et al., (2005), construction supply chain management could be defined as the coordination of inter-organization's decision making and integration of key members involved in construction supply chain, including client/owner, designer, general contractors, sub-contractors and suppliers

Among the whole supply chain from production of construction materials to the end user in the industry, constructors can exert a significant and irreversible impact on the

environment, such as the enormous use of natural resources, pollution of the environment, and high energy consumption (CIEC, 1992). Chiou, et al. (2011) found that greening the supplier through green innovation contributed significant benefits to the environmental performance and competitive advantage to the company.

Ofori (2000) found that the concept of supply chain provided a useful framework for analyzing the construction process and supply chain management could help to green the construction supply chain in Singapore.

3.6 Competitors

Gonzalez-Benito & Gonzalez-Benito (2008) pointed out that one of the stakeholders affecting a company's environmental performance was the environment performance of its competitors. According to their analyses, competitor was regarded as a secondary stakeholder by both Clarkson (1995) and Buysse & Verbeke (2008), and as a community stakeholder by Henriques & Sadosky (1999).

Knowing companies that have better environmental performance can have better customers' satisfaction, companies strive to have competitive edge in environmental

protection to increase its clientele base. Sparks & McColl-Kennedy (2001) posited that customers' satisfaction was one of the key factors to corporate success since profits were generated through meeting consumer needs and wants. Thus, by improving its environmental performance, it will possess a competitive edge for that company to have more clients which can beat down its rivalry peers.

Further, companies with poor environmental performance may not meet the regulatory requirements and they will have to pay fines and penalties, which in turn will lead to less competitiveness in bidding for government projects.

Famiyeh, et al. (2018) in obtaining empirical evidence from a developing country concluded that companies practicing environmental management had a significant effect on the company's competitive operational performance, and in turn the company's competitive operational performance had a partial positive effect on the overall environmental performance.

Esty & Charnovitz (2012) asserted that environmental sustainability was an important element of corporate strategy and marketplace success, and the better environmental performance of a company in relation to its competitors, the more successful is that

company in the industry.

3.7 Media and Green Non-governmental Organisations

Public exposure by the media and civic society organizations in relation to an environmental accident or for poor environmental records could damage a company's reputation in the eyes of customers, investors, suppliers and employees, and negatively affected revenues and financial performance (Baron, 2003; Fombrun, Gardberg & Barnett, 2000; Kassinis, 2012). Literatures in management showed that press diffusion in a country was positively related with the private sector's responsiveness to environmental issues in UK (Dyck & Zingales, 2002) and that media visibility had a positive impact on a company's CSR performance (Nikolaeva & Bicho, 2011; Zyglidopoulos, Carroll, Georgiadis & Siegel, 2010).

Brown & Deegan (2012) argued that the media could be particularly effective in driving the community's concern about the environmental performance of a particular organization. The research carried out by Islam & Deegan (2010) generally supported the view that for those industry-related social and environmental issues attracting the greatest amount of negative media attention, companies reacted by

providing positive social and environmental disclosures. Maistriau & Bonardi (2014) pointed out that companies tended to react against negative media coverage or activists' attacks by self-regulating in the form of increased investments in corporate social responsibility (CSR). They suggested that negative public exposure in media broadcasts in relation to an environmental accident or for poor environmental records might be able to exert pressure on companies to adopt environmentally-responsible measures.

There are many non-governmental organizations (NGOs) in the world, some of the biggest multinational ones are the 'Greenpeace', 'WWF' and 'Friends of the Earth'. Part of their role in environmental protection is to overseeing the environmental performance of the enterprises (Bansal & Roth, 2000). NGOs' confrontational strategies could exert pressure on companies to adopt socially- and environmentally-responsible measures (Eesley & Lenox, 2006; Lenox & Eesley, 2009; Lyon, 2010).

Developing countries like China have been experiencing increasing growth of environmental NGOs in recent years. These NGOs were becoming active players in the development of environmental polices (Yang, 2005). Doh & Guay (2006) further

pointed out that these environmental NGOs not only influenced the government, but also the private sector companies and public opinion. There is evidence which showed that environmental NGOs had been influencing the environmental performance of contractors by articulating environmental concerns and framing alternatives. For example, the environmental NGOs 'Global Village' and 'Friends of Nature' were playing a proactive role in the adoption of environmental friendly construction programs by the contractors in the large construction project known as 'Yuanming Garden' (Qi, et al., 2010).

The green NGOs can reinforce with the media to highlight and shame those polluters, thus putting pressure on them to either abate the pollution or to improve their environmental performance. For example, when Greenpeace occupied the Brent Spar on April 30, 1995, and used the mass media to inspire protesters across Northern Europe, within the next two months Shell yielded to public pressure by renouncing its plans for deep-sea disposal (Bakir, 2006). Gonzalez-Benito & Gonzalez-Benito (2010) found that the pressure from NGOs played a more significant role than governmental pressure in influencing companies' environmental strategies.

3.8 Trade Unions

Other than protecting the rights and benefits of workers such as minimum wage, job security, safety and comfortable work place, unions also have social and developmental roles in protecting the environment through workers training, education and awareness about environment (Khan, et al., 2012).

In the US, the United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union, commonly known as United Steelworkers (USW), is a general trade union with 860,294 members across North America. According to Kojola & Erik (2009), USW has a long history of environmental activism. European trade unions have also been involved in environmental issues for a long time (Gabaglio & Sapir, 2002).

Union apprenticeship programmes helped to propel new members into green occupations and upgraded the skills of existing members to meet the needs of a green economy (Kojola & Erik, 2009; Khan et al., 2012). The Hong Kong Contractors Association (HKCA) provides codes of practice and seminars for personnel of construction companies to keep themselves abreast of the green practice in the industry. They have published a reference guide known as “Hong Kong Construction

Association - Environmental Legislation relevant to the Construction Industry in Hong Kong” and they produce soft copy of training material known as “Environmental ToolBox Training Kit CD-Rom”. They are available for sales to their members and public.

The Hong Kong Institute of Construction Managers (HKICM) announces in their website the various training courses for construction managers to promote their skills and knowledge in environmental protection at sites. Their Rules of Conduct stipulates that members should be able to provide evidence that they have undertaken sufficient study and personal development to fulfil their professional obligations in accordance with the current guidelines for Continuing Professional Development (CPD)” (Clause 1.6.13 of the Constitution & Bye-Laws). Aiming in that direction, the institute organizes a series of CPD activities for its members to enhance their professional competency including the skills and knowledge on environmental protection at construction sites such as the CPD held on 9 August 2018 known as “Professional Practice in Construction Management Training Course Series 4 – Environmental Practices”.

Snell, et al. (2008) suggested that unions were striving to develop their capacities as an

environmental actor through a range of activities concentrating on internal solidarity such as educating members about climate change and sustainability, external solidarity such as campaigns in support of national and international framework agreements for reducing carbon emissions, as well as proactive initiatives such as those aimed at transitioning local industries and economies towards a sustainable future.

Chapter Summary

Based on the stakeholders approach, seven stakeholder elements affecting the environmental performance of construction companies in Hong Kong are identified through literature reviews. These seven elements are shareholders' influence, customers' influence, government policies and regulatory control, subcontractors and suppliers, competitors, media and green non-governmental organisation and trade union. These seven elements, together with the three corporate governance elements will be brought before a panel of industry leaders for validation.

CHAPTER 4

Interviews with Industry Leaders

4.1 Background of the Practitioners under Interview

4.2 Open-ended Questions

4.3 Interview Findings

Chapter Summary

Chapter 4 : Interview with Industry Leaders

Local context and insight on factors affecting the project environmental performance of listed construction companies were gained via a pilot study. Structured interviews with 5 experienced practitioners who are conversant with the construction industry were conducted. All of them have over 20 years of experience. Opened-ended questions were used in the interviews to facilitate free flow of ideas

4.1 Background of the Practitioners under Interview

	Background of the Practitioner involved
1.	<ul style="list-style-type: none">• President of the Hong Kong Construction Association (“HKCA”)• Director of a listed construction company• Possesses an engineering degree• Qualified Structural Engineer
2.	<ul style="list-style-type: none">• CEO of the Hong Kong Green Building Council (“HKGBC”)• Possesses an engineering degree• Qualified Engineer
3.	<ul style="list-style-type: none">• Chairman of Building Surveying Division, the Hong Kong Institute of Surveyors (“HKIS”)• Director of a surveying and planning consultancy firm• Possesses a surveying degree• Qualified Surveyor
4.	<ul style="list-style-type: none">• Immediate Past President of the Hong Kong Institute of Construction Managers (“HKICM”)• Independent Non-Executive Director of a listed construction company• Possesses a surveying degree• Qualified Surveyor• Qualified Construction Manager

5.	<ul style="list-style-type: none"> • Immediate Past Secretary for Development, Development Bureau, HKSARG • Director of a listed group company specialized in construction and property development • Possesses an engineering degree • Qualified Structural Engineer
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Table 4.1 : Profile of interviewees

Though these five industry leaders were only giving their own personal opinions and comments, and were not speaking on behalf of the institute, organization or company from which they were working or had worked for, they had very good exposures in the industry when they were discharging their official duties for instance when they were sitting on various government consultation boards or committees, or when they were having meetings discussing issues relating to the construction industry. As a result, these five industry leaders can apprehend the perceptions of the construction companies in Hong Kong. In fact, their background spans across a wide spectrum of the Hong Kong construction industry :-

(1) The Hong Kong Construction Association (HKCA) is consisted of 324 members at April 2019 who are all registered construction companies¹⁶ in Hong Kong. It is estimated that its members have taken up more than 75% of all the construction

¹⁶ They are all registered with the Buildings Department under the Building (Administration) Regulations

work in Hong Kong¹⁷. It provides leading voice for Hong Kong main contractors, and over the years it has established a harmonious working relationship with the HKSAR Government, the Construction Industry Council (CIC), other professional institutions and labour unions. The views of HKCA are often solicited in the formulation of legislation and policies relating to the construction industry in Hong Kong.

(2) The Hong Kong Institute of Construction Managers (HKICM), which was established in 1997, is the only local professional institution representing the construction management profession in Hong Kong. As at 4 April 2019, it has a total of 2,872 members, out of which 1,129 are corporate members. HKICM has been playing an active role in providing responses when it is being consulted in the Government policy, particularly to those topics related to the construction industry and on issues affecting the construction management profession. Further, HKICM has been nominating its representatives to sit in the boards, committee or panels of government and statutory bodies to give expert advice on construction related policies and issues.

¹⁷ Estimation made by the President of the Hong Kong Construction Association

(3) The Building Surveying Division is one of the 6 divisions¹⁸ of the Hong Kong Institute of Surveyors (“HKIS”). As at 1 April 2019, HKIS has 6,896 corporate members in total, out of which 1,350 are Building Surveyors and 3,142 are Quantity Surveyors. Many directors and senior management of listed construction companies are Quantity Surveyors and Building Surveyors¹⁹. The Building Surveying Division provides expertise and feedback to government consultations relating to the technical knowhow, site safety, environmental management and other construction issues.

(4) The Secretary for Development is the head of the Development Bureau, and he oversees the registration of contractors and the construction activities in Hong Kong. The Director of Buildings, the Director of the Lands and the Director of Planning are directly reporting to him. The Works Branch of the Development Bureau is responsible for formulating public works policies and coordinating and monitoring the implementation of public works projects.

(5) The Hong Kong Green Building Council promotes the adoption of green building standards and construction of green buildings in Hong Kong for environmental

¹⁸ They are the Quantity Surveying Division, the Building Surveying Division, the General Practice Surveying Division, the Land Surveying Division, the Property & Facility Management Division and the Planning & Development Division

¹⁹ Information provided by the Chairman of the Building Division of HKIS

protection. In conjunction with the Hong Kong BEAM Society Limited, it establishes standards and guidelines for the environmental performance of buildings in Hong Kong.

Based on the above backgrounds of these five industry leaders, logically they can acknowledge the perceptions and represent the voice of the construction industry in Hong Kong.

4.2 Open-ended Questions

The ten elements identified through literature reviews in Chapter 2 and Chapter 3 were posed to the industry leaders to seek their views on whether each one of these elements would have an impact on the project environmental performance of listed construction companies in Hong Kong, and the reasons behind their views. One further question was on whether they would suggest any further elements to be added to the model. The 11 open-ended questions have been posted to each of them in turn and the interviewees were encouraged to reveal whatever they considered relevant to the subject under discussion. The questions are attached at Appendix H.

4.3 Interview Findings

After interviewing with the aforementioned practitioners (Appendices I & J), the following are my findings :-

4.3.1 Board of Directors

All of the interviewees agreed that the board of directors was a very important element affecting the environmental performance of construction companies. Most of them said that the board was the ‘power-centre’ or the brain of the company and it could dictate the environmental standard for the company to adopt. The board could steer the company’s orientation and make decision on how to deploy the resources to meet the environmental requirements and standard. Three interviewees said that the board of directors should be involved in formulating the environmental policy in accordance with ISO 14000. The feedback from the environmental audits should be directed back to the board so that it could change the strategies, aims and objectives of the environmental management to improve the environmental performance of the company.

Though in theory the large board could have more expertise and resources than small

board, only two interviewees thought that the size of the board would have effects on the environmental performance of construction companies, while the rest disagreed. Those who disagreed said that it was the background of the directors, such as their average education level, green qualifications and expertise, really mattered. Three of the interviewees mentioned that the average age of the board directors would have an effect on the environmental performance and they believed that the young generation (those below forty years' old) would have better environmental awareness than the elderlies. For the inclusion of independent non-executive directors (INEDs) in the board, four of the interviewees agreed that the INEDs should be more environmental conscientious and would support the concepts of corporate social responsibility, and by increasing the number of the INEDs in the board, it should have an impact on the environmental performance of construction companies. Two interviewees thought that the board diversity on gender, that is more female directors in the board, was a factor affecting the environmental performance of listed construction companies, while the other three thought that female directors were neutral and should have very minimal effect on the environmental performance, if any. Those three disagreed interviewees thought that it was the education background and experience of the directors that mattered, not their gender.

All interviewees agreed that the setting up of a green committee (by borrowing the ideas of audit committee or remuneration committee as required under the Hong Kong Stock Exchange rules) would improve the project environmental performance. One interviewee knew that a large listed construction company did have a sustainability committee which had the full support of the board and could deploy resources of the company to resolve all the environmental issues of the company. All interviewees agreed that the green committee could dedicate themselves in dealing with all the important green issues of the listed company, rather than haphazardly leaving them to various staff to deal with. One interviewee suggested that the Hong Kong Stock Exchange should stipulate the setting up of a green committee to be part of the Listing Rules requirements.

All interviewees agreed that the possession of green qualification by the board members would improve the project environmental performance of listed construction companies. Some of them believed that in going through the process of obtaining such green qualification, directors would have acquired some environmental cognitive concepts. This should change their mindset so that they would have better awareness to the various environmental issues of the company.

All interviewees agreed that the remuneration tie-in with the company's environment performance could improve the environmental performance of the construction company, though two of them said that it would be difficult to implement in reality. It is due to the lack of a widely accepted environmental performance index for the construction industry to gauge for any improvement or deterioration in the environmental performance. One interviewee said that the Hong Kong Stock Exchange should provide guidelines to the listed companies on how to quantify the information contained in their environment, sustainability and governance report (ESG Reports) for comparison and benchmarking purpose

Four interviewees agreed that the separate appointment of chairman and chief executive officer (CEO) would improve the environmental performance of listed construction companies. Most of them believed that having the chairman and the CEO as two separate persons could produce a check and balance system, and views from different angles so that a truly informed decision could be made by the board. In doing so, the environmental issues could be dealt with in a better way. Further, they thought that sharing the workload between two persons could discharge their duties better than just having one person carrying all the workload by himself.

4.3.2 Environmental Management System ISO 14000

All of the interviewees concurred that the implementation of an environmental management system such as ISO 14 000 would improve the environmental performance of construction companies, though there was a disparity on the degree of significance of such influence. They were generally aware that while some contractors did genuinely adopt ISO 14 000, others just had it on documentation in order to meet the requirements of government departments or other private developers in the pre-qualification stage of the bidding, and they regarded such “documentation type” of ISO 14 000 certification simply as gimmicks. Two of the interviewees mentioned that the effectiveness of ISO 14 000 implemented would heavily anchor on the quality of the accreditation bodies themselves. One interviewee mentioned that those ISO 14 000 systems accredited by HKQAA were reliable and effective. All of them agreed that a truly implemented ISO 14 000 could reduce the number of breaches on environmental law.

4.3.3 Corporate culture

All interviewees agreed that corporate culture was definitely a factor affecting the environmental performance of construction companies. Three of the interviewees

pointed out that corporate culture was largely mold by the top management such as the chief executive officer or managing director. They saw the environmental training provided in a company as a sign of commitment of the top management to cultivate an environmental culture. The award of “Green Star” in praising and commending the best worker in observing and practicing environmental protection in some large construction company such as Shui On Construction Company Limited and Hip Hing Construction Company Limited could encourage and promote the environmental belief, norm, value, as well as the attitude and behavior of the staff towards environmental protection.

4.3.4 Shareholders

While all the interviewees concurred that influence of shareholders could be a factor affecting the environmental performance of construction companies, they indicated that the influential shareholders were those major shareholders holding a substantial proportion of shares of the company, in particular the chairmen of the companies. Some said that the portion of shares should be a minimum of 15% while others said not less than 20%. They all observed that for a minority shareholder, it was not easy for them to voice out their environmental concerns if there was not such an item in the agenda of the general meeting. The items for discussion were set by the senior

management and those with major shareholdings. Minority shareholder may only put forward their green ideas and views through the AOB item which might only be lightly discussed in the meeting. They opined that the institutional shareholders activism in Hong Kong construction industry was pretty weak.

4.3.5 Customers' expectation

Though all the interviewees agreed that customers' expectation was a factor affecting the environmental performance of construction companies, some subdivided the customers into two categories, namely the developers and the ultimate individual flat or house buyers. They said that while some developers truly desired to gain their reputation by constructing green buildings, quite a lot of them were very much lured by the gross floor area (GFA) exemption that they could built more floor space on top of the statutory maximum under the Buildings Ordinance and Regulations. Three of the interviewees mentioned that some developers did not care about the green features but merely focused on the financial benefits of having extra GFA, and they simply obtained the "unclassified" green building certification which was the bare minimum threshold for green buildings. On the other hand, two interviewees observed that quite a lot of foreign banks were very dedicated in having their bank buildings and retail banking facility structures be built up to platinum standard. Four of the

interviewees opined that the HKSAR Government should extend the green building GFA exemption scheme to LEEDS and other green building award institutions to allow benign competition with the BEAM Plus system. They mentioned that there were a lot of noise from the private green building practitioners reflecting the bureaucracy and partiality of the way BEAM Society Limited in handling the green building award applications. For individual buyers, four of the interviewees believed that they did not care too much about the green features and labelling but they would very much concern about the energy savings since they were the ones to foot the electricity and water bills.

All of the interviewees concurred that by adhering to the green building standards as required under BEAM Plus, listed construction companies would have complied with the various provisions of the environmental legislations.

4.3.6 Government Regulations and Related Control

All interviewees opined that government did play a role in enhancing the environmental performance of construction companies. However, they all saw the environmental regulatory standard in Hong Kong as the minimum threshold and more

proactive environmental strategies should be adopted by construction companies.

Two interviewees mentioned that the two envelope mechanism (i.e. technical score and bidding price score) in government project bidding was very effective since one point technical score deduction due to poor environment performance could equal to several million dollars' worth of one point bidding price score.

All interviewees mentioned the government policy in promoting green buildings through GFA exemption. Four of the interviewees shed light on other government policies, like the viva interview for renewal of registered general building contractor status and the deduction of scores for government project bidding if there were a lot of environmental convictions. Apparently, all these government policies were reinforcing the regulatory control. Two interviewees said that the Buildings Department was considering the deletion of the environmental requirements from the RGBC renewal viva system since the construction industry advocated that only offences relating to site safety should be considered. They thought that there should be a balance between intervention of the government policies and regulations with business in the construction industry. The law and policy should not be too onerous and vexatious to the construction industrialists.

4.3.7 Subcontractors and Suppliers

It was the common ground of all interviewees that the performance of subcontractors and suppliers would affect the environmental performance of construction companies. They agreed that due to the subcontracting mode of business in the construction industry, most of the work were carried out by the subcontractors and suppliers rather than the main contractor. Two interviewees said that the main contractor usually took up the role of financing the subcontractors and the cash flow of the main contractor was vital to the success of a construction project. They reinforced the importance of financial institutions and credit rating agencies on the project environmental performance of listed construction companies mentioned above.

Half of the interviewees mentioned that the suppliers are vital in obtaining green building scores under the BEAM Plus manual since the material source, the mode of transportation of material and the packing for the material would have an impact on the carbon footprint and waste generation.

4.3.8 Competitors

All interviewees concurred that the project environmental performance of the competitors of a construction company would greatly affect the environmental

performance of that company. All of them said that it was obvious because if a listed construction company was lacking behind its competitors in its project environmental performance, it would be penalized in the technical proposal scores when bidding for a government job, and even if it could get the job, there would be a lot of negative complaints due to pollutions emanating from their construction sites and it would attract prosecutions and fines. All these would render the company uncompetitive and might ultimately lose out from the industry. All interviewees mentioned that a construction company could not survive if it was uncompetitive in its project environmental performance when compared with its peers in the industry.

4.3.9 Media and Green NGOs

All interviewees concurred that the media and green NGOs could affect the environmental performance of construction companies because they could shame them if they were not doing well. Two interviewees said that Apple Daily would magnify the negative environmental impact caused by the naughty contractors. They said that senior government official in EPD would read newspapers to see if there were any complaints being published in the news and they would try to deal with them as soon as possible. Four interviewees agreed that one of the most effective ways to deal with environment pollutions in Hong Kong was to report them to the media.

4.3.10 Trade Unions

One interviewee did not think that the unions could have any influence on the environmental performance of construction companies, and two interviewees opined that the influence would be weak. It was because they thought that the trade union Hong Kong Construction Association (HKCA) was simply a “boss club” where all the bosses of construction enterprise met. The union would do anything to support the business interest of the industry. They would even act against the government, if the interest of the industry is at stake. One interviewee pointed out that it was the HKCA which opposed the imposition of imprisonment terms for directors if their companies breached the Noise Control Ordinance when the amendment bill was examined in the Legislative Council in 2003.

In addition to the above observations and comments on the 10 elements identified by literature reviews, the panel of industrial experts also suggested the following 2 additional elements, they were :-

4.3.11 Building Project Team

Three interviewees suggested the building project team could have an impact on the project environmental performance of listed construction companies. They said that

the project team members such as the architects, engineering consultants and surveyors all collaborated with the contractors to uphold the environmental laws and to enhance the environmental performance of the construction companies. Further, two of them mentioned that these project team members were simply putting the environmental law and various codes of practice in their specifications, and they further supervised the contractors to ensure that the contractors would strictly observe them. In other words, they regarded the government law and policy could influence the construction companies more than that of the project team members in their project environmental performance.

4.3.12 Financial Institutions and Credit Rating Agencies

Two interviewees suggested that financial institutions and credit rating agencies could have an influence on the environmental performance of listed construction companies. Literature reviews suggested that when financial institutions and credit rating agencies perceived companies with poor environmental records and felt risky to invest in these companies, they might demand a high risk premium (Henriques & Sadosky, 1996), or voice their discontent by withdrawing capital or refusing to extend new loans (Buysse & Verbeke, 2003).

They said that financial institutions and credit rating agencies invariably adopted the equator principle when they consider lending money to borrowers. Literature reviews showed that this Equator Principles (EPs) was a set of voluntary guidelines adopted by private financial institutions to ensure that large scale development or construction projects appropriately considered the associated potential impacts on the natural environment and the affected communities (Conley & Williams, 2011; Hardenbrook – Vand & Transnat'l L., 2007)

Equator Principles Financial Institutions (EPFIs) formulated their own environmental and social guidelines to comply with the Equator Principles framework, which in turn confirmed compliance with the underlying IFC Performance Standards and World Bank Group EHS Guidelines. EPFIs also established internal management systems to ensure that clients implemented their projects in consideration with the environment and society. Under these management systems, EPFIs would assess the environmental and social impacts of large-scale projects and would incorporate compliance with EPs as a condition of lending (Richardsoni, 2005).

Two interviewees perceived that most construction companies need financing to ease

their cash flow throughout the projects and they thought that if the financial institutions and credit rating agencies could rate construction companies according to their project environmental performance, and based on such rating they could impose an interest premium when they lend money to these construction companies, it would certainly enhance the project environmental performance of construction companies. One of them said that this was one of the most effective mean to tackle environmental problems in the western countries. Both interviewees agreed that though the banks and financial institutions in Hong Kong were not at the moment imposing any penalty interest rate on their lending for listed construction companies whose environmental performance was poor, there was a trend for them to look at the environmental corporate governance which could be reflected in their environment, sustainability and governance (ESG) reports.

One of the interviewee mentioned that credit rating agents were performing similar functions to EPFIs in that they would give a poor rating to those developers or investors who had bad reputation for not taking environmental and social risk management in their projects.

He explained that credit rating was an assessment of the creditworthiness of a borrower in general terms or with respect to a particular debt or financial obligation. Credit assessment and evaluation for construction companies was generally done by a credit rating agency such as Standard & Poor's (S&P), Moody's, or Fitch. These rating agencies were paid by the entity that is seeking a credit rating for itself. (Attig, et al., 2013)

Chapter Summary

The literature reviews on corporate governance and stakeholders theories in Chapter 3 hereinabove together with the findings obtained from interviewing industry leaders in Chapter 4 suggest that there are 12 elements which can affect the project environmental performance of construction companies, and these 12 elements are :-

- (1) “Board of Directors”,
- (2) “Company Culture”,
- (3) “Environmental Management System”,
- (4) “Shareholders”,
- (5) “Customers”,
- (6) “Government”,
- (7) “Subcontractors and Suppliers”,
- (8) “Competitors”,
- (9) “Media and Green NGOs”,
- (10) “Trade Unions”.
- (11) “Building Project Team”, and
- (12) “Financial Institutions and Credit Rating Agencies”,

Further, literature reviews in Chapter 2 together with the interview findings in Chapter 4 suggest that the project environmental performance of listed construction companies in Hong Kong might be affected by the composition, attributes and characteristics of the board of directors, and they are :-

- (a) Size of the board;
- (b) Number of female directors in the board;
- (c) Average age of the board;
- (d) Chairman and CEO duality;
- (e) Number of directors holding green qualification;
- (f) Percentage of INED in the board; and
- (g) Existence of green committee
- (h) Directors' remuneration tie-in with environmental performance of the company

CHAPTER 5

Methodology

- 5.1 Formulation of Models and Hypotheses
 - 5.2.1 The ‘Twelve Variable’ Model
 - 5.2.2 Eight Hypotheses
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 - 5.2.1 Critical Factors Affecting Project Environmental Performance
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- 5.5 Limitation of the statistical methods
 - 5.5.1 Exploratory Factor Analysis
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Chapter Summary

Chapter 5 : Methodology

5.1 Formulation of models and hypotheses

Based on the literature reviews in Chapter 2 and Chapter 3 together with the interview findings in Chapter 4, I am now going to :-

- (a) devise a model to encapsulate the critical variables affecting the project environmental performance of listed construction companies, and
- (b) propose hypotheses that certain attributes and characteristics of board of directors can affect the project environmental performance of listed construction companies.

5.1.1 The ‘Twelve Element’ Model

Based on literature reviews and observations, views and opinions of industrial experts, a new model containing the twelve elements affecting the project environmental performance construction companies in Hong Kong is formulated (Figure 5.1). Each element previously identified is a variable for the purpose of the statistical analyses in the following chapters.

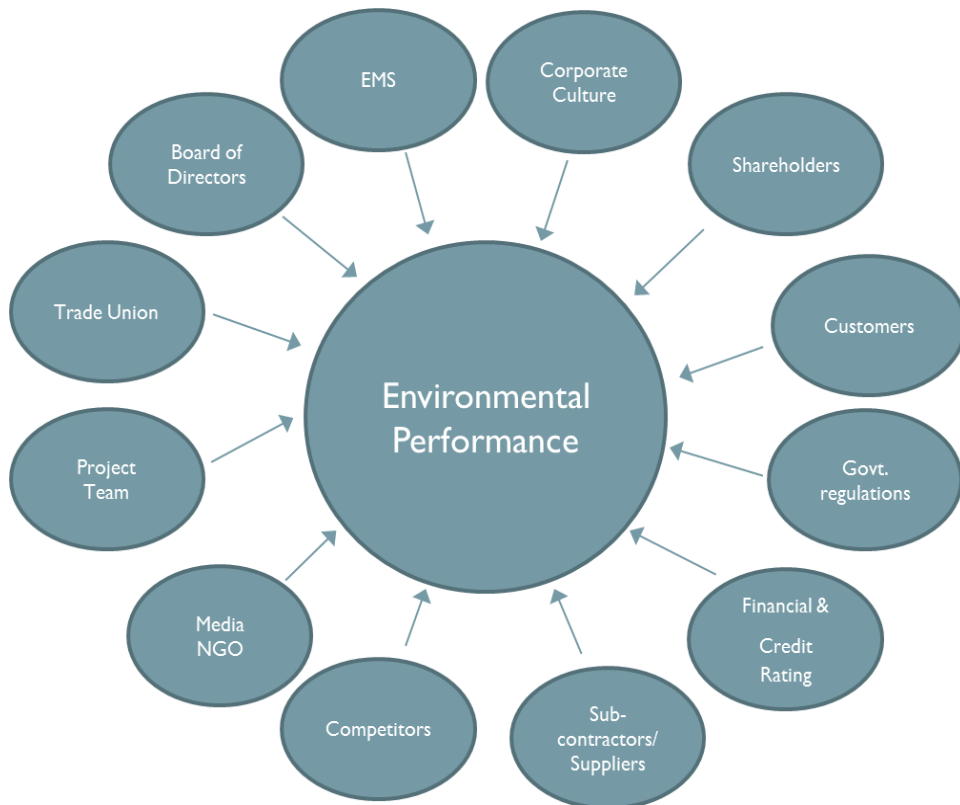


Figure 5.1 : The 12 Elements Model – 12 variables affecting the project environmental performance of listed construction companies in Hong Kong

5.1.2 Eight Hypotheses

Further, within the variable²⁰ of the board of directors, the eight compositions and attributes of the board of directors might have an influence on the project environmental performance of listed construction companies, they are :-

- (a) Size of the board
- (b) Number of female directors in the board
- (c) Average age of the board

²⁰ For statistical analyses purpose, the elements are now called as variables

- (d) Chairman and CEO duality
- (e) Number of directors holding green qualification
- (f) Percentage of INED in the board
- (g) Existence of green committee
- (h) Remuneration of directors tie in with company's environmental performance

Based on the above, eight null hypotheses are postulated below for testing:-

- (a) Hypothesis No.1 (H_0^1) : $\mu_{H1} < \mu_3$ (one-tailed)

H_0^1 : The population mean for effect of the size of the board on the project environmental performance is less than 3, that is the effect is not significant

- (b) Hypothesis No.2 (H_0^2) : $\mu_{H2} < \mu_3$ (one-tailed)

H_0^2 : The population mean for effect of the number of female directors in the board on the project environmental performance is less than 3, that is the effect is not significant

- (c) Hypothesis No.3 (H_0^3) : $\mu_{H3} < \mu_3$ (one-tailed)

H_0^3 : The population mean for effect of the average age of the board directors on the project environmental performance is less than 3, that is the effect is not significant

(d) Hypothesis No.4 (H_0^4) : $\mu_{H4} < \mu_3$ (one-tailed)

H_0^4 : The population mean for the effect of chairman and CEO duality on the project environmental performance is less than 3, that is the effect is not significant

(e) Hypothesis No.5 (H_0^5) : $\mu_{H5} < \mu_3$ (one-tailed)

H_0^5 : The population mean for the effect of the number of directors holding green qualification on the project environmental performance is less than 3, that is the effect is not significant

(f) Hypothesis No.6 (H_0^6) : $\mu_{H6} < \mu_3$ (one-tailed)

H_0^6 : The population mean for the effect of the implementation of directors' remuneration tie-in with the environmental performance on the project environmental performance is less than 3, that is the effect is not significant.

(g) Hypothesis No.7 (H_0^7) : $\mu_{H7} < \mu_3$ (one-tailed)

H_0^7 : The population mean for the effect of the number of INEDs in the board on the project environmental performance is less than 3, that is the effect is not significant

(h) Hypothesis No.8 (H_0^8) : $\mu_{H8} < \mu_3$ (one-tailed)

H_0^8 : The population mean for the effect of the existence of green committee in the board on the project environmental performance is less than 3, that is the effect is not significant

where μ_{Hx} is the population mean with respect to the attribute x, and μ_3 is equal to 3, the score for having significant impact of the attribute on the project environmental performance.

5.2 Questionnaire-based surveys

Two sets of questionnaires-based survey are devised. They are attached at Appendix K and Appendix L. The first set shown in Appendix K is used to acquire the views from directors and senior managers of listed construction company on what extent each of the 12 elements²¹ identified in the model affect the project environmental performance of listed construction companies in Hong Kong.

The second set of questionnaires shown in Appendix L is used to obtain the views from board directors of listed construction companies in Hong Kong on whether there is any significant relationship between the project environmental performance of listed construction companies in Hong Kong and the eight different compositions and attributes of their board of directors, again one by one respectively.

²¹ they are the variables for statistical analyses

5.2.1 Critical factors affecting project environmental performance

The first set of questionnaires (Appendix K) was sent to 226 directors and/or senior management of 27 Hong Kong listed construction companies (Appendix M) out of all the 135 listed construction companies in Hong Kong as listed in the AASTOCK.com website²² on 10 April 2019. They include associate directors, project directors, construction directors, non-executive directors of the board, independent non-executive directors of the board, executive directors of the board, chief executive officers and chairmen of listed construction companies in Hong Kong. The choice of the 27 listed companies are based on their size in terms of their market capitalization. Market capitalization is the value equal to the total number of shares multiplied by the share price.

In this study, listed construction companies with market capitalization of less than 500M are regarded as small, those with market capitalization between HK\$500M and HK\$1,000M are regarded as medium, and those with market capitalization greater than HK\$1,000M (i.e. HK\$1B) are regarded as large²³. With such classification, within all the 135 listed construction companies in Hong Kong, there are 24

²² The industrial details – Construction & Decoration – Properties & Construction
www.aastocks.com/en/stocks/market/industry/sector-industry-details.aspx?industrysymbol=6021

²³ 'small' if market capitalization ≤ HK\$500M; 'medium' if market capitalization > HK\$500M and < HK\$1,000M; and 'large' if market capitalization ≥ HK\$1,000M (i.e. HK\$1B)

large-sized (18%), 36 medium-sized (27%) and 75 small-sized (55%). Analyses of the nature and size of the 27 listed construction companies chosen for our studies are shown in Appendix M. Within these 27 samples, there are 4 large-sized (15%), 8 medium-sized (30%), and 15 small-sized listed construction companies. The size distribution of the sample is roughly in line with that of the population, i.e. all the listed construction companies in Hong Kong.

The recipients of the first set questionnaire were asked to grade the influence of each element with a Likert scale from “1” to “7”. “7” represents the one with the greatest influence on the project environmental performance and “1” the lowest. The questionnaires were sent to them through emails and WhatsApps. Some questionnaires were delivered in person and they were filled on the spot. There were in total 88 valid returns.

5.2.2 Project environmental performance and attributes of board of directors

The second set of questionnaire-based survey (Appendix L) was conducted on a sample of board directors selected from the same 27 listed construction companies in Hong Kong (Para.5.2.1 above) The recipients of questionnaire were asked that in their own opinions to what extent could the project environmental performance of listed construction companies be affected by each of the eight compositions and attributes of their board of directors as identified in Chapter 2.

Recipients of the questionnaire were asked to grade the improvements in the environmental performance with a Likert scale from “1” to “5” :-

“5” represents very definite and very strong impact on the project environmental performance of the listed construction company

“4” represents strong impact on the project environmental performance of the listed construction company

“3” represents significant impact on the project environmental performance of the listed construction company²⁴

“2” represents insignificant impact on the project environmental performance of the

²⁴ Note that the ‘mid-point’ of the Likert Scale ‘3’ is the turning point. Any grade less than 3 means the respondent to the questionnaires does not agree that the attribute has any significant effect on the environmental performance, and vice versa for any grade greater than or equal to ‘3’.

listed construction company

“1” represents no impact at all on the project environmental performance of the listed construction company

Out of 56 questionnaires sent to board directors of 27 listed construction companies in Hong Kong (Appendix M), there were 31 valid returns.

5.3 Statistical Analyses

Two types of statistical analyses will be used. They are the exploratory factor analysis and the one sample difference of means p-value testing analysis²⁵.

5.3.1 Exploratory Factor Analysis (EFA)

Statistical analysis known as ‘Exploratory Factor Analysis (EFA)’ has been conducted to find out the relationship and their relative importance among those 12 variables²⁶ previously identified.

Factor analysis is a collection of methods used to examine how underlying constructs influence the responses on a number of measured variables. Basically, there are two

²⁵ Also known as one sample Z-test

²⁶ They are called elements in previous Chapters

types of factor analysis: exploratory and confirmatory. Exploratory factor analysis (EFA) endeavours to discover the nature of the constructs influencing a set of responses and it is based on the Common Factor Model. Factor analyses are carried out by examining the pattern of correlations (or covariances) between the observed measures. Measures that are highly correlated (either positively or negatively) are likely influenced by the same factors, while those that are relatively uncorrelated are likely influenced by different factors (DeCoster, 1998).

The primary objectives of an EFA are to determine : (a) the number of common factors influencing a set of measures, and (b) the strength of the relationship between each factor and each observed measure (Williams, et al., 2010).

EFA is heuristic in its process. In EFA, the researcher has no expectations of the number or nature of the variables. It is exploratory in nature and allows the researcher to explore the main frame to generate a theory, or model from a relatively large set of latent constructs to be represented by a smaller set of items (Williams, et al., 2010).

From literature reviews, there are several observations in applying the EFA :-

- (a) By using the EFA, a large number of measured variables are assumed to be related to a smaller number of unobserved factors which are intended to be found out by the EFA. The number of measured variables to include in the EFA should be carefully considered in order to obtain the most accurate results (Fabrigar et al, 1999). The first step is to review whether the size and nature of data are suitable for factor analysis. Although sample size is important in factor analysis, there are varying opinions. The lack of agreement is noted by Hogarty et al. (2005) who stated that these *“disparate [sample size] recommendations have not served researchers well”*. According to MacCallum, et al. (1999), cited in Henson and Roberts (2006), that such rule of thumb could sometimes be misleading and it did not take into account the complex operation of factor analysis : *“They illustrated that when communalities are high (greater than 0.60) and each factor is defined by several items, sample sizes can actually be relatively small”*. Others such as Guadagnoli & Velicer (1998) found that solutions with correlation coefficients > 0.80 can justify the use of small sample size.

Previous studies revealed that the nature of data would determine the adequacy of sample size (Fabrigar, et al. 1999; MacCallum, et al. 1999). In theory, the stronger

the data, the smaller the sample could be for an accurate analysis. “Strong data” in factor analysis meant uniformly high communalities without cross loadings, and there are several variables loading strongly on each factor (Costello & Osborne, 2005).

To conclude, based on the literature reviews, there is no hard and fast rule stipulating the minimum size of the sample required for the EFA. In this research, in finding the critical factors for affecting the project environmental performance of listed construction companies in Hong Kong, a sample size of 88 is used.

There is another set of recommendations which provides researchers with guidance regarding the number of participants required for each variable, often termed, the sample to variable ratio, and often denoted as N:p ratio where N refers to the number of participants and p refers to the number of variables. From literature reviews, again the same disparate recommendations also occur for sample to variable ratios as they do for determining adequate sample sizes. Hogarty et al., (2005) noted that “*our results showed that there was not a minimum level of N or N:p ratio to achieve good factor recovery across conditions examined*”. In our analysis, the N:P ratio is about 7.3.

(b) Prior to the extraction of the factors, several tests should be used to assess the suitability of the respondent data for factor analysis. These tests include 'Kaiser-Meyer-Olkin (KMO)', 'Measure of Sampling Adequacy', and 'Bartlett's Test of Sphericity' (Williams, et al., 2010). The KMO index, in particular, is recommended when the cases to variable ratio are less than 1:5. The KMO index ranges from 0 to 1, with 0.50 considered suitable for factor analysis. The Bartlett's Test of Sphericity should be significant ($p < 0.05$) for factor analysis to be suitable (Williams, et al., 2010).

(c) The next step is to determine how the factors be extracted by rotation. The aim of rotation is to simplify the factor structure of a group of items, or in other words, high item loadings on one factor and smaller item loadings on the remaining factor solutions. There are numerous ways to extract factors: principal components analysis (PCA), principal axis factoring (PAF), image factoring, maximum likelihood, alpha factoring, unweighted least squares, generalized least squares, image factoring and canonical. However, PCA and PAF are used most commonly in the published literatures. The decision whether to use PCA and PAF has been fiercely debated among analysts, although according to Thompson & Daniel (1996)

the practical differences between the two are often insignificant, particularly when variables have high reliability, or where there are 30 or more variables. As suggested by Pett, et al. (2003), following PCA analysis, PAF should also be examined for comparison and assessment for best fit. In other words, whichever rotated solution produces the best fit and factorial suitability, both intuitively and conceptually, should be used.

(d) The third step is to find out what criteria will assist in determining factor extraction.

The aim of the data extraction is to reduce a large number of variables into factors. In order to produce scale uni-dimensionally and to simplify the factor solutions, several criteria are available to researchers. However, given the choice and sometimes confusing nature of factor analysis, no single criteria should be assumed to determine factor extraction. This is reinforced by Thompson & Daniel (1996), who stated that the “*simultaneous use of multiple decision rules was appropriate and often desirable*”. Hair et al. (1995) point out that the majority of factor analysts typically use multiple criteria. Many extraction rules and approaches exist and they include Kaiser’s criteria (eigenvalue > 1 rule), the Scree test, the cumulative percent of variance extracted, and the parallel analysis. It is suggested that multiple approaches be used in factor extraction (Hair et al.,

1995)

- (e) As noted by Gorsuch (1997) and Tabachnick, et al. (2007), interpreting Scree plots is subjective, requiring researcher judgement. The “Scree Test” is given its name by Cattell (1966) due to the Scree Test graphical presentation, which has visual similarities to the rock debris (scree) at the foot of a mountain. In inspecting and interpretation of a Scree plot, it may involve two steps : (i) draw a straight line through the smaller eigenvalues where a departure from this line occurs. This point highlights where the debris or break occurs. (If the Scree is messy, and difficult to interpret, additional manipulation of data and extraction should be undertaken), and (ii) the point above this debris or break (not including the break itself) indicates the number of factors to be retained (Williams, et al., 2010). Following these analyses a final number of factors or best-fit solution will be presented. At this point the researcher will require careful and thoughtful judgement on which solution is the best-fit and which of the factors extracted make the most conceptual sense.
- (f) Another consideration when deciding the number of factors can analyze the data at hand is whether a variable might relate to more than one factor. Rotation

maximizes high item loadings and minimizes low item loadings, therefore producing a more interpretable and simplified solution. There are two common rotation techniques: orthogonal rotation and oblique rotation. Researchers have several methods to choose from both rotation options, for example, orthogonal varimax / quartimax, oblique oblimin / promax, or oblimin with Kaiser Normalization.

- (g) Interpretation involves the researcher examining which variables are attributable to a factor, and giving that factor a name or theme. Traditionally, at least two or three variables must load on a factor so it can be given a meaningful interpretation. The labelling of factors is a subjective, theoretical, and inductive process. Henson & Roberts (2006) noted that *“the meaningfulness of latent factors was ultimately dependent on researcher’s definition”*.

Despite EFA being a seemingly complex statistical approach, the approach taken in the analysis is in fact sequential and linear, involving many options. With the assistance of the statistical computer program known as Statistical Package for the Social Sciences (SPSS), the EFA can be carried out and the KMO values, eigenvalues, scree plot and the factor matrix can all be generated without much difficulty.

5.3.2 One Sample Z-test : P-Value Hypotheses Testing

In the analysis on the questionnaire survey for finding out which attributes of the board of directors can affect the project environmental performance of listed construction companies in Hong Kong, the ‘one sample difference of means test’, or commonly referred to as ‘one sample Z-test’, will be applied. By this method, a single sample mean is being compared to a population mean. There are three requirements and assumptions in applying the one sample Z-test, and they are : (a) the sample so taken must be a random one; (b) population from which sample is drawn is normally distributed and (c) variable is measured at interval or ratio scale; and (d) for sample greater than 30, the following test statistics (McGrew & Manroe, 2014) should be applied :-

$$Z = (\bar{x} - \mu)/s/\sqrt{n} \quad \text{for } n \geq 30$$

where

Z is the Z-score,

n is the sample size,

\bar{x} is the sample mean,

s is the sample standard deviation, and

μ is the population mean.

Using the null hypothesis for each parameter in turn, and through statistics in estimating the population mean can be found from the sample mean and sample standard deviation using 99% confidence level for one tail. From Z-score table (Appendix K) :-

For $n = 31$, $p\text{-value} = 0.99$, $Z = 2.3266$.

The null hypothesis is that $\mu < \mu = 3$, i.e. there is no significant relationship between the project environmental performance of the listed construction company and the parameter under investigation.

5.4 Validations

5.4.1 Results obtained from the first set of questionnaires

The same five industry leaders listed in Chapter 4 were interviewed to obtain their views on the results of the factor analysis. The results obtained from the EFA were brought before them for their comments. The observations and comments from these interviewees are delineated in Para. 7.3 of Chapter 7.

5.4.2 Results obtained from the second set of questionnaires

Case studies on two listed companies with specific board characteristics that have different environmental performance would be examined to validate the results obtained from the one sample difference of means statistical test : One company with small sized board and high proportion of female directors and INEDs in the board; and the other company with a large sized board, no female director and the existence of a green board committee. The observations and comments on the statistical results are delineated in Chapter 7.

5.5 Limitations of the Statistical Methods

5.5.1 Exploratory Factor Analysis

Firstly, in determining how many factors to include in the model will require the researcher to balance the need for parsimony (i.e., a model with relatively few common factors) against the need for plausibility (i.e., a model with a sufficient number of common factors to adequately account for the correlations among measured variables) (Fabrigar, et al., 1999). Thus, the researcher should aim at determining the number of "major" factors underlying a battery of measures. Errors in selecting the number of factors in a model can have a substantial effect on the results obtained (Comrey, 1978; Fava & Velicer, 1992; Levonian & Comrey, 1966; Wood, et al., 1996).

Secondly, as mentioned earlier in Paragraph 5.3.1, the labelling of factors is a rather subjective. The meaningfulness of latent factors depends entirely on researcher's definition (Henson & Roberts, 2006).

5.5.2 One Sample Difference of Means Test

It is also known as the one sample Z-test. As the estimation of the population from a sample mean and standard deviation requires the selection of the significant level of probability, which can be quite arbitrary, consequently the value of the population mean can be different, though the different is not large. Further three assumptions have to be fulfilled for the test to be correctly applied, they are : (a) the sample so taken must a random one; (b) population from which sample is drawn is normally distributed and (c) variable is measured at interval or ratio scale.

Chapter Summary

Two sets of questionnaires-based survey were carried out. The purpose of the first set is to find out what are the critical factors as perceived by construction companies in Hong Kong that can affect their project environmental performance. The second set is to find out whether there is any significant relationship between the environmental performance of listed construction companies in Hong Kong, and the composition and attributes of their board of directors.

A sample of 27 listed construction companies has been chosen out of 135 total number of all the listed construction companies in Hong Kong. The distribution of the market capitalization of companies within the sample matches with that of the population.

In the first set of questionnaires, the participants graded the influence of 12 elements on a Likert scale of '1' to '7'. 226 questionnaires were sent to the directors and senior management of the listed companies in our sample and there were 88 valid returns. Statistical analyses known as 'Exploratory Factor Analysis (EFA)' would be conducted to find out the relationship and their relative importance among those 12 elements previously identified, and the results would be discussed in the following chapters.

Interviews with industry leaders would also be carried out to validate the results obtained from the first set of questionnaires.

In the second set of questionnaires, the participants who are the directors of listed companies in our sample were asked to grade the influence of various attributes of the board of directors on the project environmental performance of construction companies on a Likert scale of '1' to '5', with 5 being the highest. Out of 56 questionnaires sent to board directors of listed construction companies in Hong Kong, there were 31 valid returns. Hypotheses have been set up for each attribute of the board and they were statistically tested by using the one sample difference of means p-value test.

Further, two listed companies with specific board characteristics that have different environmental performance would be examined to validate the statistical results : one company with small sized board and high proportion of female directors and INEDs in the board; and the other company with large sized board, no female director and existence of a green board committee.

CHAPTER 6

Data Analyses and Research Results

- 6.1 Critical Factors Affecting the Project Environmental Performance
 - 6.1.1 The Results of the KMO and Barlett's Test
 - 6.1.2 Extraction of Factors
 - 6.1.3 The Eigenvalues
 - 6.1.4 The Scree Plot
 - 6.1.5 Factor Matrix
 - 6.1.6 Pattern Matrix
 - 6.1.7 Factor Correlation Matrix

- 6.2 Environmental Performance and the attributes of the board of directors
 - 6.2.1 The data obtained from questionnaires
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 - 6.2.3 Observations from the distribution histograms
 - 6.2.4 Estimation of the population mean and testing the hypotheses
 - 6.2.5 Conclusion drawn from the data and hypotheses testing

Chapter Summary

Chapter 6 : Data Analyses and Research Results

6.1 Critical factors affecting the project environmental performance

The data obtained from questionnaire survey are tabulated at Appendix N and they are now statistically analyzed. The correlations among all the elements indicate that there was no linear dependency in the correlation matrix. The value for the determinant of the matrix range between 0 and 1, and therefore it is logical and reasonable to apply factor analysis to these data.

In considering the use of factor analysis, it is necessary to conduct Kaiser-Meyer-Olkin Test (KMO) and Barlett's Test of Sphericity to determine whether there is sufficient number of significant correlations among the variables. KMO is a measure of sampling adequacy that compares the magnitudes of the observed correlation coefficients to those of the partial correlation coefficients (Pett et al., 2003). KMO value ranges between 0 and 1, and a presence of small value indicates that the use of factor analysis is inappropriate. According to Kaiser (1974), only values of greater than 0.5 are acceptable, and the level of acceptance for KMO is as below :-

KMO Value	Comment
0.90 – 1.00	Marvelous
0.80 – 0.89	Meritorious
0.70 – 0.79	Middling
0.60 – 0.69	Mediocre
0.50 – 0.59	Miserable
0.00 – 0.49	Unacceptable

Table 6.1 : Acceptance level of KMO Value

Further, the matrix should have sufficient correlations to justify the application of a factor analysis, and Bartlett's Test of Sphericity which examines the correlations among the variables should be applied. Bartlett's Test of Sphericity is used to test the null hypothesis that the correlation matrix is an identity matrix (i.e. there is no relationship among the items) (Pett et al., 2003). A matrix can be factor analyzed if the null hypothesis is rejected and the Bartlett's Test of Sphericity is found to be significant.

6.1.1 The Results of the KMO and Bartlett's Test

The results of the KMO and Bartlett's Test are shown below:-

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.742
Bartlett's Test of Approx. Chi-Square	358.130
Sphericity df	66
Sig.	.000

Table 6.2 : Results of the KMO and Bartlett's Test

From the table above and based on our collected data the KMO measure of sampling adequacy is 0.742, which is 'Middling' according to Table 6.1. Since the value of the Bartlett's Test of Sphericity is 358.130 and the associated significance level is small, it is very likely that the correlation matrix is not an identity matrix. Based on these statistical results, it can be concluded that factor analysis is an appropriate statistical method to be adopted.

6.1.2 Extraction of Factors

Principal axis factoring (PAF) is applied to identify the underlying factors. PAF is regarded as common factor analysis assuming that the variance in a given variable can be explained by a small number of underlying common factors and by the variance that is unique to the variable. The factors in PAF are not defined as linear combinations of the observed variables as they are generated from common variance instead of total variance (Pett et al., 2003). In order to determine how many factors should be extracted to represent the variables, several basic criteria can be applied (Pett et al., 2003) : (i) extracting factors with eigenvalues greater than 1.0 (Kaiser's

criterion); or (ii) factors should be stopped extracting when the cumulative percentage of variance is over 60% (Hair et al., 1995) for humanities research, or (iii) the last factor accounting for only a small portion of the explained variance (rule of thumb < 5%); or (iv) through examination of the extracted factors by means of a scree plot. Amongst these four tests, the Kaiser's criterion (i) is the dominant rule (Williams, et al., 2010), though multiple approaches should be adopted in factor extraction (Para. 5.3.1(d) of Chapter 5).

An eigenvalue (λ) in PAF represents the amount of common variance among the variables that are explained by a particular common factor (Pett et al., 2003). It can be negative and positive but in the factor analysis, all eigenvalues have to be greater than 0 as they represent the amount of explained variance in the variables associated with a common factor (Pett et al., 2003).

6.1.3 The Eigenvalues

The eigenvalue for each factor is presented in the table below: -

Total Variance Explained							Rotation
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Sums of Squared Loadings ^a
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.124	34.370	34.370	3.696	30.797	30.797	2.445
2	1.649	13.745	48.115	1.236	10.303	41.100	2.029
3	1.311	10.926	59.041	0.853	7.106	48.206	1.655
4	1.174	9.787	68.828	0.682	5.687	53.894	2.475
5	.898	7.484	76.312				
6	.591	4.928	81.240				
7	.525	4.376	85.616				
8	.437	3.639	89.256				
9	.386	3.218	92.474				
10	.354	2.952	95.425				
11	.319	2.662	98.087				
12	.230	1.913	100.000				

Table 6.3 : The eigenvalue and the variance explained for each factor in the Principal axis factoring analysis

Total variance explained by each factor and the percentage of total variance contribution to each of them are also listed in the table above. It can be observed that the first four factors have eigenvalues greater than 1.0 and accumulated % of variance explained is 68.828% (> 60%) Since the fifth factor has eigenvalue less than 1.0, according to Kaiser's criterion, four factors should be extracted to represent the data.

6.1.4 The Scree Plot

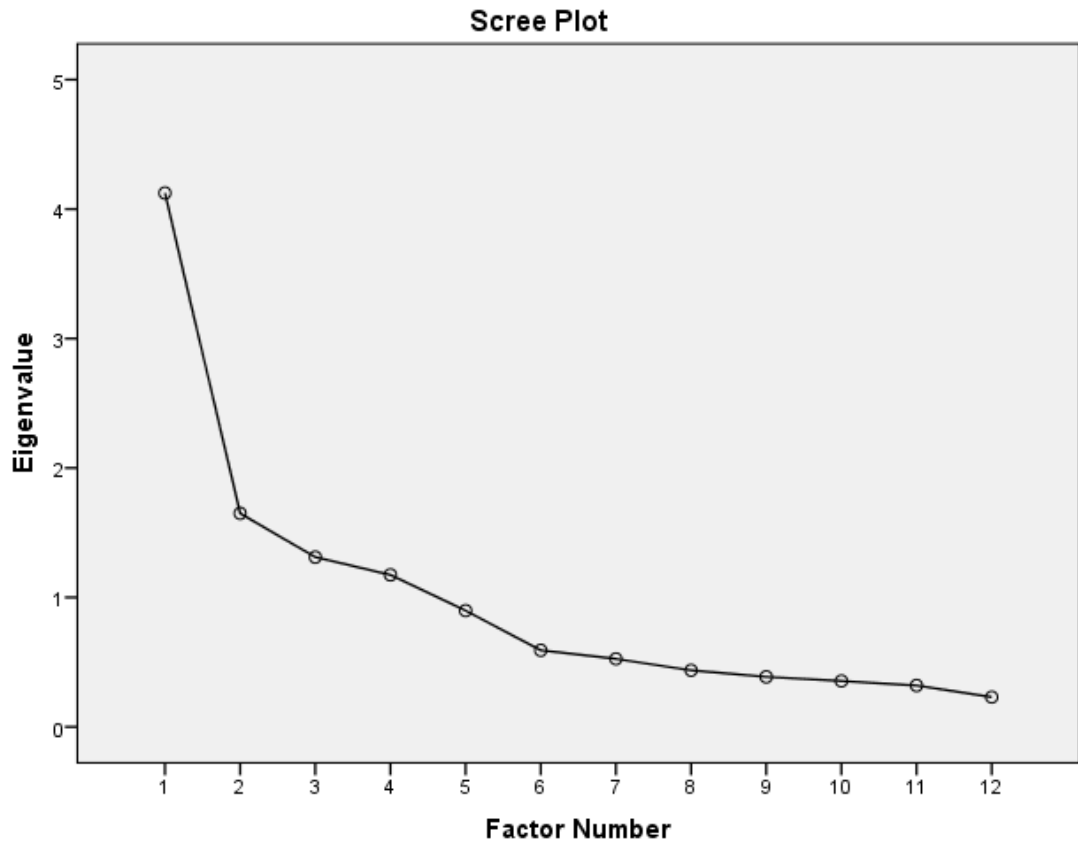


Figure 6.1 : Scree plot showing the change of eigenvalue with the number of factors

The scree plot above is a visualized method to decide how many factors to be extracted. The figure also shows four factors should be extracted in the factor analysis.

6.1.5 Factor Matrix*

	Factor			
	1	2	3	4
Competitors' environmental performance	0.733	-0.092	0.082	-0.373
Media and green NGOs' supervision	0.649	-0.266	0.014	-0.252
Establishment of green corporate culture	0.644	0.448	-0.251	-0.073
Trade unions' influence	0.637	-0.448	-0.249	0.157
Building project teams' influence	0.555	-0.228	-0.099	0.306
Implementation of an effective environmental management system such as ISO 14 000	0.537	0.225	-0.176	0.355
Suppliers' and sub-contractors' influence	0.535	-0.523	0.130	0.139
Financial institutions and credit rating agencies' influence	0.515	0.138	0.092	-0.361
Government policies and regulatory control	0.465	0.271	0.423	0.140
Shareholders' influence	0.347	0.041	-0.241	-0.155
Board of directors' leadership on environmental protection	0.442	0.500	-0.262	0.106
Customer's expectations	0.485	0.187	0.591	0.159

Extraction Method: Principal Axis Factoring (* 4 factors extracted, and 22 iterations required)

Table 6.4 : Results of factor extraction using the Principal axis factoring

The above table shows the result of extraction using the factor analysis. The results are generated after 22 iterations. To achieve the simplest factor structure, and to obtain meaningful and more interpretable factors, Promax rotation with a power (Kappa) of 4 has been applied. Promax rotation assists in finding correlations amongst the extracted factors. It is a reasonable assumption in the practical world that factors are correlated because different aspects of a dimension, although separated are invariably correlated to some extent (Pett et al., 2003). Promax rotation raised the factor loadings to mathematical powers so that the moderate and low loading factors are reduced while the high loading one remained substantial (pett et al., 2003). By maximizing the differences between the high and low loadings on a particular factor, the factor structure became simpler, obvious, interpretable and meaningful (Norusis, 2004). The pattern matrix generated from rotation is shown below.

6.1.6 Pattern Matrix^a

	Factor			
	1	2	3	4
Competitors' environmental performance	0.717	-0.011	0.135	0.166
Financial institutions and credit rating agencies' influence	0.596	0.086	0.161	-0.105
Media and green NGOs' supervision	0.561	-0.082	0.032	0.347
Shareholders' influence	0.298	0.236	-0.160	0.084
Board of directors' leadership on environmental protection	0.046	0.706	0.065	-0.072
Establishment of green corporate culture	0.322	0.664	0.061	-0.048
Implementation of an effective environmental management system such as ISO 14 000	-0.148	0.568	0.155	0.312
Customer's expectations	0.073	-0.014	0.776	0.043
Government policies and regulatory control	0.069	0.138	0.637	-0.007
Trade unions' influence	0.131	0.084	-0.151	0.776
supplier and sub-contractors' influence	0.129	-0.244	0.141	0.699
Building project teams' influence	-0.061	0.177	0.076	0.625

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization

(**Rotation converged in 13 iterations)

Table 6.5 : Results of factor extraction with Promax rotation with a power (Kappa) of 4

After 13 iterations, the rotation provides the following results :-

- (a) The first factor is consisted of 4 components, viz. “competitors’ environmental performance”, “financial institutions and credit rating agencies’ influence”, “media and green NGOs’ supervision” and “shareholders’ influence”. Let us label this factor as “Business Competitiveness”. The reasons for such label will be provided in Chapter 7.

- (b) The second factor is consisted of 3 components, viz. “board of directors’ leadership on environmental protection”, “establishment of green corporate culture” and “implementation of an effective environmental management system”. Let us label this factor as “Green Corporate Governance”. The reasons for the label will be provided in Chapter 7.

- (c) The third factor is consisted of 2 components, viz. “customers’ expectations” and “government policies and regulatory control”. Let us label this factor as “Government Requirements”. The reasons for the label will be provided in Chapter 7.

- (d) The fourth factor is consisted of 3 components, viz. “trade unions’ influence”,

“suppliers’ and sub-contractors’ influence” and “building project teams’ influence”.

Let us label this factor as “Collaborators”. The reasons for the label will be provided in Chapter 7

6.1.7 Factor Correlation Matrix

Factor	Business Competitiveness	Green Corporate Governance	Government Requirements	Collaborators
Business Competitiveness	1.000	0.309	0.223	0.364
Green Corp. Governance	0.309	1.000	0.203	0.200
Government requirements	0.223	0.203	1.000	0.205
Collaborators	0.364	0.200	0.205	1.000

Extraction Method: Principal Axis Factoring.

(Rotation Method: Oblimin with Kaiser, Normalization)

Table 6.6. : Factor correlation matrix of the 4-factor solution

The factor correlation matrix shows the correlation coefficient between each pair of factors. In our analyses, the greatest correlation coefficient was 1 which meant the two factors were perfectly correlated to each other. A correlation coefficient of 0 meant the two factors were not related to each other at all. A correlation coefficient below 0.5 means there is a weak correlation between the two factors, and vice versa.

The factor correction matrix shown at Table 6.6 indicates that the correlation between

any of these four critical factors is weak. In other words, they stand on their own.

To conclude the statistical findings, the Exploratory Factor Analysis shows that as perceived by the listed construction companies in Hong Kong, there are four critical factors affecting their project environmental performance, they are in order of priority :

(a) the Business Competitiveness, (b) the Green Corporate Governance; (c) the Government Requirements; and (d) the Collaborators.

6.2 Environmental Performance and the attributes of the board of directors

6.2.1 The data obtained from questionnaires

The results of the 2nd set of questionnaire survey are tabulated below:-

Reply	Size of Board	No. of Female Director	Avg. Age	Chairman & CEO Duality	Green Qualification	Percentage of INED	Green Committee	Remuneration Tie in with Environmental Performance
1	4	4	5	5	5	2	5	3
2	4	4	4	5	5	4	5	5
3	4	4	4	5	5	5	5	5
4	4	4	4	3	5	4	5	5
5	5	5	5	5	5	4	5	5
6	3	1	3	4	4	4	4	4
7	2	1	3	1	4	1	2	2
8	5	5	5	4	5	4	4	4
9	4	4	4	5	4	4	4	5
10	3	1	4	5	4	1	5	5
11	5	4	4	5	4	4	4	4
12	2	3	4	4	5	4	5	5
13	4	1	2	5	4	3	4	4
14	3	4	4	4	4	3	3	4
15	3	2	2	4	4	3	3	4
16	3	4	3	4	3	4	3	4
17	3	3	3	4	5	3	5	5
18	4	1	2	5	4	4	5	4
19	4	4	4	5	5	5	5	5
20	3	3	4	5	4	3	4	5
21	1	4	4	5	2	1	2	2
22	1	1	2	1	4	3	4	5
23	5	4	4	5	5	5	5	5
24	5	1	1	4	3	1	3	4
25	4	4	4	5	5	4	5	4
26	3	2	2	5	5	5	3	5
27	1	1	4	5	5	5	5	4
28	3	2	4	5	5	4	4	5
29	3	4	4	4	4	3	4	3
30	1	1	3	5	5	5	5	1
31	5	4	5	5	5	5	5	5
Mean	3.35	2.90	3.55	4.39	4.39	3.55	4.19	4.19
SD	1.25	1.42	1.03	1.05	0.76	1.26	0.95	1.05

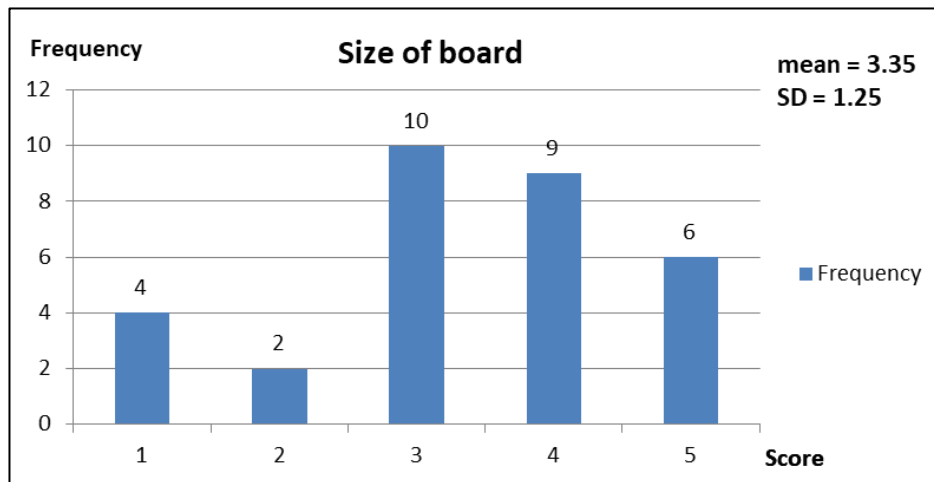
Table 6.7 : The results of the 31 collected valid responses and the corresponding mean and SD of the grading of the Likert Scale

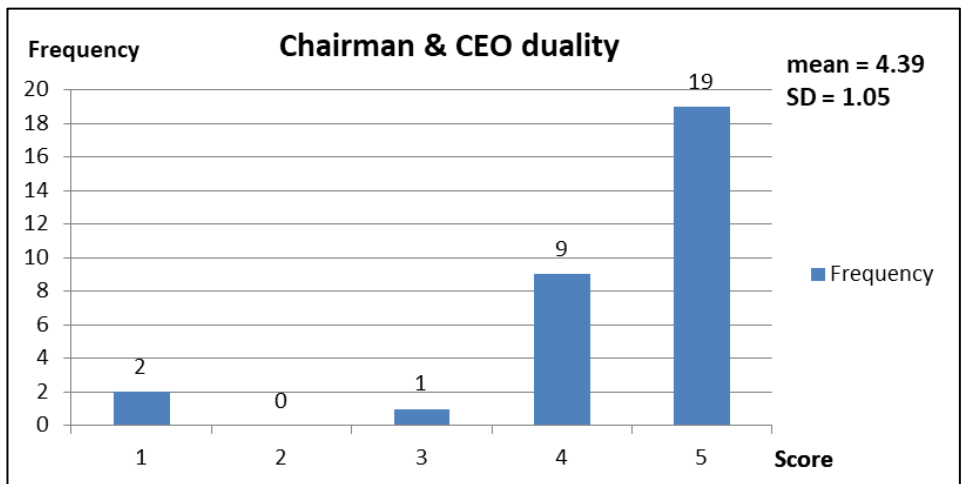
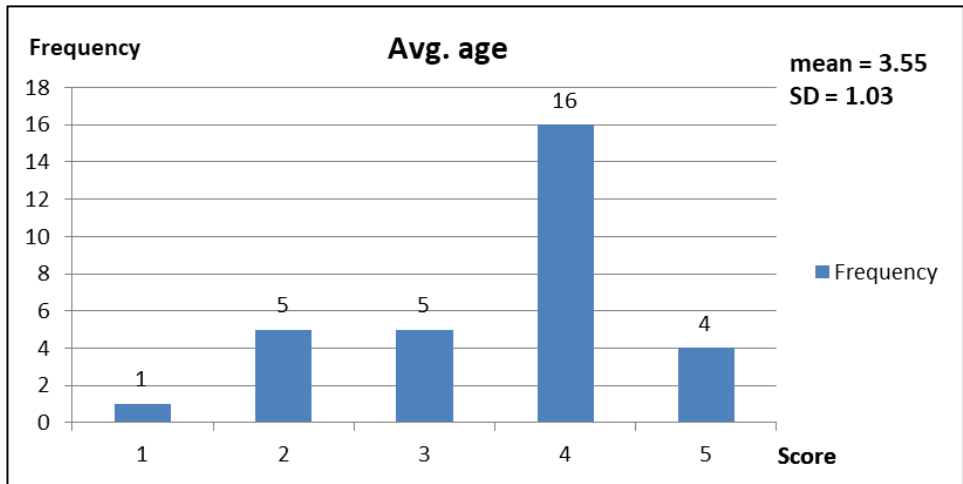
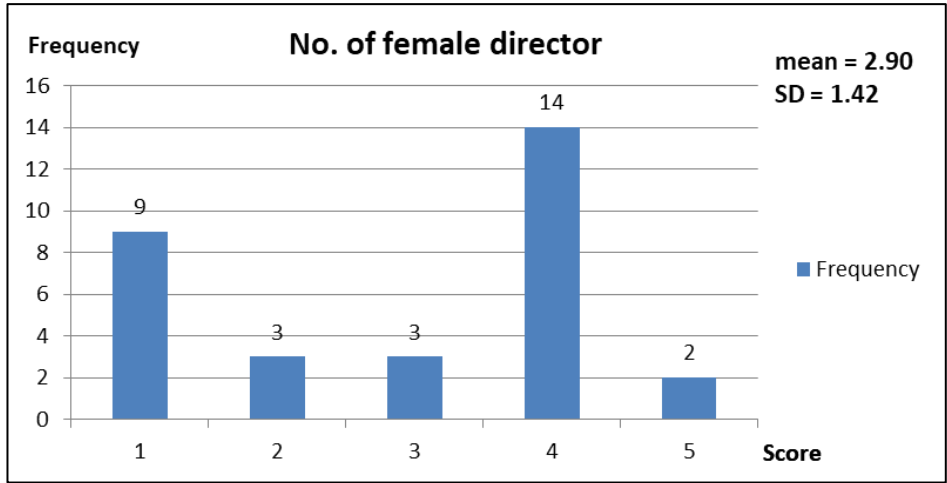
Note that the ‘mid-point’ of the Likert Scale ‘3’ is the turning point. Any grade less

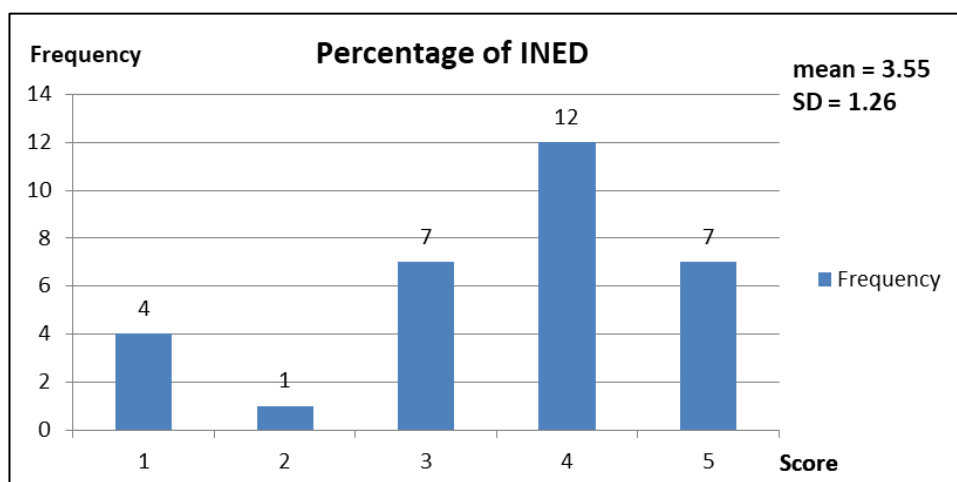
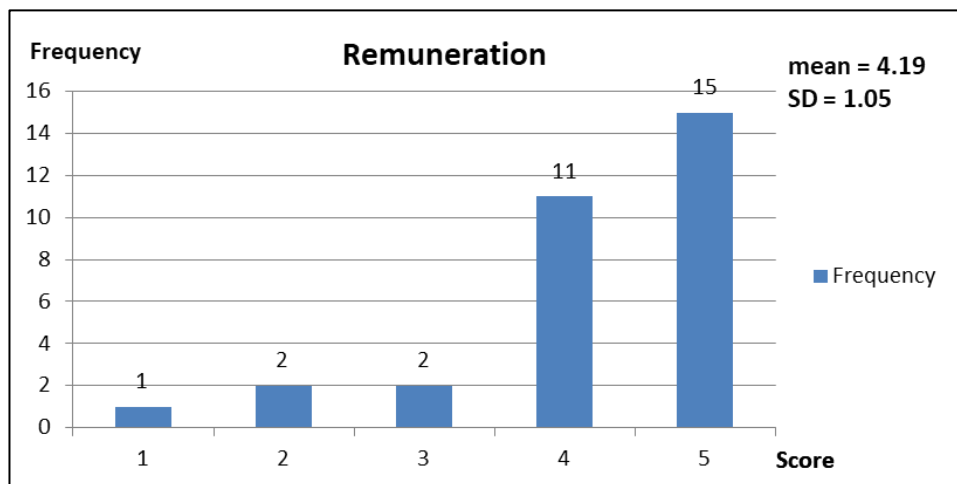
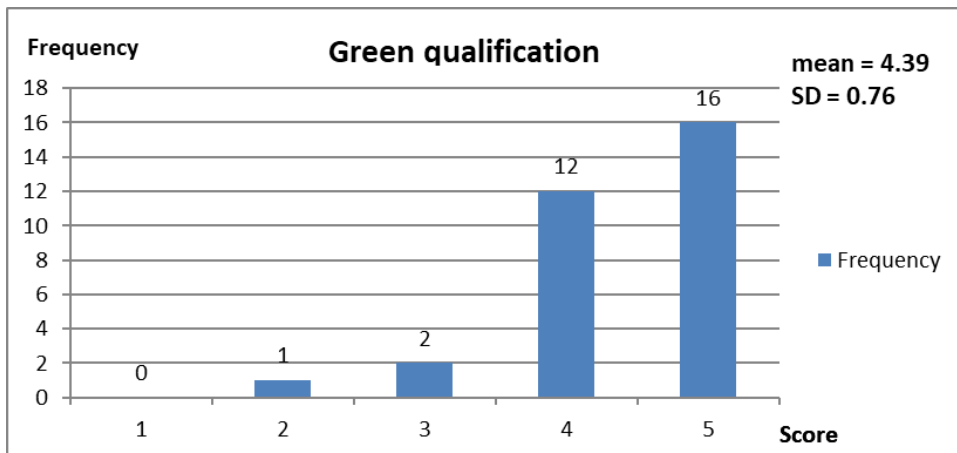
than 3 means the respondent to the questionnaires does not agree that the attribute have any effect on the environmental performance, and vice versa for any grade greater than or equal to '3'. The questionnaire has set '3' as having significant effect (Appendix L)

6.2.2 Frequency Distributions

Histograms showing the frequency distributions for each attribute/composition of the board are shown below :-







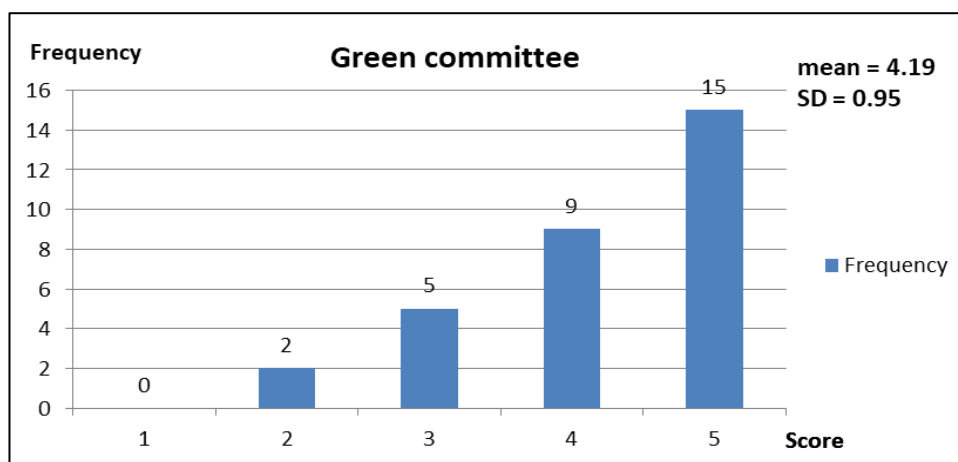


Figure 6.2 : Frequency distributions of the grading for 8 board parameters

6.2.3 Observations from the distribution histograms

The mean and standard deviation of the grading for each of the 8 parameters are calculated and shown in Table 6.7. The frequency of grading is counted and the frequency distributions bar charts are plotted in Figure 6.2. As shown by the graphs, the four most influential parameters of the board of directors to the environmental performance are “chairman and CEO duality”, “Directors holding green qualification”, “Remunerations tie-in with the environmental performance” and “Green Committee”, with the mean scores of 4.39, 4.39, 4.19 and 4.19 respectively. The standard deviations of the scores associated with these 4 parameters are also relatively small, they are 1.05, 0.76, 1.05 and 0.95 respectively, representing a greater agreement

among the respondents to the influence of these four attributes of the board of directors.

On the other hand, the mean score of “number of female directors”, which is 2.9, is less than the grading 3.0 for having a significant impact on the project environmental performance. Further, the mean scores for “size of board”, “average age of board” and “percentage of INED”, which are 3.35, 3.55 and 3.55 respectively, are very close to 3.0 showing that their impacts are just marginally significant. The standard deviation showing the spreads of the distribution for them are also quite high, they are 1.25, 1.03 and 1.26 respectively, when compared with those for “green qualification” and “green committee” which are 0.76 and 0.95. It shows that there are greater disparities on the respondents on those three attributes “size of board”, “average age of board” and “percentage of INED”, with quite a percentage of the respondents who do not think that these three attributes have any significant impact on the project environmental performance.

6.2.4 Estimation of the population mean and testing the hypotheses

Further from equation for one sample difference of means tests as delineated in

Paragraph 5.3.2 hereinabove, that is :-

$$Z = (\bar{x} - \mu)/s/\sqrt{n} \quad \text{for } n \geq 30$$

where Z is the Z-score,

n is the sample size,

\bar{x} is the sample mean,

s is the sample standard deviation, and

μ is the population mean,

and using the sample mean and sample standard deviation as shown in Table 6.7, the eight hypotheses as listed in Para. 5.1.2 are tested and we have the following results :-

- (a) μ (size of board) = 2.83²⁷ < μ_3 , therefore do not reject H_0^1 .
- (b) μ (no. of female directors) = 2.30 < μ_3 , therefore do not reject H_0^2 .
- (c) μ (average age of board) = 3.11 \geq μ_3 , therefore reject H_0^3
- (d) μ (chairman and CEO duality) = 3.94 \geq μ_3 , therefore reject H_0^4
- (e) μ (green qualification) = 4.07 \geq μ_3 , therefore reject H_0^5
- (f) μ (remuneration tie-in env. performance) = 3.74 \geq μ_3 , therefore reject H_0^6

²⁷ $\mu_{H1} = 3.35 - 2.3266 \times 1.25 / \sqrt{31} = 3.35 - 0.5223 = 2.8277$

(g) μ (percentage of INED) = 3.01 \geq μ_3 , therefore reject H_0 ⁷

(h) μ (green committee) = 3.79 \geq μ_3 , therefore reject H_0 ⁸

Thus at 99% confidence level with one tail :-

(a) For the parameter ‘the size of the board’, the population mean is 2.83 (< 3) which means that the size of the board will have no significant impact on the project environmental performance of listed construction company in Hong Kong;

(b) For the parameter ‘female directors’, the population mean is 2.30 (< 3) which means that there is no significant improvement in the project environmental performance of listed construction company with the increase in the number of female directors in the board;

(c) For the parameter ‘average age’, the population mean is 3.11 (\geq 3) which means that there is a significant improvement in the project environmental performance of listed construction company with the increase in the average age of the board directors;

(d) For the parameter ‘duality of chairman and CEO’, the population mean is 3.94 (\geq 3)

which means that there is a significant improvement in the project environmental performance of listed construction company with the separation of chairman from CEO;

(e) For the parameter ‘director’s green qualifications’, the population mean is 4.07 (≥ 3) which means that there is a significant improvement in the project environmental performance of listed construction company with the increase in the number of board director holding green qualifications;

(f) For the parameter ‘remuneration of directors tie in with the environmental performance of the company’, the population mean is 3.74 (≥ 3) which means that there is a significant improvement in the project environmental performance of listed construction company and the existence of the remuneration policy of directors tie in with the environmental performance of the company;

(g) For the parameter ‘percentage of INED’, the population mean is 3.01 (≥ 3) which means that there is no significant improvement in the project environmental performance of listed construction company with the increase in the percentage of INED in board membership; and

(h) For the parameter ‘setting up of green committee’, the population mean is 3.79 (\geq 3) which means that there is a significant improvement in project environmental performance of listed construction company with the setting up of green committee within the board.

The hypotheses testing results can be different if we change the confidence level, for instance from 99% to 99.9%. At 99.9% confidence level, the population means for the “average age of the board” and “percentage of INED” attributes will become 2.98²⁸ and 2.85²⁹ respectively, therefore the null hypotheses H_0^3 and H_0^6 should not be rejected.

6.2.5 Conclusion drawn from the data and hypotheses testing

To conclude, as perceived by the listed construction companies in Hong Kong, there are 4 attributes of the board of directors which have strong significant effects on their project environmental performance, they are :-

- (a) No duality of chairman and CEO,
- (b) Directors holding green qualifications,

²⁸ $\mu_{H3} = 3.55 - 3.1 \times 1.03 / \sqrt{31} = 3.55 - 0.5735 = 2.9765 (< 3)$

²⁹ $\mu_{H6} = 3.55 - 3.1 \times 1.26 / \sqrt{31} = 3.55 - 0.7015 = 2.8485 (< 3)$

- (c) Directors' remuneration tie-in with the company's environmental performance, and
- (d) Establishment of green committee within the board.

There are 2 attributes that have borderline or marginal significant impact on the project environmental performance and they are in order of the magnitude of their estimated population means (at 99% confidence level) :-

- (a) Average age of the board (3.11); and
- (b) Percentage of INED in the board (3.01).

Finally, the listed construction companies in Hong Kong do not consider the attributes of 'size of the board' and 'number of female directors' can have any significant impact on the project environmental performance.

Chapter Summary

In analyzing the data obtained from the first set of questionnaires on the critical factors affecting project environmental performance, EFA have been applied. To determine how many factors should be extracted, 3 basic criteria have been applied (Pett et al., 2003) : (i) extracting factors with eigenvalues greater than 1.0 (Kaiser's criterion); or (ii) factors should be stopped extracting when the cumulative percentage of variance is over 60% (Hair et al., 1995) for humanities research, or (iii) the last factor accounting for only a small portion of the explained variance; or (iv) through examination of the extracted factors by means of a scree plot. Amongst these four tests, the Kaiser's criterion (i) is the dominant rule (Williams, et al., 2010), though multiple approaches should be adopted in factor extraction. Using PAF and after 13 iterations, the Oblimin with Kaiser Normalization rotation generates four factors, they are in order of their priorities :-

- (a) The first factor has four components, viz. "competitors' environmental performance", "financial institutions and credit rating agencies' influence", "media and green NGOs' supervision" and "shareholders' influence". This factor will be labelled as "Business Competitiveness".

- (b) The second factor has three components, viz. “board of directors’ leadership on environmental protection”, “establishment of green corporate culture” and “implementation of an effective environmental management system”. This factor will be labelled as “Green Corporate Governance”.
- (c) The third factor has two components, viz. “customers’ expectations” and “government policies and regulatory control”. This factor will be labelled as “Government Requirements”
- (d) The fourth factor has three components, viz. “trade unions’ influence”, “suppliers’ and sub-contractors’ influence” and “building project teams’ influence”. This factor will be labelled as “Collaborators”

The analysis of the data obtained from the second set of questionnaire on the various attributes of the board of directors reveals that the four most influential parameters of the board of directors to the environmental performance are : “Directors holding green qualification”, “Green committee” and “Remunerations tie-in with the environmental performance” and “separation of chairman from CEO”, with the mean scores of 4.39, 4.19, 4.19 and 4.39 respectively. Further, the small standard deviations of these four attributes indicate a great agreement among the respondents.

There are 2 attributes that have borderline or marginal significant impact on the project environmental performance and they are in order of the magnitude of their estimated population means (at 99% confidence level) :-

(a) Average age of the board (3.11), and

(b) Percentage of INED in the board (3.01).

Finally, the listed construction companies in Hong Kong do not consider the attributes of 'size of board' and 'number of female directors' can have any significant impact on the project environmental performance.

CHAPTER 7

Observations and Discussions

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Chapter Summary

Chapter 7 : Observations and Discussions

7.1 Labelling the critical factors affecting the project environmental performance

The factor analysis in Chapter 6 shows that there are four critical factors that can influence the project environmental performance of Hong Kong listed construction companies. What does each of the critical factors mean ?

7.1.1 The “Collaborators”

From the results of factor analysis, the fourth critical factor consists of “project team supervision”, “suppliers’ and subcontractors’ collaboration” and “trade unions’ assistance” and they altogether account for just 9.787% of the total variation explained.

There are some similarities or connections amongst the first two components of this critical factor in that the project team, suppliers and subcontractors are part of the construction supply chain members and they collaborate with the main contractor to procure and implement the project. The consultants of the project team will certainly provide all the environmental requirements, in particular those regulatory requirements, in the tender and specifications for construction companies to follow. They should

also supervise the construction works to ensure construction companies comply with all the environmental requirements. The consultants are taking a supervisory and enforcement role, but unlike government officers who can instigate prosecutions, they do not have real teeth.

On the other hand, suppliers and subcontractors are parties assisting the main contractor to actually carrying out the works on site. Since they are the agents acting on behalf of the main contractor, their compliance with the environmental regulations and specification requirements will be of paramount importance to the construction companies. If there is any violation of these requirements, the main contractor may be required to take up the responsibilities.

Trade unions are the business bodies or professional bodies which provide trainings and information to their members to keep them abreast of the environmental legislations and requirements. They are working together with the construction supply chain members in particular the subcontractors to upkeep the environmental performance of the construction companies on sites by providing them the updated technological know-how and equipment in protecting the environment on site. The trade unions have the highest correlation coefficient 0.776 within this critical factor

(Table 6.5), though the other 2 components³⁰ are very close to it. These 3 components together can best be named “Collaborators” as they are collaborating with the main contractors, which invariably are those large listed construction companies, to upkeep or enhance the project environmental performance of construction companies on site.

7.1.2 The “Government Requirements”

The third most critical factor consists of “customers’ expectation” and “government regulations” and they altogether account for 10.926% of the total variance explained.

There are some similarities or connections between these 2 components in this critical factor. The component “government regulations” represent the minimum level that the construction companies should attain in environmental protection in order not to cause excessive pollution and nuisance to the people in Hong Kong. The customers’ expectations represent the requirements imposed by the developers on the contractors. Since the majority of developers in Hong Kong strive to contain their development costs, they adopt meeting the bare minimum requirements of the government legislation on environment. For green building certification, a lot of them only apply

³⁰ Pattern matrix correlation coefficient for ‘project team’ is 0.625 and that for ‘suppliers and sub-contractors’ is 0.699

for the unclassified certification. It allows them to get the exempted gross floor area at the minimum cost.

Further, though the green building concepts, in particular the use of energy saving device or mechanisms, are material to the developers and the ultimate users of the building in reducing the energy bills, to the contractors all they need to do is to confirm with the green building consultants' specifications. Since the green building requirements will necessarily include the compliance with all the environmental legislation, this may be the reason why the Pattern Matrix correlation coefficient (Table 6.5) for "customers' expectation" (0.776) is slightly higher than the "government regulatory control" (0.637). The two components in this critical factor can best be grouped under the label "Government Requirements".

Government requirements may take many forms. For instance, the Development Bureau policy contained in their technical circular DEVB TCW No.3/2009 clearly focuses on penalizing those contractors who frequently breach the environmental legislations.

The low priority of regulatory control is in disparity to the observations of previous

researchers, in particular those from western countries, which regard government regulations as the very important element affecting the environmental performance for many industries, in particular the energy and chemical industries (Para. 3.4).

7.1.3 The “Green Corporate Governance”

The second most critical factor consists of the “board of directors’ leadership on environmental protection”, “establishment of green corporate culture” and “implementation of an effective environmental management system”, and this factor can best be called the “Green Corporate Governance” factor. It has a total eigenvalue 13.745% and it is the factor with the second largest eigenvalue.

From the Pattern Matrix, among those constituents of the “Green Corporate Governance” factor, the influence of the “board of directors’ leadership on environmental protection (correlation coefficient 0.706 as shown in the Pattern Matrix Table 6.5) is the highest. The second most influential component within this factor is “establishment of green corporate culture” (correlation coefficient 0.664) and the least influential component is “implementation of environmental management system” (correlation coefficient 0.568). It shows that the environmental performance can

better be explained by “board of directors’ leadership” than “establishment of green corporate culture” or “implementation of an effective environmental management system”. This is probably due to the fact that the board of directors might dictate what sort of green corporate culture to be established within the company, and decide whether to implement an effective environmental management system or not. Further, as the ISO 14000 environmental management is a continuous improvement looped management system which necessarily involves the board of directors. The board is therefore of cardinal importance to the success of the ISO 14000.

Further, the results of the statistical test on the various parameters on the composition and attributes of board directors show that environmental awareness of the board can be strengthened by appointing more directors with green qualifications, by commensuration of the directors’ remuneration with the company’s environmental performance, separation of the chairman from the CEO, and by setting up of green committee within the board. These measures will enhance the green corporate governance of construction companies.

Listed construction companies know that the implementation of good environmental corporate governance within their companies is vital for their business to be

competitive and to gain good reputation in front of their stakeholders. An effective implementation of ISO 14 000 will render construction companies in compliance with all the environmental legislations. That might explain why the critical factor “Green Corporate Governance” is more influential than the critical factor “Government Requirements” in directing listed construction companies to have good project environmental performance.

7.1.4 The “Business Competitiveness”

Finally, from the results of factor analyses, the most critical factor consists of the components “competitors’ environmental performance”, “financial institutions and credit rating agencies’ influence”, “media and green NGOs’ supervision” and “shareholders’ influence” which altogether account for 34.37% of the total variation explained. It is the most predominant critical factor perceived by listed construction companies in Hong Kong that affect their project environmental performance at sites.

There is a common thread collating the four components of this critical factor in that they all aim at improving the business competitiveness of the listed construction company. If the construction company outperforms its peers in terms of

environmental protection on site, they can gain reputation and goodwill so that they would have more business. In the contrary, if it is not performing well when compared to its peers, the pollution emanated from its sites will be published in the press and be condemned by the green NGOs. The negative press-made image may render its financiers to impose an interest premium to its loan. As the cost of borrowing increases, its tender will become less competitive. Eventually it will lose out its business or even its shareholders.

The EFA has shown that business competitiveness is the most important driver for good project environmental performance. Good environmental performance is an asset to the company. Nowadays in the pre-qualification of tenders, the client invariably adopts the two envelope approach, that is, the technical submission and the tender price submission. The loss of a few points in the technical aspects simply because of the poor environmental performance when compared to its peers may render the construction company to lower a few million to tens of million dollars' tender sum in order to win the job. Thus, the intangible asset of good project environmental performance can be crystallized into monetary terms to improve the business competitiveness of the company

On the other hand, the intangible aspect of having good environmental performance will improve the reputation and goodwill of the company before its potential clients, media and the green NGOs, the financial institutions and credit rating agencies as well as the shareholders, so that there will be more business, more favourable credit terms, and as a result it will attract more people to subscribe its shares and bonds

From the Pattern Matrix (Table 6.5), among the 4 components of the “Business Competitiveness” critical factor, “competitor’s environmental performance” has the strongest correlation coefficient³¹ indicating that exhibiting competitiveness in environmental performance would be highly related to better business competitiveness. The second strongest influence is “financing and credit rating institutions” (0.596), the third one is “media and green NGO’s influence” (0.561), and the least influential component is the “shareholders” (0.298).

The influence of shareholders is much shadowed by the financial institutions and credit rating agencies because when considering shareholder value, financing costs play a major role. The discounting rate when calculating shareholder value depends on costs of borrowed capital and equity capital. When company faces environmental

³¹ correlation coefficient = 0.717

risk, which is highly systematic, the interest rate on borrowed capital will increase and so will the discount rate (Schaltegger and Figge, 2000).

7.2 Correlation between the Critical Factors in Pairs

Though the factor correlation between any two critical factors in pair is rather weak (Para. 6.1.7), it is worth to examine them, and below are my observations :-

From the Factor Correlation Matrix shown at Table 6.6, among the factors “Green Corporate Governance”, “Government Requirements”, and “Collaborators”, the “Collaborators” is most related to “Business Competitiveness” (0.364). This is the evidence, though not too strong, that the green support of the project building team and the supply chain members, in particular the subcontractors, together with the trade union can assist the listed construction company to enhance its business competitiveness over its peers, have better financial credit rating and better image before the media, green NGOs and shareholders. In this way, the listed company will become more business competitive in the construction industry.

The second most related factor to “Business Competitiveness” is the “Green Corporate

Governance” (correlation coefficient 0.309). This is the evidence, again though not strong, that better green corporate governance can improve the listed company’s business competitiveness. Green corporate governance is part of the corporate governance of a listed company and they share some of the similar features. For good corporate governance it should have separation of chairman from CEO as recommended by the Hong Kong Stock Exchange, which should also apply to green corporate governance, as evidenced in this research (Para. 6.4.2(d)). The possession of green qualification (as defined in this research) would necessarily mean possession of high academic qualification which may lead to better corporate governance as a whole. It supports the proposition that listed construction company with better corporate governance would be more competitive in the construction industry

Finally, for the factor “Government Requirements”, the correlation coefficients with the other 3 critical factors are small (just about 0.2) showing that they are not much related. This is the evidence that the compliance with the government requirements, in particular the environmental law, cannot improve the business competitiveness of the contractor in the industry. The environmental law is the threshold for surviving in the industry and all construction companies should be on the same level playing field.

7.3 Validation – Results Generated by EFA

7.3.1 Critical Factors - Interviews with Industry Leaders

The results generated by the factor analyses were discussed with the five industry leaders, whose qualifications and background have been described in Para. 4.1. There were free discussions and they did provide some views which could shed light on the research results. In general, they thought that the results might represent the real situation in Hong Kong and they attempted to explain the results rather than challenging them. They opined that the results were by and large stemmed from the fact that listed construction companies cared more about the financial gain than the project environmental performance. Putting their ideas together, below are their views.

7.3.1.1 Comments on the four critical factors

They said that the 4 critical factors could largely be seen as :-

- ✧ The listed company itself : the listed construction company itself who took self-initiation to improve its project environmental performance through establishment of a sound board with directors of the right attributes, the cultivation of good green corporate culture and putting in place an effective environmental

management system, such as the ISO 14 000 – “Green Corporate Governance” critical factor.

- ✧ The government : the external police, i.e. the government regulation and requirements which were essential as the background minimum requirements for the project environmental performance of all construction companies in Hong Kong – “Government Requirements” critical factor.
- ✧ The collaborators : the internal construction team such as the consultants, site agents and subcontractors collaborating with the listed main construction company to achieve the required level of project environmental performance – “Collaborators” critical factor
- ✧ The relevant external stakeholders : the external parties that could adversely affect the business profit of the listed construction company if it was not performing well in terms of on-site environmental protection. They agreed that these parties could mostly affect the project environmental performance of the listed construction company because they could adversely affect the financial interest of contractors if they were not performing well – “Business Competitiveness” critical factor.

7.3.1.2 Share price is a major concern to listed construction companies

The interviewees mentioned that the share price should be a very important consideration for listed construction companies. In order to maintain a good share price, they needed to be business competitive. They said that in the “Business Competitiveness” factor, the outperformance of a listed construction company in terms of its environmental performance would lead to business success and financial reward due to lower borrowing rate. All these would be reflected in the share price of the listed company. Similarly, the good reputation of the company in front of the green NGOs, media and the shareholders was one of the best means to promote the share of the listed company, and hence would exert a positive effect on the share price.

They said that the share price should also reflect the corporate governance of the company and they quoted the example of the China Light & Power Limited, alleging that one of the reasons for its share price to remain high was that it had very good and transparent corporate governance. They opined that the good green corporate governance could support the share price of listed construction companies in Hong Kong.

They asserted that it was because of the share price, listed construction companies

strived to improve their business competitiveness and the green corporate governance, which in turn would self-servingly improve the project environmental performance. They agreed that in this regard, the “Green Corporate Governance” should be second on the list of critical factors affecting project environmental performance of listed construction companies in Hong Kong.

7.3.1.3 Balancing the cost and benefits in raising environmental performance

They asserted that in order to justify a construction company to invest in improving its environmental performance, there had to be some benefits derived from it. In other words, the improved environmental performance should correspondingly enhance the business competitiveness. They regarded the investment to improve the environment performance as a cost which should be balanced by some corresponding revenue.

They alleged that in the eyes of a construction company, the budget and time constraints might often outweigh the required good environmental performance. For instance, some contractors might carry out noisy work after office hours in order to catch up with the programme, otherwise they had to pay heavy liquidated damages to the client for not completing the work on time. In the wake of minimizing the

liquidated damages, construction companies might lower their environmental performance, even to the blink of infringing the environmental law. They said that it might be the reason why listed construction companies in Hong Kong accorded a rather low priority to “Government Requirements” when compared with “Business Competiveness” and “Green Corporate Governance”.

They pointed out that nowadays, contractors had to bid competitively for jobs and the budget for every project is tight. The maximum standard that a construction company could perform environmentally was very much confined by the profit margin, and it was the senior management to do the balancing exercise. In this aspect, the board of director and corporate culture might come into play. The pecuniary gain through better environmental governance, culture and management such as having goodwill and reputation, lowering of financial interest rate when borrowing from financial institutions, would be balanced with the costs involved such as more environmental friendly machine and equipment and more training to frontline staff.

They also explained that even the implementation of ISO 14 0000 would involve quite some costs. Contractors would calculate how many jobs they could get by improving their environmental performance through deployment of extra resources. They

opined that any environmental measures that could not bring any competitive edge to the companies would not be adopted by the contractors.

7.3.1.4 Ineffective government regulatory control

The industry leaders were not surprised to learn from the statistical results that “Government Requirements” was low on the list of critical factors. They said that though the environmental law was essential in maintaining the project environmental performance to a certain minimum level, the regulatory regime was not effective.

They alleged that there were several reasons behind why the listed construction companies in Hong Kong had attached a lower weighing to government regulatory control than those in the western countries. Firstly, they mentioned that the penalty imposed on the environmental offenders was too lenient in Hong Kong. There was no imprisonment for the past 10 years, and the fines imposed were also insignificant when compared with the contract sum of the construction works. They said that for instance, the normal fine under the Air Pollution Control Ordinance Cap.311 for offences of the first time for first offender involving handling asbestos was about HK\$10,000. It was much lower when compared with the cost for hiring an asbestos

contractor to remove the asbestos involved which would easily incur a cost of over HK\$50,000. The cost and benefits imbalance might induce some contractors to breach the law.

They considered that the price for breaching environmental law was too low in Hong Kong. They added that even the maximum fines imposed by the environmental legislation were something in the region of HK\$200,000, this sum could not be compared with the construction costs say for a residential tower which generally costed more than HK\$200,000,000. The maximum penalty could only account for something in the region of 0.1% of the construction cost. Further, due to sentencing principle under the criminal procedural law, the fine imposed by the judges on the first offender or offender with only a few repeated offences would only be about 20 to 30 percentage of the maximum fine³². They said the penalties were insignificant in the eyes of the listed construction companies and they would therefore accord a low priority to the legal regime for influencing their project environmental performance.

They said that there was no successful prosecution on directors of construction

³² The information provided by the interviewees is in line with the sentencing principle as delineated in the book : Cross and Cheung, 2015. Sentencing Principle in Hong Kong, Chapter 6 'Classical Principles of Sentencing', 7th Edn., Sweet & Maxwell

companies for the past 10 years in Hong Kong. In spite of the fact that in 2003 the Noise Control Ordinance Cap.400 was amended to include the new s.28A and s.28B provisions for prosecuting the directors of a company, as far as the interviewees knew, up to the moment of interview there was no conviction under s.28A.

Secondly, they said that the construction industry in Hong Kong involved multi-layers of sub-contracting. Listed construction companies were usually large main building contractors and they could shift the liability to their sub-contractors. Due to different bargaining commercial power, often than not, the sub-contractors would become the scapegoats.

Thirdly, they asserted that listed construction companies had resources to take legal battle with EPD. They could hire the most competent senior counsels in the town to fight against the government prosecutors, who were invariably not commensurate with the experience of the senior lawyers appointed by the listed construction companies. As a result, quite a lot of environmental prosecutions have failed due to the defendants' challenges on legal or procedural technicalities.

Fourthly, they said that under the Development Bureau, repeated environmental

offenders would be penalized when they tender for a job. However, a construction companies would only be penalized if they had 3 offences in a row within a period of 6 months. They said that to avoid being penalized, construction companies could make use of court proceedings to spread their offences to be heard or trialed in court so that there would not be sufficient number of convictions within 6 months.

7.3.1.5 From voluntary compliance, to regulatory control, to financial inducement

They opined that the Hong Kong Construction Association, which is a trade union in Hong Kong, played the role to encourage construction companies to voluntarily adopt environmental measures to improve their project environmental performance such as through publication to introduce various types of quiet noise equipment which could be used on site. Their advice and views were not mandatory on their members, and failure to do so would not attract any prosecutions or penalties. They said that apparently the factor analysis results had reflected this point and it was less effective to ask the construction companies to voluntarily improving their project environmental performance.

They alleged that the role of the project team such as architects and engineers, together

with the supply chain members such as the subcontractors and suppliers as encapsulated within the factor “Collaborators” were carrying out the function to supervise and to procure the compliance of the environmental legislation. In drafting the specifications and contract conditions, the requirements under the environmental law and legislations would invariably be delineated. In order not to inflate the tender price, environmental performance up to the standard required by the legislation would be stipulated. That might be the reason why “Collaborators” are not so effective a factor when compared with the regulatory control in affecting the environmental performance of a construction company.

They said that the legal requirements under “Government Requirements” were mandatory, and it was the common platform for all listed construction companies to be vigilant. However, as the penalties to be imposed due to infringement of the environmental law were low, the listed construction companies accorded them a low priority as explained earlier.

Finally, financial inducement through lower borrowing interest rates, getting more competitive in bidding jobs seemed to be the most effective means to induce construction companies to pay attention to their project environmental performance.

The benefits of ISO 14 000, which included the elevation of business opportunity to win a bidding, were also another forms of inducement for the board and senior management to consider though they would have to balance the benefits with the cost involved in implementing ISO 14 000. They opined that the carrot approach of financial inducement seemed to be more effective than the stick approach of law and enforcement.

7.3.1.6 The regulatory compliance is the common platform

The compliance with the environmental regulations is a platform on which every listed construction company will strive to stand. The incentives to perform beyond the regulations are the business success that could bring pecuniary gain to both the company and its shareholders.

The industry leaders pointed out that in order to improve project environmental performance, the government might increase the penalties as well as tighten the legislation to bring more pollution acts into the net for criminal sanction, such as lowering the triggering noise limit for prosecution. However, they pointed out that the tightening of pollution limit would meet resistance in the Legislative Council since too much environmental control might stifle the construction industry.

7.3.1.7 Green building requirements

They noted that the environmental performance requirements imposed by developers were those encapsulated under the BEAM Plus requirements in Hong Kong. They commented that while BEAM Plus could enhance the green performance of buildings, they did not necessarily improve the environmental performance of the contractors' site environmental performance.

Further, they observed that even if the green building requirements could push up the environmental standards, once those standards were in place, they would again like the legislation became a platform, and every contractor will benchmark their performance with them. At the end, it would be similar to the regulatory requirements that all contractors would strive to comply with the minimum.

7.3.1.8 ISO 14000

They commented that the industry viewed high on the environmental management system within these 4 critical factors might suggest the construction industry had experienced the merits of having an effective ISO 14 000 in place. Some of the leaders who had thought that it was a gimmick explained that the ISO 14 000 might

now have turned from its infancy back in mid-1990s to a mature stage in mid-2010s. Instead of using ISO 14000 as paperwork to get jobs, some construction companies have been implementing it to lower their environmental complaints and prosecutions, and to save energy costs. They said that more construction companies should be encouraged to realistically implement the ISO 14 000.

7.4 Validation - the impact of the composition and attributes of the board

Though there is no generally accepted environmental performance index for construction industry in Hong Kong which can grade listed company's project environmental performance so that we can compare the project environmental performance of one company with another, an attempt is made to validate the results of the null hypothesis tests obtained in Chapter 6 on the eight parameters of the composition and attributes of the board of directors. Two listed companies with specific board characteristics with respect to their composition and attributes would be examined to validate the results obtained from the one sample Z-test statistical analyses.

7.4.1 First case study - Small board size, large proportion of female directors and INEDs

The first company chosen for case study and interview is a contractor listed at the Main Board of the Hong Kong Stock Exchange, and it undertakes :-

- (i) foundation works which include piling works, ELS works and pile cap construction
- (ii) superstructure building works
- (iii) other construction works such as demolition works, site formation works, ground investigation works, minor works, hoarding works, A&A works and fitting-out works.

It is a registered general building contractor³³ and also a registered specialist contractor in the categories of foundation works, site formation works and demolition works with the Buildings Department. In addition, it has been registered on the Approved Specialist List in the category of land piling (Group II) and Approved Contractors List in the category of building (Group A) maintained by the Development Bureau. Its market capitalization is HK\$594M, and is considered as a medium-sized listed construction company in our study.

The company has also received a number of certificates during its operating history in

³³ A registered general building contractor (RGBC) is a contractor registered with the Buildings Department under s.4A of the Building (Administration) Regulations

recognition of its commitment and dedication to the quality management system, occupational health and safety management and environmental compliance.

(i) Quality Management System – ISO9001:2008

(ii) Environmental Management System – ISO14001:2004

(iii) Occupational Health and Safety Management System – OHSAS18001:2007

The listed company had implemented an environmental management system which was certified to be in compliance with the standard required under ISO 14001:2004 since November 2010. It has established an environmental management policy to ensure proper management of environmental protection and compliance of environmental laws and regulations by both the employees and workers of its subcontractors on, inter alia, air pollution, noise control and waste disposal.

A female executive director of the board told me that almost every project applied for a billing account for dumping of waste onto landfill sites, water pollution licence and noise permits. The female director said that there was no specifically assigned full-time post of an Environmental Officer in the company to oversee all environmental-related matters of their daily construction activities. However, in the headquarter office, employees in charge of project administration and general

administration would also be responsible for environmental issues. At construction sites, project managers and ‘Technically Competent Persons’ of grade T1 would take care of all the on-site environmental matters.

For financial years 2014/15, 2015/16, 2016/17 and the six months ended 30 September 2017, they have incurred approximately HK\$753,697, HK\$410,503, HK\$385,043 and HK\$261,894 respectively to improve the project environmental performance, which primarily consisted of waste disposal charges and environmental compliance related expenses. However, there were 2 environmental prosecutions from January 2017 to July 2018, and the environmental performance of that company was considered by a green consultant to be mediocre³⁴. The female interviewee also scored themselves ‘3’ on a scale of 1 to 5 (with 1 being the highest) in terms of environmental performance, which was consistent with the green consultant’s view.

The size of the board was relatively small. There were altogether six directors in the board : one male executive director who was also the CEO, one female executive director, one female non-executive director who was also the chairman, and three male independent non-executive directors. There was a separation of chairman from CEO,

³⁴ By the chairlady of the first listed environmental consultant company in Hong Kong

i.e. no chairman CEO duality.

The female director of the listed construction company told me that a listed company with 6 directors on the board was the smallest size of the board she had ever known. She also told me that for the whole listed construction industry of Hong Kong, there were only a few female executive directors, because it was dominated by the male professionals in particular the engineers. According to her knowledge, there were very few listed construction companies in Hong Kong who possessed two or more female directors on their boards. Further, she told me that there were also very few listed construction companies in Hong Kong who possessed 50% or more of their board members as INEDs.

She said that the high percentage of INED was a result of the small board size because under the Listing Rules of Hong Kong 5.05 and 5.05A (Para. 3.6 of Chapter 3), each board should have a minimum of 3 INEDs and at least one third of the board should be INEDs. As a result, in Hong Kong most of the boards are consisted of nine directors with three INEDs. A board of 10 to 12 directors would necessarily have 4 INEDs on the board. On the contrary, any board less than nine directors should also have 3 INEDs which meant that the small board would necessarily increase the percentage of

INEDs on the board.

In our case study, there were two female directors on board and the percentage of female directors was 33% of the board. The percentage of INED was 50% of the board. Including the non-executive chairman, the percentage of non-executive director on the board was 67%. The average age of the board directors was around 53. There was no green committee and there were three directors who possessed a green qualification. There was a remuneration policy which tied up with the environmental performance of the company for the directors.

7.4.1.1 Analysis

According to the statistical results of the one sample Z-test in Para. 6.2.4 of Chapter 6, the following factors are very positive drivers for good site environmental performance : (a) separation of chairman from CEO, (b) quite a high proportion of the board directors are holding green qualification, (c) there is a remuneration policy which tie-in with environmental performance for the executive directors, (d) the average age of the board members near the optimum age 56 (Post, et al., 2011), and (e) high proportion of INEDs in the board. Had the small size of the board and high percentage of female director in the board were also favourable factors in improving

the environmental performance, the listed construction company under analysis should have achieved a very high project environmental performance. However, in reality the listed company is of mediocre achievement in project environmental performance, which suggests the negation of the arguments that : (a) small size of the board has positive impact on project environmental performance, and (b) high percentage of female director has positive impact on project environmental performance. This evidence is in line with the research results.

7.4.1.2 Observations from the female director of the board

The statistical analyses derived from the results of the second questionnaires were brought up to the female director for her comments. She agreed that the size of board had no significant relation with the environmental performance of the company, as she suggested that consensus from the board could usually be reached within the board regardless of its size. She said that most of the companies in Hong Kong were family business, and there should not be too much disagreement relating to environmental issues within the board.

She agreed that the number of female director would have very little influence, if any, on the environmental performance, because the company's environmental policy were

more related to the directors' education and characters than their gender. She agreed that the average age of director did have an influence on the environmental performance of the company, as younger generations generally were more conscious of environmental protection. However, she opined that this generation difference in environmental conscientiousness was reducing due to better general education on environmental protection in Hong Kong.

She had some reservations on our results showing positive influence of CEO and chairman duality on the environmental performance of a construction company. She thought that CEO and chairman duality could only have very little influence. For green qualification and green committee, she agreed with our results that these two attributes would have great influence on the environmental performance, as they were not only directly related to environment, but could also reflect the company's determination in executing proactive environmental policy such as to provide environmental training and to have dedicated team to deal with environmental problems. She agreed that remuneration tie in with environmental performance would have a positive influence, as directors would have a strong incentive to take more environmental-friendly actions. Last but not least, she agreed that the number of INED would have little influence on environmental performance since according to

her view the INEDs virtually had no power in making company's day-to-day decisions. Further according to her experience, most of the environmental issues were raised by the executive directors and there was always consensus among the executive directors and INEDs in making decision on issues relating to environmental performance.

7.4.2 Second case study – Large board size, no female director and green board committee

The second case study is a large-sized listed construction company with market capitalization of over HK\$1B. It has no female director. Its principal business is the design and construction of building works, civil engineering works, foundations, site investigations, landslip preventive measure and remedial works to slope and retaining wall. It is a registered general building contractor and a specialist contractor in the categories of foundation works, site formation works and demolitions works with the Buildings Department. In addition, it has been registered on the List of Approved Contractors for Public Works with the Development Bureau :-

- (a) Building work (Group C);
- (b) Road and drainage work (Group C); and
- (c) Site formation works (Group B on probation).

In recognition of its commitment and dedication to quality management, occupational health and safety management together with environmental management, the company has been accredited for the following management systems :-

- (ii) Quality Management System – ISO 9001 : 2008
- (iii) Environmental Management System – ISO 14000 : 2004; and
- (iv) Occupational Health and Safety Management System – OHSAS 18001 :2007.

The company has received many environmental awards in a row for quite some years for their efforts and contributions in environmental protection during construction, they include :-

- (a) HKCA Environmental Awards;
- (b) Green Contractors Gold Award from Architectural Services Department;
- (c) many awards at the Considerate Contractors Site Award Scheme;
- (d) the Wastewi\$e Certificate (Excellence Level); and
- (e) Hong Kong Construction Environmental Awards.

The interviewees, who consisted of one executive director and an environmental manager of the company, told us that there was a special department in their company known as QUENSH (which is the acronym for quality, environment, safety and health),

and it had been set up to deal with environmental issues. There were 28 full-time environmental officers in that department, and the department would assign one to two of these full-time environmental officers to each project to oversee all the on-site environmental related matters during project construction process. At the moment of the interview, the interviewees told me that their company had more than 20 active projects at hand.

They also told us that the company at its own initiative had invested in environmentally friendly equipment, such as the use of Euro 5 or Euro 6 vehicles, and the purchase of electricity generators with good energy efficiency and low emission levels. Bio-diesel fuel had also been used for more than 70% of their construction equipment.

Further, the interviewees said that their company had launched on their own research on pollution control at construction sites. For example, they have invented an equipment to retrofit their generators to provide flue gas treatment. In this way, emission of air pollutants by the generators could be reduced. He said that another example was that they had redesigned the temporary septic tank used at construction sites so that they would emit less odorous smell and would be easier for cleaning.

In terms of environmental prosecution, they told us that they generally would have 1 prosecution each year. Considering that they had more than 20 construction projects running at the same time, the number of environmental prosecution was considered to be very low.

There were 7 executive directors and 4 INEDs. 36% of the board members were INEDs. The percentage of INED was higher than a normal board of 9 directors in size with only 3 INEDs. There was a separation of the chairman and CEO, i.e. no CEO duality. There was no female director on the board. The average age of directors was around 55. There were 6 directors who possessed green qualifications and the board had a sustainability committee. There was a policy on linking the remuneration of directors with the environmental measure of the company.

7.4.2.1 Analysis

From the interview findings above, this company is not only having a very positive attitude towards environmental protection, but has invested a lot of resources on equipment which are environmental friendly. As it has won a lot of environmental awards for the past 10 years, her project environmental performance is considered to

be very good.

Assuming the one sample Z-test statistical results in Chapter 6 in rejecting the various null hypotheses with respect to the impact of the board's attributes on the company's project environmental performance are correct, the attributes of (a) absence of chairman and CEO duality, (b) the average age of the board at 55 which was very close to the optimal age of 56 according to western research, (c) there is a policy to tie-in the remuneration of the directors with environmental performance, (d) the possession of green qualification by many board directors, (d) the establishment of a sustainability committee directly report to the board, and (e) the high proportion of the INEDs in the board all tend to push up the project environmental performance of the company. Were the small size of the board and the lack of female directors significant factors in acting against the positive factors of good environmental performance, the actual environmental performance of the company should have been much weakened. However, such argument is in contrary to the reality. The deduction derived from the evidence supports the one sample Z-test statistical results of our research.

7.4.2.2 Observations from Company Environment Management Committee (CEMC)

In terms of the interviewees' comments to our statistical results of the second questionnaire³⁵, the director in charge of the CEMC agreed that the size of board had no influence on the company's project environmental performance, and he thought that site environmental performance depended very much on corporate culture, instead of size of the board of directors. He agreed that green qualifications would have positive influence on environmental performance, because he thought that green qualifications would help people building up an environmentally friendly mindset, and would enhance the awareness for environmental protection as well. He did not believe that the number of female director and average age of the board had any influence on environmental performance. He thought that it was not gender and age that matters, but instead the personal characteristics and beliefs.

They agreed that green committee would significantly enhance the environmental performance, and told me that their company also had a Company Environment Management Committee (CEMC) and it had regular meetings to resolve all

³⁵ The testing of the eight hypotheses using one sample Z-test in Chapter 6

environmental issues. On the topic of percentage of INED, he did not agree that it would have much influence on environmental performance. He said that in the board of directors meeting, every director could raise his suggestions and opinions, regardless of whether he was an executive director or INED. He added that similar to age and gender, the contribution of the INEDs to environmental performance should depend on the individual merits of each director, rather than their positions in the board.

Surprisingly, he said that directors' remuneration tie-in with environmental performance would have little influence on environmental performance of the company. He observed that though in his company there was a policy for remuneration tie-in with site safety, he found that the employees did not put extra effort in safety to earn themselves more bonus compensation. He thought that the same analogy would apply for remuneration tie-in with environmental performance. He further mentioned that it was very difficult to assess and quantify environmental performance, and the bonus payment due to "good" environmental performance could be quite arbitrary. Last but not least, he could hardly see the positive relationship between chairman & CEO duality with good environmental performance.

7.5 Discussions on the Research Findings

How can this research help in alleviating the environmental problems in Hong Kong ?

With the hierarchy of the importance of the four critical factors in mind, the research does shed light on some measures that the government, the Hong Kong Stock Exchange and the construction trade should consider :-

- (a) According to the research, the ‘green corporate governance’ is the second most critical factor in affecting the project environmental performance as perceived by listed construction companies in Hong Kong. Further, among the three components of ‘green corporate governance’ factor, the ‘board of directors’ leadership’ has shown to be mostly related to the green corporate governance.

This research also provides evidence that the establishment of green committee within the board, the possession of green qualifications by board directors and the remuneration (if not covering the basic emolument, at least the bonus part) of directors tie-in with the environmental performance of the listed company will improve the board of directors’ leadership on environmental fronts and therefore can improve the project environmental performance of the listed construction companies.

Based on the above, should the Hong Kong Stock Exchange consider to introduce the following requirements as part of their listing rules, whether as code provisions or mandatory requirements that :-

- (i) every listed construction company shall have at least one board director who possesses a green qualification; and
- (ii) every listed construction company shall establish a green committee within the board, and the green committee to be chaired by a director holding green qualification ?

On the other hand, evidence from this research reveals, unlike those found in the western world, the size of the board, the number of female directors within the board and the number of INEDs in the board may not have a very significant impact on the project environmental performance of the listed construction companies in Hong Kong

- (b) This research also provides evidence to suggest that business competitiveness is the most critical factor in affecting the project environmental performance of listed construction companies in Hong Kong.

In order to encourage the construction companies to improve themselves, why the government or the trade cannot provide a platform for disclosure of information on their project environmental performance ? In doing so, the well-performed companies will have better reputation before the three components of the critical factor 'Business Competitiveness', i.e. the media and NGOs, their shareholders and their financiers. The well-performed companies will become more competitive before their business rivals and will win more jobs. On the other hand, the ill-performed companies will have to improve themselves in order not to lose out from the industry. In short, the information platform provides the arena for the construction players to compare and sharpen their environmental skills and knowledge.

Hogner (1982) suggested the legitimacy theory as an explanation of environmental disclosure. Corporate management would react to community expectations (Tilt, 1994) and the company as part of the community would endeavor to secure the acceptance of their activities by the shareholders and stakeholders within the community by controlling their environmental pollution to fall within their acceptable limits (Barkemeyer, et al., 2014). Even when activities had an adverse

impact on the environment, the management of the company would seek the trust of the stakeholders by re-establishing her credentials through disclosure of additional information (Chithambo & Tauringana, 2014).

The disclosure of information can either be compulsory or on voluntary basis. In Hong Kong, under Appendix 27 of the Listing Rules issued by the Stock Exchange requires listed construction companies to compulsorily disclose information relating to their environmental performance in their ESG reports on an annual basis. Listed construction companies are required to provide in their ESG reports on both qualitative information³⁶ and quantitative information³⁷. However, most of the listed construction companies tend to be selective³⁸ in disclosing those quantitative information which are favourable to them to improve their image and hence their competitiveness. Importantly, only very few listed construction companies have disclosed their environmental prosecutions.

On the other hand, can the trade provide platform to allow construction companies to voluntarily disclosure their environmental performance ? Or can the

³⁶ as general disclosure of Subject Area A (Environmental) in ESG reports

³⁷ as key performance indicators (KPIs) of Subject Area A (Environmental) in ESG reports

³⁸ Comments made by Ms Grace Kwok, chairlady of a Hong Kong listed green building consultants company known as Allied Sustainability & Environmental Consultants Group Ltd, which is the only listed green building consultancy in Hong Kong in 2018

government mandatorily require the construction companies to disclose their environmental performance in the companies' websites ?

(c) Though most of the listed construction companies have obtained their ISO 14000 certifications, many of them do not really implement them but simply treat them as paperwork to satisfy the requirements of their clients. From the research results, the ISO 14000 falls within the second most critical factor "Green Corporate Governance". If the industry, especially the trade unions, can further promulgate the effectiveness of the ISO 14000 in improving environmental performance, more companies will actually implement them to improve the overall project environmental performance of construction industry.

(d) The "customers' requirements" is the most relevant component of the third critical factor "Government Requirements". One of the most important aspect within this component is the green building BEAM Plus requirements. To achieve a better project environmental performance, developers should be encouraged to pitch a higher standard such as the Platinum or Gold award instead of the unclassified award. The government should therefore consider the GFA concessions be progressively increased from 2% for unclassified, to 4% for bronze, to 6% for

silver, to 8% for gold and ultimately to 10%³⁹ for platinum award, instead of the existing policy of 10% across the board.

- (e) The environmental legislation is the second mostly related component within the critical factor “Government Requirements”. In order to improve the project environmental performance as a whole across the construction industry, the government should tighten the law and to revamp her enforcement regime. At the moment, the environmental prosecutions in Hong Kong are largely conducted by the EPD officers as lay prosecutors in courts. To improve the situation, all environmental prosecutions should be handled by legally qualified Government Counsel or Senior Government Counsel of the Department of Justice. Further, more human resources should be deployed to increase the number of enforcement officers to regularly inspect construction sites to upkeep a good environmental performance standard.

Since the “Government Requirements” is only placed at the third position on the priority list, the government regulatory control is not as important as in the western world.

³⁹ The existing ceiling of exempted GFA is at a flat rate of 10%

Finally, since the critical factors are in the decreasing order of “Business Competitiveness” to “Green Corporate Governance”, to “Government Requirements”, to “Collaborators”, therefore the effectiveness of the abovementioned measures towards environmental performance should follow the sequence, from most effective to less effective as :-

- (1) Hong Kong Stock Exchange or the government or the trade itself to demand the disclosure of project environmental performance to the public as suggested in Para. 7.5(b) hereinabove;
- (2) Hong Kong Stock Exchange to dictate the composition and attributes of the board as delineated in Para. 7.5(a);
- (3) Construction companies themselves to put the ISO 14000 in action as suggested in Para. 7.5(c);
- (4) Government to change the policy on GFA concessions for green buildings as delineated in Para. 7.5(d); and
- (5) Government to strengthen her enforcement regime as described in Para. 7.5(e).

With these measures in place, the project environmental performance of listed construction companies shall be much improved to create a benign livable space for the people of Hong Kong.

Chapter Summary

The results of the factor analysis on data obtained from the first set of questionnaires were discussed with five industry leaders. They generally agreed with the findings of the EFA which in increasing order of their priority were : “Collaborators”, “Minimum Statutory Requirement”, “The Green Corporate Governance” and “Business Competitiveness”.

They said that the 4 critical factors could largely be seen as :-

- ✧ “Business Competitiveness” : the external stakeholders that could adversely affect the business profit of the listed construction company if the listed construction company was not performing well in terms of environmental protection on-site. They agreed that these parties could mostly affect the project environmental performance of the listed construction company because it would be in its financial interest for them to perform well
- ✧ “Green Corporate Governance” : the listed construction company itself who took self-initiation to improve its project environmental performance through establishment of a sound board with directors of the right attributes, the cultivation of good green corporate culture and putting in place an effective environmental management system, such as the ISO 14 000 – “Green Corporate Governance”

critical factor.

- ✧ “Government Requirements” : government regulation and requirements which were essential as the background minimum requirements for the project environmental performance of all construction companies in Hong Kong.
- ✧ “Collaborators” : the internal construction team such as the consultants, site agents and subcontractors collaborating with the listed main construction company to achieve the required level of project environmental performance.

Observations from the pattern matrix reveal that “Collaborators” is most related to “Business Competitiveness” (0.364). This is the evidence, though not too strong, that the green support of the project building team and the supply chain members, in particular the subcontractors, together with the trade union can assist the listed construction company to enhance its business competitiveness over its peers, have better financial credit rating and better image before the media, green NGOs and shareholders. In this way, the listed company will become more business competitive in the construction industry. Further, since correlation coefficient of “Business Competitiveness” and “Green Corporate Governance” is 0.309, this evidence supports the proposition that better green corporate governance can improve the listed company’s business competitiveness

Finally, to validate the statistical results of the second set of questionnaires on how the attributes of the board can affect the environmental performance of the listed construction companies, case studies on two listed companies with specific board characteristics that have different environmental performance would be examined to validate the statistical results. The first company possesses a small sized board with high ratio of female directors and INEDs. The second company possesses a rather large sized board with no female director and a green board committee. Though not exact science, the case studies tend to confirm that : (a) the number of female directors on the board, and (b) the size of the board are not significant attributes affecting the project environmental performance of listed construction companies in Hong Kong.

CHAPTER 8

Conclusion

- 8.1 Summary of Major Findings
- 8.2 Contribution
 - 8.2.1 Theoretical Contribution
 - 8.2.2 Practical Contribution
- 8.3 Recommendations
- 8.4 Limitation
- 8.5 Significance of the Research
- 8.6 Suggestion for Future Research

Chapter 8 : Conclusion

8.1 Summary of Major Findings

Even though there is no environmental performance index for the construction industry in Hong Kong (which might take years to develop), this research has shed light on the critical factors that the construction companies in Hong Kong perceive to have influence on their project environmental performance.

Through literature reviews there are three corporate governance elements which can affect the environmental performance of companies, they are the 'board of directors', 'corporate culture' and 'environmental management system ISO 14000'. Similarly, after reviewing the stakeholders who can affect the environment performance of companies, the following elements are found. They are "shareholders', 'customers', 'government', 'sub-contractors / suppliers', 'competitors', 'media and green NGOs', and 'trade union'.

After interviewing experienced practitioners in the construction industry and with the addition of two elements as suggested by the industry leaders, the '12-element model' which consists of twelve elements (or variables) that can affect the project

environmental performance of construction companies is established as the basis for analysis. They are : ‘board of directors’, ‘corporate culture’, ‘environmental management system ISO 14000’, ‘shareholders’, ‘customers’, ‘government’, ‘financial institutions and credit rating agencies’, ‘sub-contractors / suppliers’, ‘competitors’, ‘media and green NGOs’, ‘building project team’ and ‘trade union’.

For the element ‘board of directors’, through literature reviews the composition and attributes of the board are found to have an impact on the corporate governance and they might affect the environmental performance of listed construction companies. Eight characteristics and attributes are identified in this research, they are ‘size of the board’, ‘number of female directors within the board’, ‘average age of the board’, ‘chairman and CEO duality’, ‘green qualifications possessed by directors’, ‘percentage of independent non-executive directors’, ‘remuneration of directors tie-in with the environmental performance of the company’ and ‘establishment of green committee in the board’. By conducting questionnaire-surveys, the one sample Z-test statistical results show that only four of them have very significant impacts on the project environmental performance of listed construction companies, they are the ‘chairman and CEO duality’, ‘green qualifications possessed by directors’, ‘remuneration of directors tie-in with the environmental performance of the company’ and

‘establishment of green committee in the board’. The statistical results at 99% confidence level reveal that ‘number of female directors in the board’ and ‘size of the board’ do not have any significant effect on the project environmental performance while ‘age of the board’ and ‘number of INED in the board’ only have marginal effect.

Based on the 12-element model, exploratory factor analysis has been applied to these elements to group these elements into four factors. They are, in order of priority : (i) ‘Business Competitiveness’, (ii) ‘Green Corporate Governance’, (iii) ‘Government Requirements’ and (iv) ‘Collaborators’. These four critical factors can be interpreted as follows :-

(a) Business Competitiveness : the external parties that could adversely affect the business profit of the listed construction company if it was not performing well in terms of environmental protection on-site. These parties could mostly affect the project environmental performance of the listed construction company because they could exert adverse impact on the financial interest of these contractors.

(b) Green Corporate Governance : the listed construction company itself who took self-initiation to improve its project environmental performance through establishment of a sound board with directors of the right attributes, the cultivation of good green corporate culture and putting in place an effective environmental

management system, such as the ISO 14 000. This is the only factor that a listed construction company can internally control. The other factors are outside stakeholders.

(c) Government Requirements : the external police, i.e. the government regulation and requirements which were essential as the background minimum requirements for the project environmental performance of all construction companies in Hong Kong.

(d) Collaborators : the construction team such as the consultants, site agents and subcontractors, together with the trade union collaborating with listed main construction companies to achieve the required level of project environmental performance.

8.2 Contribution

8.2.1 Theoretical Contribution

The contributions to the knowledge from this study are :-

- (1) it establishes a new '12-element model' which encapsulates all the variables (or elements) that affects the project environmental performance of listed construction companies in Hong Kong;
- (2) it identifies the critical factors that affect the project environmental performance

as perceived by the listed construction companies themselves. They are, in order of priority, (a) ‘business competitiveness’, (b) ‘green corporate governance’, (c) ‘government control’ and ‘collaborator’; and

- (3) it reveals that some of the attributes and composition of the board of directors which affects environmental performance of companies in western countries do not have any significant effect on the project environmental performance of listed construction companies in Hong Kong, namely the ‘number of female directors in the board’ and the ‘size of the board’. Further, the ‘establishment of a green committee’ at board level and ‘the green qualification’ possessed by board directors can significantly improve the project environmental performance of listed construction companies in Hong Kong.

8.2.2 Practical Contribution

The practical contribution from this study is that through the reviews and analysis on the elements that affect the project environmental performance of construction companies in Hong Kong, it reveals the reason why environmental legislation cannot curb the construction companies from emanating pollution from their construction sites.

The government regulatory control in Hong Kong is not effective⁴⁰ because the penalty imposed on the environmental offenders is too lenient, and there was no successful prosecution on the directors of construction companies. Besides, the environmental prosecutors are often not commensurate with the experience of the senior lawyers appointed by the construction companies to win legal battles. Further, due to the multi-layer of subcontracting of work and the different bargaining power between the subcontractors and the main contractors, the main contractors which are usually the large construction companies will escape from the hook. Even if the construction companies are convicted, they would spread their offences over time to avoid three offences within a period of 6 months, otherwise they may not be allowed to tender for jobs tendered out by the Development Bureau (please refer to Para. 7.3.1.4 of Chapter 7 for details). A fortiori, this research reveals that in the eyes of the listed construction companies in Hong Kong, the ‘government requirement’ is only third on the list of critical factors that affect their project environmental performance. That explain why government regulatory control in Hong Kong is not as important as the western countries perceive.

⁴⁰ Para. 7.3.1.4

8.3 Recommendations

The recommendations in practice are :-

- (1) Since this research reveals that ‘green qualification’ and ‘green committee’ can have significant effect on the project environmental performance of listed construction companies, the Hong Kong Stock Exchange should consider to require listed construction companies to (a) have at least one board director to possess a green qualification; and (b) establish a green committee (similar to other board committee like the audit committee) within the board to look after all the green issues at board level.
- (2) Since this research reveals that business competitiveness is the most critical factor in affecting the project environmental performance of construction companies in Hong Kong, the Government of Hong Kong or the trade union should consider to establish a platform of disclosure of environmental performance information so that the good performers can be rewarded for having better reputation and more jobs while the poor performers will be shamed and lose out from their business.
- (3) Since this research reveals that green corporate governance is the second critical factor that can affect the project environment performance of construction companies, and within the green corporate governance critical factor the implementation of ISO 14000 is second on the list, the trade union should

promulgate the effectiveness of ISO 14 000 that it is no longer just a paper certification, but instead it can down to the earth improve the environmental performance of its members.

(4) Through the interviews and analyses conducted in this research, the government regulatory control is found to be ineffective in harnessing construction companies in producing pollutions from their sites. To improve this situation, the government should consider (a) deploy more human resources in enforcing the environmental legislation and (b) provide well legally trained prosecutors in conducting environmental prosecutions in courts.

(5) As suggested in the interviews and analyses conducted in this research, the government should consider to induce the developers to achieve a higher standard of green building by giving GFA concessions progressively, for instance say from 2% for unclassified, to 4% for bronze, to 6% for silver, to 8% for gold and ultimately 10% for platinum award. At present, the policy is 10% across the board.

8.4 Limitation

As the deductions and conclusion can only be as accurate as the statistical model used, the following are the limitations for this research :-

- (a) As mentioned earlier, though there are sustainability indices in Hong Kong, there is no environmental performance index for the construction industry in Hong Kong. Without such an index for the construction industry in Hong Kong, in this study the environmental performance of construction companies can only be assessed by the subjective views of the senior management of listed construction companies;
- (b) Though the 12-element model used in this research has been validated by a panel of industry leaders, the elements found may not be exhaustive;
- (c) The random sample size of 27 Hong Kong listed construction companies out of a population of 135 can be increased to improve the reliability of the statistical results. Alternatively focused sample should be used which would improve the reliability of the results.
- (d) Though the sample size for the EFA is already 88, more samples would produce more accurate and reliable results
- (e) Similarly, the 31 sample size for the one sample Z-test may be increased to improve the reliability of the statistical results
- (f) In testing the 8 hypotheses, the estimation of population means wholly relies on the p-value confidence level used, which is arbitrary. The confidence level will affect the acceptance of the null hypotheses;

- (g) The labelling of the 4 factors generated by EFA is subjective; and
- (h) The validation on the 8 attributes of the board by 2 case studies may not be comprehensive enough

Having said that, the research has been carried out to stretch the very limits : for instance the use of a panel of industry leaders to validate the 12- element model; the use of perceived environmental performance instead of a numerical environmental performance index, which is not available at this time of the research. Though the sample size and number of case study can be increased, the results should not deviate too much from the conclusions of this research.

8.5 Significance of the Research

Though there are a lot of limitations in this research, in particular the lack of an environmental performance index for construction industry in Hong Kong, this study serves, as I am aware, as the first research on (i) what are the critical factors that affect the environmental performance of listed construction companies in Hong Kong, and (ii) which attributes and composition of the board of directors can significantly affect the environmental performance of construction companies in the Hong Kong perspective.

The subjective perception of the listed construction companies are used which can in reality accurately reflect how the listed construction companies feel in response to the stakeholders' pressure, in particular whether they would or would not improve their environmental performance, and what would they do if they would like to improve their performance.

The value of this research also lies in collecting data from the directors including the CEOs and chairmen of listed construction companies in Hong Kong. They are very busy people and making appointments with them is not without difficulties. In collecting views from board directors out of 20% of all the listed construction companies as shown in the website of AASTOCK.com is by itself a very onerous and arduous job. Further, the successful invitation of the five industry leaders to participate in this research is another challenge. Their comments and inputs can certainly add a lot of credibility and reliability to this research.

8.6 Suggestion for Future Research

Unlike US where they have the KLD index, Hong Kong does not have an environmental index for construction industry which can act as a barometer in

measuring the environmental performance of construction companies. Though the Hong Kong Stock Exchange has imposed a requirement in their listing rules that all listed companies have to publish their environment, sustainability and governance (ESG) report as part of their annual reports, there is no consensus on the exact amount of quantifiable information to be provided and therefore the environmental performance of listed construction companies cannot be easily compared among themselves.

Future study should be carried out to establish an environmental performance index for the construction industry which would be acceptable by the government and the industry. By establishing a commonly recognized environmental or sustainability index with agreed parameters to be measured quantitatively, the numerical index can be used to gauge the environmental performance of listed construction companies in Hong Kong.

It shall be a very valuable piece of information because a lot of researches anchor on the finding out of the environmental performance of an entity. It would also enrich this research since :-

(a) Based on the environmental performance index, the research above can be revisited. For instance for the attributes of the board, the numerical value of the environmental performance of sufficient number of listed construction companies can be used as y-variable and with the various attributes as x-variables, and using structural equation modeling or multiple regression analysis, their relationships can be precisely found as shown below :-

$$Y = \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \dots + \alpha_{n-1} X_{n-1} + \alpha_n X^n$$

Where Y = environmental performance (based on environmental index); and

X = the variables like size of the board or the number of female directors

α_n = regression coefficients

(b) With this quantifiable environmental performance index, part of the directors' compensation package can be tie-in with this index to give momentum to listed construction companies to enhance their environmental performance.

In the premises, the environmental performance index for the construction industry will definitely facilitate further research on construction topics relating to the environment.

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Appendix A - Listing Requirements in Hong Kong

Main Board			GEM
Market for more established companies. Listings range from conglomerates, banks and property developers to internet companies and healthcare providers			Market for small to mid-sized companies
Financial Requirements (Satisfy One of The Below Tests)			Financial Requirements
Profit Test	Market Cap / Revenue Test	Market Cap/Revenue/ Cashflow Test	
<ul style="list-style-type: none"> • 3-Year aggregate profit \geq HK\$50m • Market cap \geq HK\$500m 	<ul style="list-style-type: none"> • Latest year revenue \geq HK\$500m • Market cap \geq HK\$4bn 	<ul style="list-style-type: none"> • Latest year revenue \geq HK\$500m • Market cap \geq HK\$2bn • Positive 3-year aggregate operating cash flow (OCF) \geq HK\$100m 	<ul style="list-style-type: none"> • Positive 2-year aggregate OCF \geq HK\$30m • Market cap \geq HK\$150m

Source: World Federation of Exchanges, HKEX. Note 1: Includes both Main Board and GEM.

Appendix B

Hong Kong Business Sustainability Index

香港企業可持續發展指數

The 3rd Hong Kong Business Sustainability Index Company List (in alphabetical order)

第三屆【香港企業可持續發展指數】公司名單（按英文名稱排列）

Company Name	公司名稱
AAC Technologies Holdings Inc.	瑞聲科技控股有限公司
AIA Group Ltd.	友邦保險控股有限公司
Bank of China Ltd.	中國銀行股份有限公司
Bank of Communication Co., Ltd.	交通銀行股份有限公司
Bank of East Asia, Ltd., The*	東亞銀行有限公司*
Belle International Holdings Ltd.	百麗國際控股有限公司
BOC Hong Kong (Holdings) Ltd.*	中銀香港（控股）有限公司*
Cathy Pacific Airways Ltd.*	國泰航空有限公司*
China Construction Bank Corporation	中國建設銀行股份有限公司
Cheung Kong Property Holdings Ltd.	長江實業地產集團有限公司
China Construction Bank Corporation*	中國建設銀行股份有限公司*
China Life Insurance Co. Ltd.	中國人壽保險股份有限公司
China Mengniu Dairy Co. Ltd.	中國蒙牛乳業有限公司
China Merchants Ports Holdings Co. Ltd.	招商局港口控股有限公司
China Mobile Ltd.	中國移動有限公司
China Overseas Land & Investment Ltd.	中國海外發展有限公司
China Petroleum & Chemical Corporation	中國石油化工股份有限公司
China Resources Land Ltd.	華潤置地有限公司
China Resources Power Holdings Co., Ltd.*	華潤電力控股有限公司
China Shenhua Energy Co. Ltd.	中國神華能源股份有限公司
China Unicom (Hong Kong) Ltd.	中國聯合網絡通信（香港）股份有限公司
CITIC Ltd.	中國中信股份有限公司
CK Hutchison Holdings Ltd.	長江和記實業有限公司
CK Asset Holdings Limited	長江實業集團有限公司
CK Infrastructure Holdings Ltd.	長江基建集團有限公司
CLP Holdings Ltd.*	中電控股有限公司*
CNOOC Ltd.*	中國海洋石油有限公司*
Galaxy Entertainment Group Ltd.	銀河娛樂集團有限公司

Geely Automobile Holdings Ltd.	吉利汽車控股有限公司
Hang Lung Properties Ltd.*	恆隆地產有限公司*
Hang Seng Bank Ltd.*	恆生銀行有限公司*
Henderson Land Development Co. Ltd.*	恆基兆業地產有限公司*
Hengan International Group Co. Ltd.	恆安國際集團有限公司
Hong Kong and China Gas Co. Ltd., The*	香港中華煤氣有限公司*
Hong Kong Exchanges and Clearing Ltd.*	香港交易及結算所有限公司*
HSBC Holdings plc*	匯豐控股有限公司
Industrial and Commercial Bank of China Ltd.	中國工商銀行股份有限公司
Kunlun Energy Co. Ltd.	昆侖能源有限公司
Lenovo Group Ltd.*	聯想集團有限公司*
Li & Fung Ltd.	利豐有限公司
Link Real Estate Investment Trust	領展房地產投資信託基金
MTR Corporation Ltd.*	香港鐵路有限公司*
New World Development Co. Ltd.*	新世界發展有限公司*
PetroChina Co. Ltd.	中國石油天然氣股份有限公司
Ping An Insurance (Group) Co. of China Ltd.	中國平安保險（集團）股份有限公司
Power Assets Holdings Ltd.*	電能實業有限公司*
Sands China Ltd.	金沙中國有限公司
Sino Land Co. Ltd.*	信和置業有限公司*
Sun Hung Kai Properties Ltd.*	新鴻基地產發展有限公司*
Swire Pacific Ltd. 'A'*	太古股份有限公司*
Tencent Holdings Ltd.	騰訊控股有限公司
Want Want China Holdings Ltd.	中國旺旺控股有限公司
Wharf (Holdings) Ltd., The	九龍倉集團有限公司

*首 20 名【香港企業可持續發展指數】公司 Top 20 Companies in Hong Kong Business Sustainability Index (50 Hang Seng Index Constituents as at 6 June 2017) (以 2017 年 6 月 6 日當天列為恆生指數成分股的 50 間企業)

Source: <http://www.polyu.edu.hk/mm/hkbsi/result.html>

Appendix C

The Fourth Hong Kong SME Business Sustainability Index 第四屆香港中小企企業可持續發展指數

List of Recognized Companies

(in alphabetical order)

*Top 10 companies in the index

*4M Industrial Development Limited

Abas Business Solutions Limited

Arredamenti Company Limited

*Baby Kingdom

Chalotte Travel Limited

*City Cut Hair & Beauty Salon

Cyber Villa Limited

*Diving Adventure Limited

*Dunwell Enviro-Tech (Holdings) Limited

EcoSage Limited

Energy Source Health Management Centre Limited

EP Venture Company Limited

Fast Base Enterprises Limited

Happy Star Travel Service Limited

HL and C Employment Agency Limited

*Intimex Business Solutions Company Limited

*Jenston Technology Corporation Limited

Linkz Industries Limited

*Meiriki Japan Company Limited

MYLAMSTUDIO

OKIA Optical Company Limited

Projexasia Limited

Regal World Transport System Limited

Sailing Boat Catering Group Limited

Silver Printing Company Limited

*Sunta Chemical Limited

TOGO Pacific Limited

獲嘉許企業名單

(按英文名稱排序):

*指數排行首十名公司

*科文實業有限公司

珠璣商業軟件有限公司

歐達傢俱有限公司

*親子王國

樂悠遊有限公司

*匠髮廊

電腦山莊

*潛水歷險會有限公司

*正昌環保科技(集團)有限公司

衡睿有限公司

能量站健康管理中心有限公司

商策顧問有限公司

泛基企業有限公司

惠迅旅遊有限公司

康樂居僱傭中心有限公司

*泰美商業科技有限公司

*仁達科技集團有限公司

領先工業有限公司

*日本命力健康食品有限公司

心林魅影

澳加光學有限公司

博建(香港)有限公司

利嘉國際航運有限公司

帆船飲食集團有限公司

式慧印刷有限公司

*新達化工有限公司

道高太平洋有限公司

*Ultra Active Technology Limited

Version 2 Limited

Waste & Environmental Technologies Limited

Wessen Group Limited

Wing On CPA & Associates Limited

Yeung's Fiberglass Company

*超敏科技有限公司

二版有限公司

保然技術有限公司

維森集團有限公司

永安會計師事務所有限公司

楊氏玻璃纖維公司

Source: <http://www.polyu.edu.hk/mm/sme/About.html>

Appendix D – Value-Process-Impact Model, Sustainability Management Research Centre (“SMRC”)

- ✧ Values (V): Business sustainability values refers to the philosophical orientation of a CSR-caring organization. This should be reflected in the vision and mission statements that indicate a well-defined sense of direction that the firm will take.
- ✧ Process (P) – Management: A company’s process, as reflected in its CSR management, is deeply rooted in its corporate values. Managerial skills, including planning and coordinating, will have an impact on the firm’s CSR performance.
- ✧ Process (P) – Practice: Sustainable firms should balance stakeholder interests rather than serve shareholder interests alone in their CSR practices. This comprehensive stakeholder approach allows firms to add value and gain competitive advantage.
- ✧ Impact (I): Impact refers to the influence a business activity has on society, the environment and the various stakeholders. It enables a firm to gauge the results of its CSR effort, thus helping it to recognize the relationship it has with its stakeholders and make adjustments as necessary.

Appendix E – KLD Sustainability Index

Environmental Strengths

Beneficial products and services	The company derives substantial revenues from innovative remediation products, environmental services, or products that promote the efficient use of energy, or it has developed innovative products with environmental benefits. (The term “environmental service” does not include services with questionable environmental effects such as landfills, incinerators, waste-to-energy plants, and deep injection wells.)
Pollution prevention	The company has notably strong pollution prevention programs including both emissions reductions and toxic-use reduction programs.
Recycling	The company either is a substantial user of recycled materials as raw materials in its manufacturing processes, or a major factor in the recycling industry.
Clean energy	(previously called Alternative fuels). The company has taken significant measures to reduce its impact on climate change and air pollution through use of renewable energy and clean fuels or through energy efficiency. The company has demonstrated a commitment to promoting climate-friendly policies and practices outside its own operations.
Communications	The company is a signatory to the CERES (Coalition for Environmentally Responsible Economics) Principles, publishes a notably substantive environmental report, or has notably effective internal communications systems in place for environmental best practices. KLD began assigning strengths for this issue in 1996.
Property, plant and equipment	The company maintains its property, plant, and equipment with above-average environmental performance for its industry. KLD has not assigned strengths for this issue since 1995.
Other strength	The company has demonstrated a superior commitment to management systems, voluntary programs, or other environmentally proactive activities.

Environmental Concerns

Hazardous waste	The company's liabilities for hazardous waste sites exceed \$50 million, or the company has recently paid substantial fines or civil penalties for waste management violations.
Regulatory	The company has recently paid substantial fines or civil penalties for violations of

problems	air, water, or other environmental regulations, or it has a pattern of regulatory controversies under the Clean Air Act, Clean Water Act, or other major environmental regulations.
Ozone-depleting chemicals	The company is among the top manufacturers of ozone-depleting chemicals such as HCFCs, methyl chloroform, methylene chloride, or bromines.
Substantial emissions	The company's legal emissions of toxic chemicals (as defined by and reported to the EPA) from individual plants into the air and water are among the highest of the companies followed by KLD.
Agricultural chemicals	The company is a substantial producer of agricultural chemicals, i.e., pesticides or chemical fertilizers.
Climate change	The company derives substantial revenues from the sale of coal or oil and its derivative fuel products, or the company derives substantial revenues indirectly from the combustion of coal or oil and its derivative fuel products. Such companies include electric utilities, transportation companies with fleets of vehicles, auto and truck manufacturers, and other transportation equipment companies.
Other concern	The company has been involved in an environmental controversy that is not covered by other KLD ratings.

Source: Sharfman, Mark., 1996. The Construct Validity of the Kinder, Lydenberg & Domini Social Performance Ratings Data. *Journal of Business Ethics*. 15. 287-296. 10.1007/BF00382954.

Appendix F - Fines for Environmental Offences in 2018 (HK\$)

Ordinance	Total	Highest	Lowest	Average
APCO	764 500	46 500	1 000	6 950
NCO	1 117 500	30 000	1 500	8 402
WPCO	658 100	58 000	2 000	18 803
WDO	2 965 550	60 000	1 000	6 378
OLPO	0	0	0	0
EIAO	20 000	20 000	20 000	20 000
DASO	40 000	10 000	5 000	6 667
HCCO	5 000	5 000	5 000	5 000
PERO	11 900	4 000	900	2 380
PCPNR	9 000	3 000	3 000	3 000
Total	5 591 550	60 000	900	7 367

Notes :

1) **APCO -Air Pollution Control Ordinance**

NCO -Noise Control Ordinance

WPCO-Water Pollution Control Ordinance

WDO -Waste Disposal Ordinance

OLPO -Ozone Layer Protection Ordinance

EIAO -Environmental Impact Assessment Ordinance

DASO -Dumping at Sea Ordinance

HCCO-Hazardous Chemicals Control Ordinance

PERO -Product Eco-Responsibility Ordinance

PCPNR -Public Cleansing and Prevention of Nuisances Regulation

2) **The average fines are calculated by dividing the total fines by total no. of convictions**

Source : https://www.epd.gov.hk/epd/english/laws_regulations/enforcement/resource_enfor2.html

Appendix G – Hong Kong Environmental Complaints Statistics

Year	Total No. of Environmental Complaints	No. of Complaints originates from Construction and Renovation	Proportion (%)
2017	22,376	5,675	25.4
2016	20,480	5,195	25.4
2015	21,603	4,851	22.5
2014	20,964	4,393	21.0
2013	24,366	5,279	21.7
2012	24,980	5,270	21.1
2011	21,915	5,192	23.7
2010	23,678	5,870	24.8
2009	24,498	5,885	24.0
2008	25,206	5,745	22.8
2007	27,531	5,330	19.4
2006	27,553	5,098	18.5

Source: https://www.epd.gov.hk/epd/english/laws_regulations/enforcement/pollution_complaints_statistics.html

Appendix H – Open-ended Questions in the Interviews with 5 Industry Leaders in Chapter 4

- (1) Do you agree that the implementation of an environmental management system like ISO 14 000 within a construction company can improve the project environmental performance of that company in Hong Kong? Why do you think so?
- (2) Do you agree that the board of directors can affect the project environmental performance of a construction company? Why do you think so? Further, do you think that the composition and attributes of the board, such as (i) their attributes in terms of their average age, average education level, average green qualifications, (ii) the board diversity like the number of female directors in the board, and (iii) the size of the board, will have an effect on the project environmental performance ?
- (3) Do you agree that company culture can affect the project environmental performance of construction companies? Why do you think so?
- (4) Do you agree that shareholders of a company can affect the project environmental performance of that construction company? Why do you think so?
- (5) Do you agree that customers / developers can affect the project environmental performance of construction companies? Why do you think so?
- (6) Do you agree that government policy and regulations can affect the project environmental performance of construction companies? Why do you think so?
- (7) Do you agree that subcontractors and suppliers can affect the project environmental performance of construction companies? Why do you think so?
- (8) Do you agree that trade competitors can affect the project environmental

performance of construction companies? Why do you think so?

(9) Do you agree that media and green NGOs can affect the project environmental performance of construction companies? Why do you think so?

(10) Do you agree that trade unions, like the Hong Kong Construction Association and Hong Kong Institute of Construction Managers, can affect the project environmental performance of construction companies? Why do you think so?

(11) Other than the above factors, what else can you think of that can affect the project environmental performance of construction companies in Hong Kong? Why do you think so?

Appendix I – Interviews with Industry Leaders : Brief Notes

Interviewee No.1 (random selection from the panel)

He agreed that the board of director was definitely a key element affecting the project environmental performance of a listed construction company. He thought that the board of directors was the brain of a listed company and its composition would have an impact on the company's environmental performance. He opined that the background of the directors i.e. his educational achievements in particular if he was holding a degree or a certificate in green building or environmental protection or sustainability would affect his judgment and decision in relation to the project environmental issues. From his experience as a director of a listed construction company, he felt that construction professionals and lawyers have stronger initiatives than accountants, who quite often were the chief financial officers (CFO) of the companies, in adopting initiatives in environmental protection measures. He thought that accountants were more concerned about the turnover and profitability of the company rather than protecting the environment. However, if the environmental protection measures could improve the company's image and hence its competitiveness in bidding for new jobs, the accountants or CEOs would certainly

deploy the resources of the company to do so. He also opined that the gender of the directors mattered as he thought that females would be more receptive to environmental protection ideas and practices though there were only a few female directors in the construction industry. When inquired if the HKCA had any data on the number of female directors as their members, he said that they did not have such information, but he agreed that it would be good to have such statistical information in future. He observed that across the whole spectrum of the construction industry, from foundation contractors, superstructure contractors, electrical and mechanical contractors to fitting out contractors, the boards of directors of all these listed construction companies were still dominated by males. Besides, he observed that the young generation was more akin to environmental protection measures and practices. He said that this might be due to the promulgation of the media and due to the green education the young generation could receive these days. Thus, he agreed that the average age of the board would affect the project environmental performance of the construction company.

He also thought that the number of independent non-executive director (“INED”) in the board would affect the board’s decision since from his past experience the INEDs did try to act in the best interest of the company which in effect was for the common

good of the minority individual shareholders. For the size of the board he thought that it was not a factor because it was not the size of the board but the quality of the directors of the board that matters.

He opined that the setting up of green committee within the board would help promoting environmental protection since there would be an executive director of the board taking the lead to deal with all the environmental issues. However, he told me that there were only a few listed construction companies in Hong Kong did have such green or sustainability committees whilst the majority of the construction companies did not have such committee. Those companies have green or sustainability committees were invariably the very big listed construction companies in Hong Kong.

For the CEO duality, he did not believe that there could be any impact on the environment performance if the roles of CEO and chairman were taken up by the same person. He opined that though the workload would be very heavy for a person to assume both positions, it was the capability of that person wearing these two hats that determined how much time resources that he could use to look after all the environmental issues of the company.

Further, he agreed that the remuneration of directors tied in with the environmental performance of the listed company would certainly improve the environmental performance of the company, though he was doubtful whether the board would implement such practices. Further, he observed that the project environmental performance would anchor on many on-site factors which were outside the control of the directors sitting in his office for most of the time. Nevertheless, he took the view that the linking of remuneration with the project environmental performance would encourage the directors to have greater vigilance and attentions on the company's environmental issues, and hence could improve the project site environmental performance.

He agreed that the environmental management was a very important element that could affect the project environmental performance of a listed construction company.

He said that the environmental management system generally encouraged the company to avoid breaching the environmental laws, since it was part and parcel of the environmental policy under ISO 14000. He said that though HKCA had put their emphasis on safety and health of workers, they were also putting weights on environmental protection. In fact, in or around 2003 when the Noise Control (Amendment) Bill was passed, they had successfully persuaded the Legislative

Council to adopt an effective environmental management system as a defence for the statutory offence against directors of a construction company under by now s.28A of the Noise Control Ordinance Cap.400. He opined that a truly implemented ISO 14000 would definitely improve the project environmental performance of construction companies and it would reduce the number of environmental complaints and prosecution by the Environmental Protection Department.

He also agreed that corporate culture was very important since it would dictate the behaviour of the employees which included the middle managers and the frontline on-site workers in observing the environmental law and various codes of best practice relating to environmental protection.

He further agreed that the stakeholders like the customers, shareholders, government regulations, subcontractors and suppliers, competitors, media and green NGOs did have an influence on the project environmental performance of listed construction companies. He emphasized that the HKCA did promote the site environmental performance. They have conducted talks and seminars on topics relating to environmental protection and he believed that the trade union has exerted much influence on their members to observe the environmental laws to improve their project

environmental performance.

Finally when he was asked whether he would add any new elements into the list, he said that he would add one more, that is, the building project team which included the architect and engineers. He explained that it was because the building team members could stipulate standards and procedures so that the project environmental performance of listed construction companies could be maintained and improved.

Interviewee No.2 (random selection from the panel)

In answering questions relating to the three corporate governance elements, he opined that the board of directors of a listed construction company was of pivotal importance to its project environmental performance. However, he thought that the environmental performance could not be much improved without the cooperation of the workers on site in implementing the standards and beliefs of the board, therefore company culture was of equal importance when compared with the board governance of a construction company. Further, he generally agreed that the implementation of environmental system ISO 14000 would provide an impetus for the construction company to provide environmental strategies and measures within the company, because the audit results would shame those badly performing staff.

He thought that the academic qualifications, in particular the green qualifications, and practical experience of the board directors were essential to the company's environmental performance. He suggested that the Listing Rules should be amended to stipulate mandatory green building training for all board directors in Hong Kong.

He particularly stressed the importance of independent non-executive directors

("INED") who could provide a balanced view between financial gain and environmental protection. He believed that the INEDs would have more concern about the social corporate responsibility, and they could influence the project environmental performance of construction companies.

He also thought that the size of board might have an influence on the environmental performance of the company because larger board would have more independent non-executive directors who could provide different aspects of expertise to improve the environmental performance of the company. However, he opined that the size should not be too large to be managed, and he considered a board with 9 directors should be the right size. He explained that in accordance with the Listing Rules of Hong Kong Stock Exchange, there should be at least 3 numbers or one third of the board to be INEDs whichever is the greater. Thus, a board of 9 directors should have 3 INEDs. He suggested that the board size should not be greater than 12.

He thought that the young generation should be more susceptible to change their mindset to accept new environmental initiatives. He agreed that young company directors should have a better awareness of environmental issues and practices due to the good general education offered by the government of Hong Kong. They were

more receptive in deploying resources to promote environmental protection and hence their project environmental performance.

On the other hand, he did not think female directors would improve the company's environmental performance. He said that with the good general education in Hong Kong, the gender impact on environmental concern would converge. The difference between the views of the males and females might be true for the sixty years or seventy years old cohort, but certainly not for those cohorts less than sixty years old. Furthermore, there was only very few numbers of female directors with age more than sixty working in listed construction companies in these days.

In considering the elements of customers' influence, the government regulations, the subcontractors and suppliers assistance on environmental issues, competitors, media and green non-governmental organizations' pressure, he generally agreed that they could exert an influence on the project environmental performance of a listed construction company in Hong Kong. He considered the government regulatory control and green NGOs' pressure were the very powerful external momentums for the contractors to enhance their environmental performance within the construction industry. However, he was a bit disappointed on the low penalty for environmental

breaches, he claimed that the Hong Kong courts were far too lenient on environmental culprits. Further he considered the criminal procedures in prosecuting environmental offenders were far too convoluted and time-consuming.

For the customers influence on environmental performance, he opined that the developers were keen to have their buildings graded for green building in accordance with the BEAM Plus standard because they could gain exemptions for certain floor areas from gross floor area (GFA) calculations. These exempted floor areas could however be sold to the individual purchasers. He added that other than this monetary inducement, the reputation of having green building award also attracted the developers to adopt green construction. He shared his experience that he had witnessed several foreign bank buildings been constructed in pursuance to platinum BEAM Plus rating. Regarding the BEAM Plus rating, he explained that the BEAM standard was higher and above the government regulatory requirements. He said that the government statutory control was the bare minimum standard. In complying with the developers' demand, the contractors were pushed to achieve a higher environment performance. When he was asked whether he would also regard the individual flat or house purchasers as customers, he replied that they would not require too high standard because they knew pretty well that they would be the ultimate ones to foot

the green construction bill. The developers tried to strike a balance by meeting the individual purchasers' demand for green building and at the cost acceptable to them. This was usually accomplished by adopting green construction to meet the lower end of the green building scale, that is, either the unclassified or bronze award standard. In doing so, the developer would gain their exempted gross floor area and at the same time meeting the individual purchasers' requirements. On this BEAM issue, he commented that the government of Hong Kong should allow other green building standards such as the LEED to be eligible for GFA exemptions. At the moment, there was noise in the private sector that some of the BEAM assessors, who were necessarily Hong Kong professionals, were not impartial and their processing time for approval was too long.

When he was inquired whether he aware of any generally accepted environmental performance index in the construction industry in Hong Kong which might be similar to the BEAM plus ratings in grading green buildings, he gave me a negative answer. However, he opined that this environmental performance index would be crucial since without it every construction company would claim itself to be the best in environmental performance. Without such a generally accepted index, there would be no way to compare the environmental performance of one construction company

with another.

He accorded a high priority of shareholders' influence and he shared his knowledge of shareholders activism in US which could be a powerful driving force in propelling the move for good environmental performance. However, he doubted very much the influence of trade union in Hong Kong as he opined that it was much less powerful when compared with those in the western world or communist countries.

Finally, he would like to add 'the financial institutions and credit rating agencies' as another element that could affect the project environmental performance of listed construction companies. He said that these institutions which provided funds for the construction companies could dictate the standard of environmental performance in their loan agreements and in rating the construction company for loan credits. He asserted that since construction work invariably involved huge investment, these financial institutions and credit rating agencies could be very powerful in affecting the environmental performance of listed construction companies in Hong Kong.

Interviewee No.3 (random selection from the panel)

He believed that the board of director was a very important element affecting the project environmental performance of listed construction companies in Hong Kong because the board was the decision making body who could dictate the resources to be deployed in pitching good environmental performance for the company. Further, he thought that the size of the board would affect such decisions to be made. Large boards would have more directors on board would logically possess more expertise and time resources. Besides, he thought that lawyers on board would advise the board matters relating to the environmental law, and thus would avoid the company from breaching the environmental legislations. However he thought that the size of the board could not be enlarged unlimitedly. He suggested that the optimum size to be nine persons with three INEDs and six executive directors.

He also cherished the green qualifications possessed by the directors saying that through the education or experience in getting these qualifications, the green construction concepts would be implemented into the minds of the directors so that they would have a better awareness of how to improve their project environmental performance. He generally agreed with the definition of green qualifications used in

this research, in particular he appreciated that the standard for such green qualification should be having a basic construction related degree, and on top having a BEAM Pro assessment or qualification granted by the HKGBC.

He did not support the idea that female directors could have an impact on the environmental performance of listed construction companies. He thought the green mindset of the directors should prevail over their gender. He thought that the education background would prescribe the green awareness and reception of environmental protection much more than the effect of gender.

He also did not agree that the INED could have any impact on the environmental performance because he opined that most of the INEDs would not be an advocate in the board. They knew that they could not act against the executive directors without the risk of being removed by the board. He said that it was well known in industries that INEDs were friends of the chairman or the CEO and they would not act against them. Their presence was simply as a 'yes-man' and would not affect the decision of the executive directors. If the executive directors were good in conducting green practices, the company would have good environmental performance and vice versa.

Regarding the age of the directors he had a different view from others alleging that the age would not be a factor affecting the environmental performance of the company because it really depended on the mindset of the directors themselves. He said that a lot of people had thought that young persons would have better environmental awareness, however he thought that young directors might sometimes too concentrate on profit and they might leave all the corporate social responsibility aside. On the other hand, older directors should have better life experience and they could strike a balance between profit and environmental protection. For the remuneration of directors be tied in with the company's environmental performance and the CEO duality, he agreed that both elements would have an impact on the environment performance of the listed construction companies. At this point on directors' remuneration, he commented that since the company's environmental performance could not be quantitatively assessed (at least not in the environmental, sustainability and governance reports as required by the Hong Kong Stock Exchange), directors would be very reluctant to tie in their remuneration with parameters which were not definite and exact. He said that Hong Kong construction industry needed to establish her own environmental performance index. He added that the Hong Kong Stock Exchange should provide a guideline in quantifying the information provided in the ESG reports into some sorts of number and index.

He concurred with the idea that the setting up of the greens committee within the board would improve the environmental performance of the listed construction company because this board committee would be dedicated in dealing with all the environmental issues of the company. Further, he agreed that the cultivation of an environmental culture within the company should echo with the implementation of the environmental management system. He said that both of them were important in establishing good environmental governance within the construction company. However, he criticized that a lot of construction companies were flagging up their ISO 14000 when they were bidding for jobs and they did not implement such environmental management system in substance. They were simply paper work and gimmicks for gaining an entrance ticket for job bidding.

For all the elements such as the shareholders, company culture, customers pressure, subcontractors' and suppliers' cooperation in green construction, NGOs' invigilation, and competitors' drive for environmental excellence, he agreed that these factors did have an impact on the environmental performance of all listed construction companies. In relation to the element 'customers', he commented that most of the developers were aiming at achieving the minimum BEAM Plus standard in order to gain the exempted

gross floor area without incurring excessive resources. He commented that the GFA exempted green feature of utility platform was sometimes a white elephant to the individual purchasers because it was usually a tiny platform about twenty square feet in size and was provided inside the master bedroom on the glazing side of the room which quite often installed with curtain wall. However, since the master bedroom was small of about seven-feet times seven-feet in area, the placing of a six-feet long bed along the glazing side of the room would virtually block any access to the utility platform except by climbing through the bed ! He said that most of the individual flat purchasers were concerned with the energy bills for green building rather than the site environmental performance of the contractors when the buildings were built.

For the subcontractors he opined that they should also obtain an ISO 14000 certificate in order to comply with the requirements from their main contractors. He agreed that the NGOs could impose an enormous pressure on the list of construction companies through shaming them in the press or televisions, or by lodging complaints to various government departments. They could be more powerful than the government regulations because of their prompt and effective actions in dealing with environmental pollutions when compared with the instigation of environmental prosecution which involved with tedious evidence collection and vexatious legal

procedures. Even for taking civil actions against the nuisance created by the construction sites, it would take a lot of time and resources, in particular the legal fees involved would be tremendous.

When he was asked to suggest any other element that would have an impact on the project environmental performance of list of construction companies in Hong Kong, he replied that the element 'building team' which includes the architect, engineer surveyor and planner should have an impact on the environmental performance because these building professionals were supervising the construction companies on-site in reminding them to be vigilance and to pay attention to all the legal requirements.

Interviewee No.4 (random selection from the panel)

He considered the board of directors an essential element to ensure good environmental performance for listed construction companies in Hong Kong. While he agreed that the background of the directors was important such as their age and academic achievements as well as their working experience, he did not believe that the size of the board would have any impact on the environmental performance of the company. He asserted that the size was not a determinant, but instead the quality of the directors should prevail. Regarding the gender of the directors, he agreed that female directors should be environmentally more conscious and they would implement measures in relation to corporate social responsibility more readily than male directors.

For the 'average age of the board' element, he thought that young generation would be more receptive to environmental practices and measures. It might be due to the general education offered in primary and secondary schools in Hong Kong in promulgating the importance of environmental protection to save our earth.

He particularly emphasized the importance of having green qualification such as the

‘BEAM Pro’ or other environmental management courses offered by various universities in Hong Kong such as HKUST and the Polytechnic University. He said that through receiving the cognitive concepts on environmental protection the construction managers would become more aware of the importance of project environmental performance, particularly in minimizing the nuisance emanated from their construction sites.

Though he did not have the experience of working for a listed board with a dedicated green or sustainability committee, he believed that the dedication of a board director together with some construction professionals to set up such green committee would greatly improve the environmental performance. He said that it was akin to a central processing unit specifically established to deal with all the environmental issues of the construction company, instead of haphazardly requesting staff of different departments to deal with various environmental problems in an unorganized manner. Expertise would be pooled together, and with the endorsement of the senior management, the environmental issues would be discussed and decisions could be made expeditiously to curb the environmental problems at hand.

For the remuneration tie-in with the environmental performance of the company, he

totally agreed that such measure would enhance the environmental performance. However, he doubted very much whether such measure would be implemented in reality because a lot of construction companies would only focus on the profitability of the company rather than the environmental performance. All the environmental measures and practices would be applied only if the construction company could make a profit out the projects. If the contractor was doing very well in terms of environmental performance but fail to gain any profit, it would not survive. He emphasized that it was only when the construction company could gain a profit, it would have the impetus and incentives to perform well in term of environmental protection.

Regarding the CEO duality, he agreed that the separation of the chairman from the CEO would improve the environmental performance of the company. It was because the workload of the chairman and CEO would be spread by two persons. Further, there would not be concentration of power. They could act as check and balance to ensure the company would arrive at the right decisions in relation to environmental issues.

Turning to the environmental management and event, he agreed that the setting up of

an environmental management system such as ISO 14000 would certainly improve the project environmental performance. He said that a lot of contractors were having ISO 14000 certification as gimmicks in getting through the tender pre-qualification exercise. He said that the accreditation body for the ISO 14000 could shed light on whether the ISO 14,000 was just paperwork or there was real implementation of such environmental management system. He said that if the accreditation body was HKQAA there would be greater chance that it was a real implementation since it was a very formal and high quality accreditation body with good reputation.

For other elements such as the 'shareholders', 'customers', 'government regulations', 'subcontractors and suppliers', 'competitors', and 'NGOs', he concurred that these were elements that could affect the project environmental performance. Considering government regulations, he asserted that they were the minimum requirements on project environmental performance. He alleged that contractors should implement measures and practices over and above such legal requirements. The impulse could be originated from the developers who could stipulate conditions in the building contracts the BEAM requirements in the construction stage so that contractors would not produce too much pollution affecting his neighbours. However, he has received some complains from members of his construction manager institute that sometimes

the requirements stipulated by the environmental protection department were unreasonable such as the prosecution of an accounting directors under s.28A of the Noise Control Ordinance Cap. 400. He added that effectiveness of environmental regulatory control would not only embrace all the legislations, but also the enforcement regime in particular how the law was enforced.

He admitted that the element 'competitors' might be the most important element affecting the environmental performance since if a contractor could not follow the norm of its peers, it would lose out from the construction industry. However, construction companies would not outperform its competitors too much without an appropriate reward from the developers because the more stringent environmental requirements would inflate the building contract price resulting in a loss in running the projects. Thus, the contractor had to cut corners in order to not making a loss and the on-site project environmental performance would deteriorate.

He said that the unions and institutes for construction personnel were upholding the on-site project environmental standards for the construction industry by providing trainings, seminars and research for better environmental construction methods like the quiet powered mechanical equipment. He asserted that 'union' was one of the

very important elements affecting the project environmental performance of listed construction companies.

Finally when he was asked whether he would like to add any further element into the list, he replied that it would be the building team which include the professionals like the architect and engineers together with the construction personnel such as the construction manager, site agent and foreman who were supervising and reminding the on-site workers to adhere to all the environmental initiatives and to comply with all the environmental legislations. Without them, the required environmental performance standard would not be achieved.

Interviewee No.5 (random selection from the panel)

First of all he told me that he had gone through all the interview questions before the interview, and he opined that all the 10 elements put before him were important to ensure good environmental performance on site. Those elements included the board of directors, the implementation of environmental management system, the cultivation of green corporate culture, shareholders influence, customers' pressure, government regulations, suppliers and subcontractors' cooperation, competitors' challenges, NGOs supervision, and unions' assistance.

He considered the board of directors important because it was the centre of power for the whole company. All decisions and strategies originated from the board. He regarded the chairman of the board as the company leader in guiding the company along the directions that it should follow and to provide a compass for the CEO to steer the company. The CEO was the head of the executive arms and he was the one to implement all the strategies as devised and formulated within the board. He considered the CEO duality, which meant the separation of the chairman from the CEO, would improve the environmental performance. The superimposition of the duties of the chairman and the CEO on one single person would probably overload the

person and he could not have binocular objective views to make informed decisions relating to the company's issues. With the above explanation, he supported the CEO duality arrangement.

He emphasized that the composition of the board was very important because the board has embraced different expertise and different perspectives in looking at a problem. He said the board could be regarded as a concerted effort in managing the company, and there should be different opinions and ideas to enrich deliberation before finding solution for a problem.

He agreed with the importance of having green qualifications because the knowledge gained by the directors through gaining such qualification would be implanted within the brain so that when they carried out their work or making decisions relating to the business of the company, the green concept would always come into their mind. He also considered the INEDs were important because they tended to be more receptive to the concept of social corporate responsibility. He said that the setting up of green committee should be included in the listing rules for the Hong Kong Stock Exchange. He explained that the green committee concept was very similar to that for the establishment of the audit committee or the remuneration committee within the board.

Board directors should be assigned to such green committee, or in some construction companies known as sustainability committee. They had endorsement from the board and could gain access to the resources for senior staff or professionals within the company to assist the committee.

However he was not convinced that the average age of the board would have an influence on the environmental performance of the company because he thought that it was not the age that determined a person's mindset, but rather his educational background and his experience. He disagreed that elderly people would be less environmental friendly because from his experience quite a lot of board directors of listed companies were more than 50 years old and they were pioneers in implementing environmental measures within their own listed company. He also did not believe that the size of the board would be a determinant for the environmental performance of a construction company. He said that it was not the size that mattered but instead the attributes and characters of the directors should prevail. Regarding female directors, again he did not believe that the female directors could have any actual impact on the environmental performance of a listed construction company. He stressed that it was not gender that prescribed a person's environmental awareness, but rather that person's education background and experience.

For the element 'environmental management', he considered that due to the complicated onsite working procedures it would be essential to the contractors nowadays for achieving good project environmental performance. He said that the implementation of an effective environmental management system was a necessary but not sufficient condition to ensure good environmental performance. That meant, without it, it would be certain that the contractor could not perform well in terms of environmental protection. He mentioned that an effective environmental management system could help cultivating a green culture within the company which could be crucial to the success of the company in competing with its rivals in the construction industry.

For the element 'shareholder' he shared his experience that in US and other western countries shareholders activism could influence the board to take up more corporate social responsibilities. Shareholders from pension funds and insurance companies could request the company to be more environmental friendly. In relation to the element 'customer', he thought that some developers had BEAM certification for their buildings because they could gain extra gross floor area from the Buildings Department. Other developers in particular those foreign banks really wanted to

build green buildings to improve the environment. He knew that some of these bank buildings had BEAM platinum awards. For the individual flat buyers, what they mostly concerned about BEAM certification would possibly be the energy saving aspect because they were the ultimate user of the buildings and they had to foot the energy bills every month. Further he added that the BEAM requirements had encapsulated the environmental legislations, so that in complying with the BEAM requirements the contractor would have already complied with all the environmental legislations.

He mentioned that though the union did have an impact on the environmental performance, their influence in Hong Kong was far less than those in the US or other western countries. On the other hand, the NGOs were more effective and powerful than the government legislations. He said that it would be easier to lodge a complaint to the press than reporting the breaches of the law to the Environmental Protection Department.

Finally when he was asked what other elements he would like to add, he answered that he would like to add two more i.e. (a) the building team which consists of all the building professionals, and (b) the financial institutions and credit rating agencies. The first one he said was obvious because the professionals were assisting

and cooperating with the construction company to ensure all the building contract provisions relating to environmental protection be complied with. The second factor was crucial because from his experience the banks and other financial institutions could prescribe green provisions in the loan agreement, failing which the contractor would be required to return the loans. Also, the credit rating institutions were important because if a contractor was rated low they might not be able to secure their loans and therefore might not have sufficient funds to run its projects. Business survival and competitiveness were of prime concern to a construction company, in particular those listed construction companies for carrying out mega projects which required a lot of funds in terms of loans. He commented that for listed construction companies, the majority of which were main contractors, they were required to bridging loans to their subcontractors for the time period between carrying out the work on site and the actual receipt of the interim payments. He said that depending on how the building contract was drafted, such period would normally span from one month to three months.

Appendix J - Summary of Interview Findings

Element	attributes	Interviewee No. 1	Interviewee No. 2	Interviewee No. 3	Interviewee No. 4	Interviewee No. 5
BOD (5)		Y	Y	Y	Y	Y
	female directors (2)	Y	N	N	Y	N
	board Size (3)	N	Y - Large better (12)	Y – a limit (9)	N	N
	age (4)	Y (Young)	Y (Young)	N	Y (Young)	N
	green qualification (5)	Y - lawyer	Y	Y	Y	Y
	INED (4)	Y	Y	N	Y	Y
	green committee (5)	Y	Y	Y	Y	Y
	remuneration	Y	Y	Y	Y	Y
	CEO duality	N	Y	Y	Y	Y
Env. Mgt (5)		Y	Y Not paper work	Y (gimmick)	Y (gimmick) accreditation	Y
Culture (3)		Y	Y	Y	Y	Y
Shareholder (5)		Y	Y	Y	Y	Y
Customers (5)		Y	Y	Y	Y	Y
	unclassified (3)	N/A	Foreign bank unclassified	unclassified	unclassified	Foreign bank
	LEED	N/A	Y	N/A	N/A	N/A
	energy	Y	Y	N/A	N/A	Y
	env. legislations	Y	Y	Y (court procedures)	Y (enforcement)	Y
Government regulations (5)		Y	Y	Y	Y	Y
Subcontractor (5)		Y	Y	Y	Y	Y
Competitor (5)		Y	Y	Y	Y	Y
NGO (5)		Y	Y	Y	Y	Y
Union (4)		Y	N	Y	Y	Y
Others		Building team	Financial institutions & credit rating agencies	Building team	Building team	Building team, financial institutions

Appendix K – 1st Set of Questionnaires Mentioned in Chapter 5

Factors Affecting the Environmental Performance of a Listed Construction Company

In Hong Kong, statistics from the Environmental Protection Department from 2006 – 2015 shows there were at average 22% of all the environmental complaints originated from construction and renovation works, which is the worst amongst all sources of pollution.

The purpose of this research is to explore the various factors that have an impact on the environmental performance of Hong Kong listed construction companies so that we can monitor and control these factors to reduce pollution and to provide a better environment in Hong Kong.

Through literature reviews, factors affecting environmental performance of a listed construction company can be divided into two domains. They are the corporate environmental governance and stakeholders' pressure. The corporate environmental governance domain includes the composition and attributes of the board of directors, whether an environmental management system such as ISO 14001 has been implemented, the shareholders' attitude towards environmental protection and the corporate culture. The stakeholders' pressure domain includes external pressure such as government and regulatory agents, Hong Kong Stock Exchange rules, customers' expectations, suppliers/subcontractors, the invigilation of the media and NGOs, the environmental performance of competitors, trade unions' expectations, influence of the financial institutions & credit rating agencies and the supervision of the project team (architects, surveyors and engineers). These factors affecting the environmental performance of a listed construction company can be shown in the diagram below.

This research will endeavor to explore most of the commonly recognized factors affecting the environmental performance and their weightings.

1. On a scale of 1 – 7 (with 7 being the highest), please rate the influence of the board of directors on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

2. On a scale of 1 – 7, please rate the influence of environmental management system, such as ISO 14001, on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

3. On a scale of 1 – 7, please rate the influence of corporate culture on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

4. On a scale of 1 – 7, please rate the influence of shareholders on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

5. On a scale of 1 – 7, please rate the influence of government/regulatory agents/HKEx on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

6. On a scale of 1 – 7, please rate the influence of suppliers and sub-contractors on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

7. On a scale of 1 – 7, please rate the influence of media and NGOs on the environmental performance of a listed construction company.

1 2 3 4 5 6 7

8. On a scale of 1 – 7, please rate the influence of competitors on the environmental

performance of a listed construction company.

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. On a scale of 1 – 7, please rate the influence of trade unions' expectations (e.g. HKCA in HK) on the environmental performance of a listed construction company.

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. On a scale of 1 – 7, please rate the influence of customers on the environmental performance of a listed construction company.

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

11. On a scale of 1 – 7, please rate the influence of financial institutions and credit rating agencies on the environmental performance of a listed construction company.

1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. On a scale of 1 – 7, please rate the influence of project team (architects, surveyors and engineers) on the environmental performance of a listed construction company.

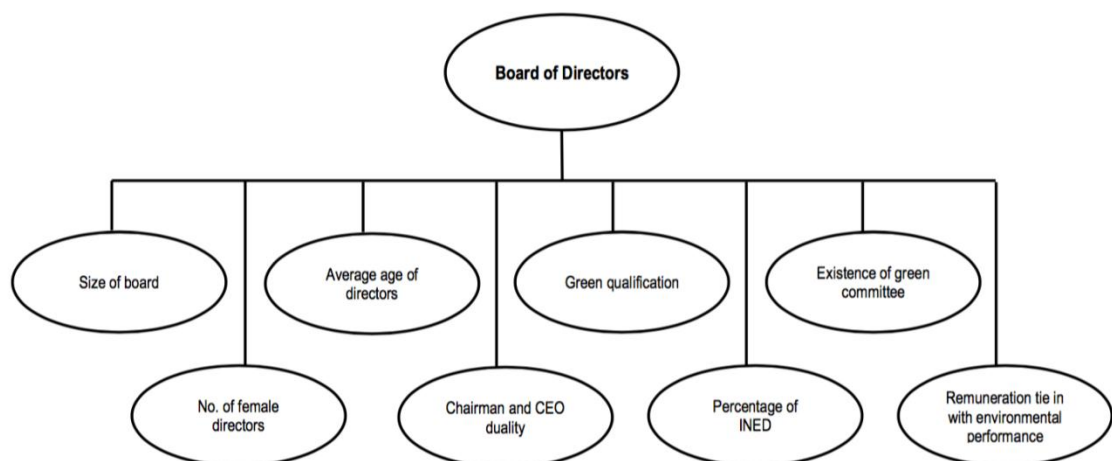
1	2	3	4	5	6	7
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix L – 2nd Set of Questionnaires Mentioned in Chapter 5

How the Composition and Attributes of the Board of Directors can affect the Environmental Performance of a Listed Construction Company in Hong Kong

Established research results in western countries show that the environmental performance of a company can be affected by the composition and attributes of the board of directors, in particular the following parameters: size of the board, female directors within the board, the average age of directors, chairman & CEO duality, directors holding green qualification, the percentage of independent non-executive director (“INED”), green committee as well as remuneration tie in with the environmental performance. The attributes of the board of directors affecting the environmental performance of a listed construction company can be shown in the diagram below.

This study pioneers in exploring the association between the environmental performance of a listed construction company in Hong Kong with the composition & attributes of the board of directors.



“1” represents no impact, “2” insignificant impact, “3” significant impact, “4” strong impact to “5” very definite and super-strong impact

1. On a scale of 1 – 5, please rate the influence of the size of the board on the environmental performance of a listed construction company.

1 2 3 4 5

2. On a scale of 1 – 5, please rate the influence of the no. of female directors on the environmental performance of a listed construction company.

1 2 3 4 5

3. On a scale of 1 – 5, please rate the influence of the average age of directors on the environmental performance of a listed construction company.

1 2 3 4 5

4. On a scale of 1 – 5, please rate the influence of chairman and CEO duality on the environmental performance of a listed construction company.

1 2 3 4 5

5. On a scale of 1 – 5, please rate the influence of directors holding green qualification on the environmental performance of a listed construction company.

1 2 3 4 5

6. On a scale of 1 – 5, please rate the influence of the percentage of INED on the environmental performance of a listed construction company.

1 2 3 4 5

7. On a scale of 1 – 5, please rate the influence of the existence of green committee on the environmental performance of a listed construction company.

1 2 3 4 5

8. On a scale of 1 – 5, please rate the influence of remuneration tie in with the environmental performance on the environmental performance of a listed construction company.

1 2 3 4 5

Appendix M – 27 Hong Kong Listed Construction Companies

No.	Size	Market Capitalization (HK\$M)	Nature of Work
1	M	920	Foundation / Builders' / Fitting out
2	S	207	Builders' / Fitting-out
3	S	233	Foundation / Builders
4	L	1,089	Builders' / Fitting-out
5	S	276	Builders' / Fitting-out
6	L	2,000	Builders' / Fitting-out
7	S	237	Foundation
8	M	568	Demolition / Foundation
9	S	323	Builders' / Fitting-out
10	S	300	Demolition / Builders
11	S	205	Foundation
12	S	400	Builders'
13	S	204	Builders / Fitting-out
14	S	297	Builders'
15	M	728	Builders' / Fitting-out
16	S	265	Demolition / Foundation
17	M	840	Builders' / Fitting-out
18	S	178	Builders'
19	S	256	Builders'
20	L	7,860	Foundation / Builders / Fitting-out
21	S	440	Builders' / Fitting-out
22	M	704	Foundation
23	M	594	Foundation / Builders
24	M	795	Foundation
25	S	288	Builders'
26	M	783	Foundation
27	L	1,260	Builders' / fitting-out

Demolition work : Taking down the existing above-ground building structure

Foundation work : Construction of below-ground substructure

Builders' work : Construction of the above-ground superstructure

Fitting-out work : Interior decoration

Appendix N – Raw Data Obtained from the First Set of Questionnaires for Exploratory Factor Analysis

	board of directors	corporate culture	environmental management	shareholder	Government regulatory control	customer's expectations	supplier and sub-contractors	media and NGOs	competitors' environmental performance	trade union's influence	financial/ credit rating institutions	Project team
1	7	6	6	4	6	6	5	4	5	4	5	7
2	6	5	7	3	6	7	4	4	2	2	4	5
3	6	6	5	6	5	7	6	5	7	6	5	6
4	6	7	5	6	7	6	2	5	6	4	7	6
5	6	6	5	4	5	4	3	4	5	4	6	6
6	7	6	6	6	7	5	5	5	6	5	7	3
7	7	7	5	3	5	3	2	4	4	3	4	5
8	6	5	6	5	7	6	4	6	4	5	3	5
9	3	2	2	2	2	3	2	1	2	2	3	2
10	1	3	2	4	6	3	6	6	5	4	1	4
11	6	6	6	2	7	7	5	7	7	3	7	7
12	6	5	5	4	7	7	3	2	2	4	2	6
13	6	4	5	4	7	6	4	5	5	2	6	4
14	5	3	4	3	6	6	6	5	6	5	5	7
15	7	7	6	5	5	5	5	6	6	5	6	7
16	7	6	6	6	6	4	5	6	6	6	4	6
17	5	5	6	6	7	5	4	6	5	5	6	6

	board of directors	corporate culture	environmental management	shareholder	Government regulatory control	customer's expectations	supplier and sub-contractors	media and NGOs	competitors' environmental performance	trade union's influence	financial/ credit rating institutions	Project team
18	6	4	4	4	6	4	2	4	5	3	5	2
19	5	6	5	5	6	5	5	6	6	3	6	6
20	6	4	6	5	7	6	3	3	2	5	2	6
21	7	6	6	6	6	4	5	6	6	6	4	6
22	5	4	6	3	6	7	5	3	5	4	3	3
23	5	4	4	4	5	4	5	5	5	3	4	4
24	7	6	6	6	6	4	5	6	6	6	4	6
25	7	6	6	6	6	4	5	6	6	6	4	6
26	4	6	6	4	6	6	5	6	5	5	5	4
27	6	6	5	6	7	5	5	6	5	4	6	6
28	4	6	3	6	6	5	2	6	5	5	6	6
29	6	6	4	6	7	5	5	5	5	4	6	6
30	6	5	7	2	6	2	1	1	3	3	4	6
31	1	4	5	1	4	6	4	6	4	4	4	6
32	4	5	4	5	2	2	2	5	3	2	5	1
33	5	7	6	5	2	2	1	4	6	4	6	7
34	6	6	6	6	5	4	7	6	6	6	7	7
35	5	4	7	4	7	5	5	5	5	5	5	5
36	5	6	6	6	5	4	3	6	4	4	4	4
37	6	6	5	5	4	5	5	6	5	6	6	5

	board of directors	corporate culture	environmental management	shareholder	Government regulatory control	customer's expectations	supplier and sub-contractors	media and NGOs	competitors' environmental performance	trade union's influence	financial/credit rating institutions	Project team
38	7	6	5	5	7	7	2	5	6	1	7	1
39	7	7	5	5	6	5	5	6	6	4	6	6
40	6	5	5	3	6	4	5	5	6	4	3	5
41	6	5	5	5	4	5	5	6	5	4	5	6
42	7	6	5	4	4	4	4	5	5	2	4	2
43	7	6	6	5	6	5	3	5	5	4	6	5
44	6	3	5	4	5	3	2	2	2	2	2	3
45	5	5	6	5	5	5	5	5	6	5	5	6
46	7	4	4	5	4	3	3	5	4	4	5	5
47	6	3	5	5	5	4	4	5	6	5	5	4
48	4	4	3	3	5	3	5	5	3	3	4	4
49	7	5	3	4	7	4	4	4	4	2	6	2
50	5	6	5	6	7	5	4	6	6	5	6	4
51	6	6	5	2	6	3	5	5	5	5	5	5
52	6	6	5	4	5	6	5	6	6	6	5	7
53	5	5	6	3	3	3	3	5	4	3	5	5
54	7	6	6	3	3	3	2	4	4	4	5	3
55	6	6	7	5	5	5	5	6	6	5	5	5
56	5	6	6	6	4	6	5	6	4	3	5	4
57	6	7	5	4	6	4	2	5	4	5	6	4

	board of directors	corporate culture	environmental management	shareholder	Government regulatory control	customer's expectations	supplier and sub-contractors	media and NGOs	competitors' environmental performance	trade union's influence	financial/credit rating institutions	Project team
58	6	6	6	5	7	5	4	6	6	5	5	5
59	6	5	5	5	6	6	5	4	6	6	7	6
60	6	4	3	6	4	4	4	4	5	5	5	4
61	7	6	4	6	5	4	1	2	3	2	1	4
62	1	3	2	6	2	2	3	2	3	3	3	2
63	4	6	6	4	6	7	3	4	6	5	7	4
64	6	6	6	6	4	4	5	5	5	6	5	4
65	7	6	5	4	5	5	4	4	4	4	5	5
66	6	5	6	6	5	5	5	7	7	7	4	5
67	7	6	6	6	6	6	7	4	5	5	5	6
68	4	5	5	2	6	5	3	5	4	4	5	5
69	7	7	7	6	7	7	6	6	6	7	6	7
70	4	4	5	3	3	3	3	4	4	3	4	5
71	6	5	5	5	4	5	4	4	4	4	4	5
72	4	4	3	4	5	3	5	4	4	5	4	5
73	4	4	3	4	5	3	5	4	4	5	4	5
74	6	7	6	5	6	5	5	5	5	6	5	5
75	6	6	5	6	5	5	4	5	6	5	5	4
76	6	6	5	3	7	6	3	3	7	3	3	3
77	4	4	3	4	3	3	5	5	5	6	4	6

	board of directors	corporate culture	environmental management	shareholder	Government regulatory control	customer's expectations	supplier and sub-contractors	media and NGOs	competitors' environmental performance	trade union's influence	financial/credit rating institutions	Project team
78	5	6	6	4	5	4	6	4	5	6	5	6
79	7	4	5	7	2	4	2	5	4	4	2	4
80	4	4	4	3	4	5	5	5	4	4	4	5
81	6	5	5	6	5	4	4	4	4	4	4	4
82	3	4	5	4	5	6	5	5	4	4	4	4
83	7	6	6	5	5	4	4	5	4	4	3	4
84	7	6	5	4	7	5	4	6	5	5	5	6
85	4	5	5	4	5	6	5	6	5	4	5	6
86	7	4	6	4	4	4	5	6	6	4	5	5
87	5	5	1	5	7	7	1	4	6	2	6	2
88	6	7	6	5	6	5	4	4	5	3	3	5

Appendix P – Z-Score Table

Standard Normal Probabilities

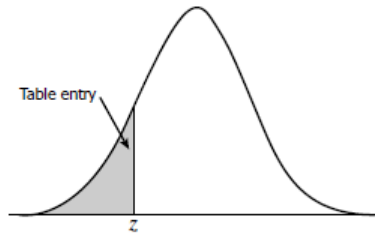


Table entry for z is the area under the standard normal curve to the left of z .

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
-0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Standard Normal Probabilities

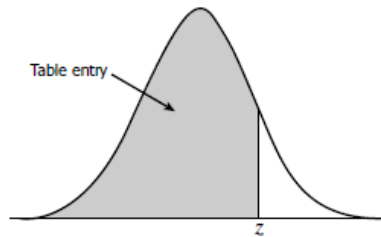


Table entry for z is the area under the standard normal curve to the left of z .

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998